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GEOSPATIAL DISTRIBUTION OF WASTE DUMPSITES AND SOCIOECONOMIC FACTORS INFLUENCING WASