



Age, gender, and self-concept as predictors of solid waste management among residents in cross river state, Nigeria

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ABSTRACT

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This research investigated the correlation between individuals' age, attitude, and practices in handling solid waste in Cross River State, Nigeria. The study formulated three hypotheses to guide its direction and utilised a survey research design. The participants included 1,106 individuals selected through random sampling from a population of 6,923 using a stratified approach. The researchers developed a questionnaire, which six experts validated, and its reliability was assessed using Cronbach's alpha method. Various statistical methods were employed to test the hypotheses at a significance level of 0.05, including simple regression, one-way analysis of variance (ANOVA), and an independent t-test. The outcomes revealed that age, gender, and self-concept influenced solid waste management practices within the studied population. Specifically, males and individuals with a strong self-concept exhibited more active engagement in solid waste management than their female and low-self-concept counterparts. The data indicated that respondents aged 38 and above demonstrated the highest level of involvement in solid waste management, followed by those aged 18-27. Conversely, respondents aged 28-37 exhibited the lowest extent of engagement in solid waste management practices. This study has valuable implications for policymakers, waste management professionals, and community stakeholders. The insights can guide the development of evidence-based strategies to encourage responsible waste management behaviours, thereby contributing to a cleaner and more sustainable future.

Contribution/Originality: This study contributes to the literature by examining the correlation between age, attitude, and practices in solid waste management among individuals in Cross River State, Nigeria. The study provided valuable insights for policymakers and stakeholders to develop targeted strategies for promoting responsible waste management behaviours and a cleaner environment.

1. INTRODUCTION

Solid waste management is a growing challenge in Nigeria due to high population growth and consumption patterns in urban areas. In Cross River State, solid waste is often disposed of indiscriminately, leading to negative environmental impacts and potential harm to human health (Eneji, Eneji, Ngoka, & Abang, 2017; Inah, Uwadiegwu,

Eko, & Inah, 2017). Poor waste management can deface the environment, spread disease, and contaminate water, air, and land quality (Mama, Nnaji, Nnam, & Opata, 2021). Improper waste disposal is a major concern in many developing countries, including Nigeria, where inadequate solid waste management has become common (Fereja & Chemedo, 2022; Ganguly & Chakraborty, 2021). Statistics show that 30-50% of solid waste generated in Nigerian cities is not sustainably collected and disposed of, contributing to Nigeria's reputation as one of the world's dirtiest countries (Adeniran, Nubi, & Adelopo, 2017; Ike, Ezeibe, Anijiofor, & Daud, 2018; Somorin, Adesola, & Kolawole, 2017).

The indiscriminate dumping of solid waste is characterised by stockpiling and insufficiency in solid waste disposal in Cross River State, and waste generated from households typically includes food waste, vegetable peelings, plastics, and hazardous waste from household products (Butu & Mshelia, 2014; Miah et al., 2022; Pirani & Arafat, 2014). Inadequate handling of waste has the potential to give rise to risks to public health, including incidents like fires, accidents, inundations, environmental contamination, and roadway impediments (Isaiah & Blessing, 2020). The tasks of gathering and appropriately getting rid of solid waste are of utmost importance for both governmental bodies and the general populace. These tasks necessitate well-defined plans encompassing the entire process, spanning from collection and conveyance to arrangement and reprocessing, all of which are essential for ensuring a sustainable approach to waste management (Kurniawan, Meidiana, Othman, Goh, & Chew, 2023; Maiurova et al., 2022).

How people are aware of their surroundings and cultural habits plays a vital role in managing solid waste (Almasi et al., 2019; Shah, Srivastava, Mohanty, & Varjani, 2021). As economies grow, there is an increase in the generation of solid waste, which, if not managed properly, leads to environmental issues. Despite having access to various waste management and recycling programs, policymakers struggle to address the ongoing problem. Urban and rural areas are affected by unpleasant smells associated with poorly managed waste. The inadequate handling of solid waste in the research region can be linked to people's attitudes. While the government and private companies promote recycling strategies, there has not been enough research into how households decide about recycling in the studied area. This gap in knowledge needs immediate attention. Solid waste management continues to be a significant problem on a global scale, capturing the focus of numerous studies (Bui, Tsai, Tseng, & Ali, 2020; Chen, Bodirsky, Krueger, Mishra, & Popp, 2020; Fan, Yang, & Shen, 2019; Rajmohan, Ramya, Viswanathan, & Varjani, 2019).

Nonetheless, prior research has dedicated attention to various facets of solid waste management, including opportunities, challenges, and innovations (Abdallah et al., 2020; Das et al., 2019; Sharma et al., 2020) policy considerations (Guo et al., 2021) dynamics and risk evaluation (Vyas, Prajapati, Shah, & Varjani, 2022) and the impact of COVID-19 (Kulkarni & Anantharama, 2020) among other factors. However, an evidence gap exists in the literature concerning the characteristics of individuals and their practices in solid waste management. The studies mentioned earlier in this paragraph have predominantly concentrated on distinct dimensions of solid waste management, such as policies, dynamics, and risk appraisal. While these areas of investigation hold significance, a discernible void exists in the literature regarding the personal attributes of those engaged in solid waste management. The research deficiency highlighted in the preceding text pertains to the lack of consideration given to the connection between individual traits and practices in solid waste management. In particular, there doesn't seem to be any academic research on how age, gender, and self-perception affect the techniques used for solid waste management.

Hence, there is a need to examine the effects of individual characteristics on how solid waste is managed. Such an investigation could investigate how age, gender, and self-perception influence people's attitudes and actions concerning solid waste handling. To illustrate, it might be explored whether specific age brackets or genders exhibit a greater propensity for adopting ecologically sound waste management practices or whether individuals with a favourable self-concept tend to partake more in recycling and waste reduction efforts. The results stemming

from such an inquiry have the potential to enhance our comprehension of the variables shaping individuals' approaches to solid waste management. Subsequently, this newfound knowledge could be useful for formulating targeted measures and regulations to foster sustainable waste management behaviours. Ultimately, this could culminate in the implementation of more efficient and successful waste management methods, thereby mitigating the adverse environmental ramifications of solid waste.

1.1. Studies on Age and Solid Waste Management

Effectively managing solid waste is a pivotal component of both sustainable development and safeguarding the environment. Given that diverse age groups exhibit varying outlooks, perceptions, and actions concerning waste management, age stands out as a pivotal element in the realm of solid waste management practices (Agissova & Sautkina, 2020; Bozoglu, Bilgic, Topuz, & Ardali, 2016; Casaló & Escario, 2018). Previous investigations have pinpointed age as a notable determinant of environmental inclinations and conduct (Fang, Ng, & Zhan, 2018; Grønhoj & Thøgersen, 2017; Wang, Hao, & Liu, 2021). Notably, younger individuals tend to possess a heightened environmental consciousness and are more actively involved in pro-environmental actions than their older counterparts (Fang et al., 2018; Grønhoj & Thøgersen, 2017; Wang et al., 2021).

While earlier investigations concerning age and waste disposal management primarily examined age through the lens of waste duration, such as landfills (Kamaruddin et al., 2017; Saadoun et al., 2021; Somani, Datta, Ramana, & Sreekrishnan, 2018), research concentrating on age and the handling of solid waste has yielded contradictory outcomes in various contexts. For instance, divergent results were observed in the study by Al-Khatib, Kontogianni, Nabaa, and Al-Sari (2015). Specifically, participants within the age brackets of 25 to 34 and 35 to 44 exhibited a higher likelihood of engaging in household solid waste cleaning than those aged between 18 and 24. However, individuals aged 55 and above were approximately 1.6 times less prone to disposing of solid waste in communal waste bins than their counterparts aged between 18 and 24 (Al-Khatib et al., 2015).

The research conducted by Babaei et al. (2015) established that age emerged as an autonomous element in forecasting the inclination of respondents to engage in initiatives related to the separation of solid waste at its source and recycling endeavours. Furthermore, individuals above 45 exhibited a heightened inclination towards endorsing schemes focused on reducing waste at its source. This inclination was linked to restricted mobility and decreased capacity to manage household responsibilities, which are prevalent among the elderly demographic. Additionally, the elderly population possesses relatively less access to contemporary information and recently introduced municipal initiatives than their younger counterparts.

Choon, Tan, and Chong (2017) discovered a direct correlation between age and behaviours aimed at reducing waste, such as reusing and recycling. Correspondingly, Martin, Williams, and Clark (2006) and Nixon and Saphores (2009) determined that individuals in their middle-aged and older years exhibited a higher likelihood of participating in recycling activities. Similarly, Singhirunnusorn, Donlakorn, and Kaewhanin (2017) revealed that as residents' age increased, their inclination towards recycling displayed a minor but noticeable enhancement, with older individuals demonstrating a greater engagement in recycling practices than their younger counterparts. Similarly, Debrah, Vidal, and Dinis (2021) highlighted the connection between education, age, and disparities in solid waste management's awareness, attitudes, and practices.

Nevertheless, significant gaps in research concerning the interplay between age and solid waste management warrant more extensive exploration. While certain studies have centred on the connection between age and waste disposal management, particularly in terms of landfills (Kamaruddin et al., 2017; Saadoun et al., 2021; Somani et al., 2018), it is imperative to consider the influence of age on other facets of solid waste management, such as initiatives for reducing waste at its source and the practice of recycling. Additionally, while certain investigations have indicated that younger individuals tend to exhibit heightened environmental awareness and actively participate in environmentally-friendly behaviours more than their older counterparts (Fang et al., 2018; Grønhoj & Thøgersen,

2017; Wang et al., 2021) other studies have uncovered that individuals in their middle-aged and older years are more prone to recycle (Martin et al., 2006; Nixon & Saphores, 2009). These contradictory findings underscore the necessity for further research to pinpoint the specific dimensions of solid waste management wherein age plays a significant role. Drawing from this context, this study's first hypothesis was formulated.

Ho: There is no significant influence of age on solid waste management.

Ha: Age has a significant influence on solid waste management.

Studies must examine the relationship between age and attitudes towards solid waste management and the barriers that may prevent certain age groups from participating in effective waste management practices. Understanding different age groups' perceptions, attitudes, and behaviours towards solid waste management is crucial for developing targeted interventions and policies to promote sustainable waste management practices across all ages. Lastly, while some studies have examined age and solid waste management practices within specific cultural and geographical contexts in developed nations, further research is needed to explore how these factors may influence the relationship between age and waste management practices in different regions of developing nations.

1.2. Studies on Gender and Solid Waste Management

Increasingly, experts acknowledge that waste management is far from a gender-neutral concept and practice. The existing landscape of gender inequalities, norms, stereotypes, and roles fundamentally shapes the positioning of waste within societal and economic frameworks (Seager et al., 2019; Thomas-Hope, 2015). The domain of waste is intrinsically impacted by gender-based attitudes and perspectives, which are intertwined with broader socially constructed activities and economic sectors (Seager, Rucevska, & Schoolmeester, 2020). The study conducted by Al-Khatib et al. (2015) exemplifies this by indicating that females exhibited a notably higher likelihood of cleaning solid waste within their households than males. This tendency stems from the prevailing perception that home cleaning is the responsibility of women in their everyday activities. Equally pertinent are the outcomes from other investigations, which consistently indicated that female participants displayed a constructive and conscientious stance towards environmental concerns (Koop & Van Leeuwen, 2017) as well as the management of solid waste, as evidenced in Ghana (Owusu, Adjei-Addo, & Sundberg, 2013; Yin & Mariwah, 2013) when contrasted with their male counterparts.

On the contrary, the results of the study conducted by Odok and Onnoghen (2018) revealed that male students were more responsive to solid waste management than their female counterparts. Similarly, Liang and Sharp's (2016) study revealed that female participants in China, Laos, and Thailand had less knowledge about enhancing environmental conditions than their male counterparts. Chikowore (2021) conducted Chi-square tests in Zimbabwe and found a significant correlation between gender and the willingness to pay for fortnightly waste collection services. However, the study did not specify which gender group scored higher. In explaining the differences in responsiveness between males and females, Wut, Ng, Kan, and Fong (2021) submit that their lifestyles and social norms influence the pro-environmental actions of female participants. In contrast, the attitude of male participants towards policy affects their lifestyle. Similarly, another study suggests that past behaviour and learned attitudes influence men's recycling intentions. In contrast, perceived behaviour control and inherent attitudes shape women's lack of recycling intentions (Oztekin, Teksöz, Pamuk, Sahin, & Kilic, 2017).

The study by Al-Khateeb, Al-Sari, Al-Khatib, and Anayah (2017) underscored that factors such as place of residence and age play pivotal roles in elucidating behaviours related to reuse and/or recycling. Conversely, dwelling premises, education level, gender, and the experience of education on waste management emerged as significant contributors influencing the willingness to support enhanced services for solid waste management financially. Likewise, Babaei et al. (2015) revealed that demographic factors, such as education level, age, gender, and occupation, shaped individuals' knowledge, attitudes, and practices regarding solid waste source separation and

recycling. Furthermore, [Ekere, Mugisha, and Drake \(2009\)](#) noted that household waste utilisation and separation behaviours were elucidated by land size, gender, household location, peer influence, and membership in environmental organisations. Furthermore, [Oztekin et al. \(2017\)](#) revealed that intrinsic differences emerged in the attitudes of females and males towards recycling. Females exhibited innate attitudes, considering recycling commendable, necessary, advantageous, and conscientious. However, attitudes among men were formed, linking recycling to values, health, and accuracy. This culminated in the observation that male recycling intentions were moulded by their past actions, a conclusion bolstered by their acquired attitudes. In contrast, the absence of recycling intention among females was determined by their perceived control over their behaviour, corresponding to their inherent recycling attitude. Based on the review of the literature on gender, the following hypotheses were developed:

Ho: Gender has a significant influence on solid waste management.

Ha: Gender does not significantly influence solid waste management.

1.3. Studies on Self-Concept and Solid Waste Management

Self-concept is an important variable predicting individuals' engagement in solid waste management. Numerous studies have delved into exploring waste management dynamics. An illustrative example can be seen in the work of [Ojedokun and Balogun \(2010\)](#) who conducted research revealing the combined impact of self-concept, environmental self-efficacy, and environmental attitude on responsible environmental behaviour. Their findings indicated that these factors collectively accounted for an 18% variation in such behaviour. Examined individually, self-concept and environmental self-efficacy emerged as significant contributors to fostering responsible environmental behaviour. Additionally, their study brought to light a noteworthy insight: the connection between self-concept, environmental self-efficacy, and responsible environmental behaviour is substantially influenced by environmental attitude ([Ojedokun & Balogun, 2010](#)). [Stoeva and Alriksson \(2017\)](#) shed light on how inadequate waste separation conditions impact individuals' participation in the process, regardless of their favourable attitudes. Expanding on this, [Owusu et al. \(2013\)](#) presented evidence that factors like gender (female) and perceptions related to sorting or health in the context of source separation positively influence the separation of household-level solid waste. Similarly, [Meng et al. \(2019\)](#) observed that a set of variables, including publicity and education, ease of access to recycling facilities, availability of sorting facilities, willingness to engage in sorting efforts, and residents' consciousness of environmental concerns, collectively rank as the five most influential factors shaping individuals' perspectives on waste management.

[Ojedokun and Balogun \(2011\)](#) explained that a combination of altruism, environmental self-efficacy, locus of control, self-concept, age, and gender collectively account for 57% of the variations in attitudes towards littering. Notably, altruism, environmental self-efficacy, locus of control, and self-concept significantly shape one's viewpoint on littering. Additionally, the level of educational attainment holds notable sway over attitudes concerning littering. Their findings establish a clear connection between psychological factors and attitudes regarding littering, offering insight into the reasons behind the limited success of previous anti-littering campaigns within the Ibadan resident community ([Ojedokun & Balogun, 2011](#)).

[Raab, Tolotti, and Wagner \(2021\)](#) showed that religion, social norms, and interpersonal relationships play crucial roles in enhancing the well-being of individuals residing in suburban regions. These factors greatly influence how individuals deliberate and contemplate their disposal practices, holding promising potential for implementing effective waste management strategies within suburban contexts. The respondents in the study displayed an elevated level of awareness regarding the adverse consequences of burning household waste, both for human health and the environment ([Raab et al., 2021](#)). Similarly, [Ojedokun \(2011\)](#) uncovered substantial impacts stemming from individual personality traits and their cumulative effects on attitudes toward littering and responsible environmental behaviour (REB). The study also highlighted the mediating role of attitude towards littering in the

relationship between personality traits and REB. The findings by Ojedokun suggest that individuals characterised by favourable personality attributes and a negative stance towards littering are more inclined to demonstrate pro-environmental behaviours. Expanding this line of inquiry, Pakpour, Zeidi, Emamjomeh, Asefzadeh, and Pearson (2014) identified a range of significant predictors, including attitude, intention, perceived behavioural control, action planning, self-identity, moral obligation, and past recycling behaviour, which collectively contributed to forecasting household waste behaviour at a subsequent time point (time 2) across various models. These factors were pivotal in shaping individuals' actions concerning household waste management. In line with the review of existing literature, the following hypotheses were derived:

Ho: There is a significant influence of self-concept on solid waste management.

Ha: There is no significant influence of self-concept on solid waste management.

1.4. Theoretical Framework

The Theory of Planned Behaviour (TPB), developed by Icek Ajzen, is a social cognitive theory designed to elucidate the intricate relationship between attitudes, beliefs, and behaviour. This theory posits that individuals' behaviour is intricately shaped by their intentions, which are influenced by their attitudes, subjective norms, and perceived behavioural control. In TPB, attitudes allude to an individual's evaluative stance, either positive or negative, towards a particular behaviour. Conversely, subjective norms pertain to the social pressures and expectations exerted by others, significantly impacting an individual's conduct. Perceived behavioural control encompasses an individual's self-assessment of their capability to carry out a specific behaviour. Collectively, these constructs determine an individual's intentions and serve as the immediate precursors to their subsequent behaviour.

In the case of solid waste management, the TPB can be useful in understanding why some individuals engage in proper waste management practices while others do not. For example, an individual's attitude towards waste management, their perception of social norms surrounding waste management, and their perceived behavioural control to perform proper waste management behaviours may influence their intentions and, in turn, their behaviour. Furthermore, examining individual attributes like age, gender, and self-perception can provide additional insight into the connection between TPB structures and waste management practices. For instance, it may be hypothesised that individuals with a strong sense of environmental responsibility and a positive attitude towards waste management are more likely to engage in proper waste management behaviours, regardless of age or gender. Alternatively, it may be hypothesised that younger individuals or those with a stronger self-concept are more likely to engage in proper waste management practices due to their desire to be seen as socially responsible.

Therefore, the TPB can be useful in guiding research on individuals' characteristics and their solid waste management practices by providing a theoretical framework for understanding the relationship between attitudes, beliefs, and behaviour. The study can test the TPB constructs concerning individuals' characteristics and potentially develop interventions to promote proper waste management behaviour in the population.

2. RESEARCH METHODS

2.1. Research Design

This research used quantitative research methods, primarily emphasising the descriptive survey research design. The descriptive survey research approach systematically collects data to provide an accurate and unbiased depiction of existing phenomena. The survey research design is specifically geared towards unravelling the nature of a given situation during the investigation. This design was deemed appropriate for the current study, as it facilitated the researchers' objective of delineating the interplay between the predictor variables, namely age and attitude, and the outcome variable (solid waste management).

2.2. Context

The setting of this study pertains to Cross River State, which is situated within the south-south geopolitical region of Nigeria. This state progressively becomes a hub for industrial, commercial, and educational activities. Renowned for its cultivation of lucrative crops like oil palm nuts and rubber and various agricultural produce, including yam, rice, cassava, fish, and crayfish, Cross River State is acknowledged for its significant contributions in these sectors. Due to the riverine nature of Cross River State, many inhabitants are prone to disposing of waste and other pollutants in sewages that empty into streams, rivers, and, by extension, the Atlantic Ocean. Apart from the waste disposal directly and indirectly into the water bodies in the area, some individuals tend to dispose of waste from their homes carelessly on the streets. This unacceptable behaviour by the populace undermines the government's efforts to ensure proper waste disposal and promote safe health. Thus, it was important to situate this study within the context to understand whether there are differences in waste disposal practices regarding some demographic attributes of the populace.

2.3. Participants

The population consists of 6,923 adults between the ages of 18 and 40 who are residents of Cross River State, Nigeria. Being a resident of Cross River State implies that the individual is living in urban or rural areas in at least one of the 18 Local Government Areas of the state. Individuals currently in the state on visitation for tourism, business, or other short-term purposes were excluded from the study. Furthermore, an individual must be between 18 to 40 years old to be eligible to participate. Regardless of whether they were residents or not, anyone under the age of 18 or over 40 was not allowed. This age range was specifically chosen because it encompasses the young and middle-adult age groups, who are generally more active, independent, and likely to engage in various activities than older age groups. For instance, older individuals may have different life experiences, health concerns, or social dynamics, which could introduce additional variables to the study. By focusing on a narrower age range, the researchers can minimise the potential confounding factors and obtain more reliable results.

The multistage sampling procedure was followed to select a sample of 1,106 respondents. In the first stage, the researchers stratified the population into three clusters according to the senatorial districts: southern, central and northern. In the second stage, the simple random sampling technique was adopted to select 25% of the region's available Local Government Areas (LGAs). This led to the selection of two LGAs each from the Southern (with seven LGAs) and Central (with six LGAs) districts and one LGA from the northern senatorial district (with five LGAs). In stage 3, the researchers randomly selected 19 communities across the five LGAs selected in the previous stage as the sampling frame. The distribution across the three districts is as follows: southern = 7 communities; central = 7; northern = 5 communities. In the last stage (stage 4), the researchers employed the simple random sampling technique in selecting a sample of 1,106 participants that met the eligibility criteria of this study.

2.4. Instrumentation

Data was collected for the study using a structured questionnaire. The researchers developed the questionnaire. The questionnaire was structured into three sections. Section A was designed to collect demographic data about the respondents, such as age, sex, marital status, education level, and occupation. Section B comprised six carefully adopted items from questionnaires validated and used by three previous studies (Hou & Sarigöllü, 2021; Ojedokun, 2011, 2013). The items in Section B were used to measure self-concept and were organised on a four-point Likert scale, ranging from strongly agree to strongly disagree. Sample items in Section B of the questionnaire include: *"I like a clean environment devoid of waste," "Proper waste management is my priority," "I am confident in managing waste," "I encourage being environmentally conscious," "I dispose my waste effectively to avoid health problems" and "I am not concerned about waste littering around me."* Section C comprised 10 items devoted to measuring the solid waste management practices of the respondents. Items in Section B were adapted from the questionnaires used by previous studies on

solid waste management (such as (Delgermaa & Matsumoto, 2016; Fratta, Toneli, & Antonio, 2019; Moghadam, Mokhtarani, & Mokhtarani, 2009; Radha, Kalaivani, & Lavanya, 2009)). Respondents rated the extent to which they agreed or disagreed with the statements on a four-point Likert agreement scale. Response options ranged from strongly disagree to strongly agree. Some sample items in Section B of the questionnaire are: “I dispose of my waste in any available space,” “I do not see any need to trek to a waste container,” “Only my children dispose of wastes,” “I dump my waste in open dumpsites,” and “I dump my solid waste in gutters.”

2.5. Validity and Reliability

Six experts affiliated with the University of Calabar (comprising three environmental education professionals and three psychometrics experts) validated the instrument used for data collection. This group meticulously evaluated the survey instrument for its face and content validity. Their assessment ensured that the questionnaire items comprehensively covered the core themes within each subsection and verified the clarity and appropriateness of statements and item positioning. In cases where certain items were perceived as irrelevant, adjustments were made, or those items were eliminated, guided by their constructive recommendations. The content validity index was computed to quantify the scale's content validity, considering the degree of unanimous agreement among experts. This index was calculated to be 0.913, reflecting a high level of consensus. Further insight was gained by examining individual item content validity indices ranging from 0.82 to 0.95 for the self-concept domain and from 0.89 to 0.93 for the solid waste management domain. The Cronbach's Alpha method was employed to establish the instrument's reliability. The outcome of this analysis yielded a coefficient of 0.884, signifying strong internal consistency across the questionnaire items.

2.6. Ethical considerations

As per national and institutional regulations, ethical clearance was not required since the study posed no physical, emotional, or social risks to the participants. However, before gathering data, participants were assured that their responses would be treated anonymously and used solely for academic purposes. They voluntarily took part in the study after receiving clear explanations of its objectives. Following the recommended Safe Harbour principles for studies involving human subjects, all participants' personal information was anonymised.

2.7. Data Collection and Analysis

The researchers collected primary data by distributing copies of the questionnaire to participants. The researchers gathered data from 1,085 respondents with the assistance of three research assistants. To analyse the data, all responses were scored, accounting for variations in item wording. The data were coded into a spreadsheet program based on the variables.

3. RESULTS

The results of this study are presented according to the hypothesis guiding the study. The section is organised under the following subheadings:

3.1. Age and Solid Waste Management

The first hypothesis aimed to determine whether age significantly influences solid waste management among study area residents. Data on the age of participants was collected categorically, such as 18-27 years, 28-38 years, and 38 years and older. Nevertheless, the dependent variable (solid waste management) had continuous data through the summation of responses to all the ten Likert scale items measuring solid waste management. A one-way analysis of variance (ANOVA) was performed to test the hypothesis at the .05 level of significance. Table 1 shows that for the age group of 18-27 years, there were 329 participants. On average, they scored 34.84 in solid

waste management, with a standard deviation of 2.42. This suggests a narrow range of results within the group and a moderate level of competence. The age group of 28-37 years consisted of 511 participants. Their mean score for solid waste management was 34.71, slightly lower than the previous group. The standard deviation of 2.48 suggests a similar level of variability in scores as the 18-27-years group. In the 38-year-old and above age group, there were 245 participants. They obtained the highest mean score of 35.46 in solid waste management, indicating a slightly better performance than the other age groups. The standard deviation of 2.51 suggests a similar level of variability in scores as the other two age groups. Considering all age groups, the mean score for solid waste management was 34.92, with a standard deviation of 2.48. This implies a moderate level of performance across the entire sample, with a moderate level of variability in scores. Table 1 reveals an F-value of 7.886, with a p-value of .000, less than the .05 significance level at 2 and 1082 degrees of freedom. This result rejected the null hypothesis, whereas the alternative hypothesis was upheld. This result implies that age significantly influences solid waste management among residents in Cross River State.

Table 1. Summary data and one-way ANOVA of the influence of age on solid waste management (N=1085).

| Age | N | | M | SD | |
|--------------------|---------|------|-------|-------|-------|
| 18-27 years | 329 | | 34.84 | 2.42 | |
| 28-37 years | 511 | | 34.71 | 2.48 | |
| 38 and above years | 245 | | 35.46 | 2.51 | |
| Total | 1085 | | 34.92 | 2.48 | |
| Source of variance | SS | Df | MS | F | p |
| Between-group | 95.97 | 2 | 47.98 | 7.89* | 0.000 |
| Within group | 6584.06 | 1082 | 6.09 | | |
| Total | 6680.02 | 1084 | | | |

Note: *Significant at 0.05 level; SS = Sum of squares; Df = Degrees of freedom; MS = Mean square.

Because age has a notable impact on solid waste management, a post hoc examination was conducted using Fisher's Least Significant Difference (LSD) method for multiple comparisons. The findings of this analysis are laid out in Table 2. Table 2 illustrates the outcomes of Fisher's LSD test, which compares three age groups: 18-27 years, 28-38 years, and 38 years and older, concerning their approaches to solid waste management. Upon scrutinising the average variation in solid waste management between the 18-27-years age group and the 28-38-years age group, it is noted that the average difference is 0.13. Nonetheless, the p-value computed for this disparity is 0.468, surpassing the significance threshold of 0.05. Consequently, the dissimilarity between these two age groups lacks statistical significance. When examining the mean distinction in solid waste management between the 18-27 age group and the 38 years and older age group, the calculated mean difference amounts to 0.62. The corresponding p-value for this contrast registers at 0.003, below the 0.05 significance level. This indicates that the divergence between these two age groups is statistically meaningful. Likewise, in comparing the mean discrepancy in solid waste management between the 28-38 age group and the 38-year-old and older age group, the observed mean difference reaches 0.75. The p-value associated with this divergence is 0.000, less than 0.05. Consequently, the distinction between these two age groups also holds statistical significance.

Table 2. Fisher's least significant difference (LSD) multiple comparison analysis of the influence of age on solid waste management.

| Age (A) | Age (A) | Mean difference (MD) | Std. error | p |
|-------------|--------------------|----------------------|------------|-------|
| 18-27 years | 28-38 years | 0.13 | 0.17 | 0.468 |
| | 38 years and above | 0.62* | 0.21 | 0.003 |
| 28-38 years | 38 years and above | 0.75* | 0.19 | 0.000 |

Note: * The mean difference is significant at the 0.05 level;

3.2. Gender and Solid Waste Management

The second hypothesis aimed to explore the impact of gender on the practices of solid waste management among residents in Cross River State, Nigeria. In this context, the independent variable is gender, encompassing two nominal categories: male and female. On the other hand, the dependent variable is the approach to solid waste management. An independent t-test analysis was conducted to test this hypothesis, with a significance level set at 0.05. The outcome of this analysis is displayed in Table 3. Table 3 illustrates that among the participants, males (N = 614) exhibited an average score of 35.09 for solid waste management, accompanied by a standard deviation of 2.32. Conversely, female participants (N = 471) displayed a mean score of 34.70 in solid waste management and a slightly higher standard deviation of 2.66. The analysis yielded a t-value of 2.60, along with a corresponding p-value of .000. The t-value quantifies the magnitude of differentiation between the mean scores of the male and female groups. In contrast, the p-value gauges the statistical significance of this disparity. With the calculated p-value being less than 0.05 ($p < 0.05$), it is evident that the variance in solid waste management scores between male and female participants is statistically significant at the 0.05 level. As a result, the alternative hypothesis was accepted, and the null hypothesis was rejected. This implies that gender does indeed exert a statistically significant influence on the way residents in Cross River State manage solid waste.

Table 3. Independent t-test analysis of the influence of gender on solid waste management (N=1085).

| Variables | Gender | N | M | SD | t | p |
|------------------------|--------|-----|-------|------|-------|-------|
| Solid waste management | Male | 614 | 35.09 | 2.32 | 2.60* | 0.000 |
| | Female | 471 | 34.70 | 2.66 | | |

Note: * Significant at 0.05 level, critical $t=1.96$, $df = 1083$.

3.3. Self-Concept and Solid Waste Management

The third hypothesis examined the influence of self-concept on solid waste management among residents in Cross River State. Continuous data were obtained for both the independent and dependent variables after summing the scores of the Likert scale items measuring both variables. A simple linear regression analysis was performed to test the hypothesis at the .05 significance level. Table 4 shows an adjusted R^2 of .375, indicating that self-concept accounted for 37.5% of the variation in solid waste management. By implication, 62.5% of the unexplained variance in solid waste management is attributable to other predictor variables not included in the model. Moreover, the F-value obtained from the regression analysis in Table 4 was 652.01, and the p-value of .000 is statistically significant ($p < .05$) at 1 and 1083 degrees of freedom. Based on this result, the null hypothesis was rejected, while the alternative hypothesis was supported. This result implies that self-concept significantly influences solid waste management among residents in Cross River State. Predictively, Table 4 shows that a unit increase in the standard deviation of respondents' self-concept is associated with a 0.61 increase in solid waste management, assuming other factors remain unchanged.

Table 4. Simple regression result of the relationship between self-concept and solid waste management

| Model | Sum of squares | Df | Mean square | F-ratio | p |
|-----------------|----------------|-------|-------------|---------|-------|
| Regression | 2510.32 | 1 | 2510.32 | 652.01* | 0.000 |
| Residual | 4169.71 | 1083 | 3.85 | | |
| Total | 6680.02 | 1084 | | | |
| Model | B | SE | Beta | t | p |
| (Constant) | 17.85 | 0.671 | | 26.60 | 0.000 |
| Online database | 0.81 | 0.032 | 0.613 | 25.534 | 0.000 |

Note: * Significant at 0.05 level; B = Unstandardised regression coefficient; SE = Standard error; t = t-test value; p = Probability value

4. DISCUSSION

The study's first findings indicate that age significantly influences solid waste management among residents in Cross River State. The mean scores obtained by participants in different age groups suggest variations in their performance in solid waste management. The result of this study aligns with previous research revealing that different age groups have varying attitudes, perceptions, and behaviours towards waste management, making age an important factor in solid waste management practices (Agissova & Sautkina, 2020; Bozoglu et al., 2016; Casaló & Escario, 2018). Similarly, previous research has identified age as a significant predictor of environmental attitudes and behaviours (Fang et al., 2018; Grønhøj & Thøgersen, 2017; Wang et al., 2021). In the current study, participants aged 18 to 27 scored an average of 34.84 in solid waste management. This result suggests that individuals in this younger age group are moderately competent at managing solid waste. Factors such as educational initiatives, environmental awareness campaigns, or exposure to waste management practices may have influenced their knowledge and behaviour in this area. The next age group, participants aged 28 to 37, obtained a slightly lower mean score of 34.71 in solid waste management. While the difference in scores is small, it indicates a slightly lower level of performance compared to the younger age group. This finding may be attributed to various factors, such as changes in lifestyle, responsibilities, or priorities, that could affect their focus on waste management practices.

Interestingly, participants in the oldest age category (38 years and older) achieved the highest mean score of 35.46 in solid waste management. This indicates a slightly better performance compared to both the younger age groups. The result disagrees with the findings of some studies revealing that younger individuals are more environmentally conscious and engage in more pro-environmental behaviours than older individuals (Fang et al., 2018; Grønhøj & Thøgersen, 2017; Wang et al., 2021). However, the result agrees with several other studies documenting a significant positive relationship between age and solid waste management. For instance, Choon et al. (2017) found a positive relationship between age and waste reduction behaviours such as reuse and recycling. Similarly, residents' recycling behaviour improved slightly with age, and older adults showed more recycling practices than younger citizens (Martin et al., 2006; Nixon & Saphores, 2009; Singhirunnusorn et al., 2017).

One possible explanation for the result of the current study is that older individuals might have accumulated more experience and knowledge in waste management over time. They may have been exposed to waste management practices for a longer period, which could contribute to their better performance. The implications of these findings are twofold. Firstly, they highlight the need for targeted interventions and educational programs to enhance solid waste management practices among younger age groups (18-27 years and 28-37 years). These initiatives could focus on increasing awareness, providing training, and promoting responsible waste disposal habits. Secondly, the study suggests that older individuals (38 years and older) demonstrate relatively better performance in solid waste management. This finding emphasises the potential value of their experience and knowledge, which could be harnessed through intergenerational knowledge transfer programs. Encouraging the involvement and collaboration of older individuals in waste management initiatives could contribute to improved overall waste management practices.

The study's second finding highlights a statistically significant influence of gender on solid waste management among residents in Cross River State. The results indicate that, on average, males exhibit more favourable solid waste management practices than their female counterparts. This result corroborates the evidence presented by some previous studies. For example, Odok and Onnoghen (2018) revealed that male students were more responsive to solid waste management than their female counterparts. Similarly, Liang and Sharp's (2016) study revealed that female participants in China, Laos, and Thailand had less knowledge about enhancing environmental conditions than their male counterparts. Nevertheless, the result is at variance with other studies, which revealed that female participants exhibited a positive and responsible attitude towards the environment (Koop & Van Leeuwen, 2017) and solid waste management in Ghana (Owusu et al., 2013; Yin & Mariwah, 2013) in comparison to male

respondents. Despite the disagreements, several possible reasons exist for this observed difference in solid waste management practices between males and females recorded in the presented study.

Firstly, societal norms and gender roles may shape individuals' behaviours and attitudes towards waste management. It is possible that males, due to cultural or social expectations, have been encouraged or socialised to take on responsibilities related to waste management, such as disposal or recycling. The social training may have impacted their attitude and mindset, leading to more advantageous waste management techniques. Secondly, differences in knowledge and awareness about waste management practices could contribute to the gender disparity. Males, on average, have greater exposure to information and education related to waste management, leading to a better understanding and implementation of effective waste management practices. This could be influenced by factors such as access to educational resources, occupational or professional exposure, or community initiatives targeting waste management education. Moreover, gender-specific factors, such as differences in mobility patterns or household roles, may contribute to the observed disparity. For example, suppose males tend to be more involved in activities that generate waste or have more responsibility for waste disposal within the household. In that case, they may have more direct control and influence over waste management practices, leading to better outcomes. The implications of this finding are significant. It highlights the need for targeted interventions and strategies to bridge the gender gap in solid waste management practices. Efforts should be made to promote gender equality in waste management, ensuring that both males and females have equal access to education, awareness campaigns, and resources related to waste management. The study's third finding indicates that self-concept significantly influences solid waste management among residents in Cross River State. Self-concept accounted for 37.5% of the variation in waste management. A higher self-concept was associated with better waste management practices. It was predicted that a 0.61 percent increase in solid waste management is associated with a one percent increase in the standard deviation of self-concept. The result aligns with the study conducted by [Ojedokun and Balogun \(2010\)](#), which revealed that self-concept, environmental self-efficacy, and environmental attitude collectively contributed 18% to the variance in responsible environmental behaviour. Similarly, [Ojedokun and Balogun \(2011\)](#) documented that a combination of altruism, environmental self-efficacy, locus of control, self-concept, age, and gender accounts for 57% of the variation in attitude towards littering. This finding suggests that individuals with a positive self-concept are more likely to exhibit responsible waste management behaviours. Promoting positive self-concept through educational campaigns and emphasising personal responsibility can encourage sustainable waste management practices. The implications of this finding are noteworthy for waste management interventions. It highlights the importance of promoting a positive self-concept and environmental consciousness among individuals. By emphasising personal responsibility and fostering a belief in one's ability to make a difference, initiatives can encourage individuals to adopt sustainable waste management behaviours. Educational campaigns and programs can play a crucial role in enhancing self-concept and environmental awareness. These interventions can focus on empowering individuals and providing them with the knowledge and skills needed to actively contribute to waste reduction, recycling, and responsible waste disposal. Moreover, by showcasing real-life examples of individuals who have successfully implemented sustainable waste management practices, communities can inspire others and enhance their self-efficacy. This further reinforces the belief that individual actions can have a meaningful impact on waste management and the environment.

4.1. Limitations of the Study and Future Research Directions

Despite its contributions, this study possesses certain limitations that warrant consideration. Firstly, the geographical scope was confined solely to Cross River State, Nigeria, potentially restricting the applicability of findings to broader contexts with varying socio-economic circumstances and waste management systems. The reliance on self-reported responses through questionnaires could have introduced recall and social desirability biases, which may have influenced the accuracy of reported waste management practices and attitudes. Though

necessary for analysis, the categorisation of age groups might not capture the subtleties within certain age ranges, potentially obscuring more nuanced age-related trends in waste management practices. Additionally, the study's consideration of factors was limited to age, attitude, and self-concept, omitting other potentially influential variables such as socio-economic status, education level, and cultural factors.

To build upon the insights gained from this study, several avenues for future research emerge. To provide a more complete picture, longitudinal studies may shed light on the temporal dynamics of waste management attitudes and practices within the same population. Comparative studies that span multiple regions or countries could help gauge the impact of diverse infrastructures, policies, and cultural norms on waste management behaviours. Complementing quantitative data, qualitative insights obtained through in-depth interviews could offer a deeper understanding of the underlying motivations and barriers that shape waste management practices. Designing and implementing interventions based on the factors identified in this study could establish causal relationships and gauge the efficacy of strategies to promote responsible waste management behaviours. Expanding the variables considered, such as education level, income, and cultural beliefs, could offer a more holistic understanding of the multifaceted factors influencing waste management practices. Integrating behavioural psychology frameworks could offer insights into the cognitive and psychological drivers of individuals' waste management decisions. Lastly, exploring the role of technology, like mobile applications or community engagement platforms, could uncover innovative ways to facilitate and incentivise responsible waste management practices.

5. CONCLUSION

This study provides valuable insights into the factors influencing solid waste management among residents in Cross River State. The findings highlight the significance of age, gender, and self-concept in shaping waste management practices. Older individuals (38 years and older) exhibit slightly better waste management practices. Males demonstrate more favourable behaviours compared to females. A positive self-concept significantly impacts waste management practices. These findings underscore the need for comprehensive waste management strategies considering age, gender, and self-concept. Interventions should promote environmental awareness, provide equal opportunities for all individuals to participate in waste management efforts, and foster a sense of personal responsibility and empowerment. Cross River State can move towards a more sustainable and efficient waste management system by implementing these recommendations. This benefits the environment by reducing pollution and promoting resource conservation, contributing to its residents' overall well-being and quality of life. Ultimately, the findings of this study provide valuable insights for policymakers, waste management practitioners, and community stakeholders to develop evidence-based strategies that promote responsible waste management behaviours and pave the way towards a cleaner and more sustainable future.

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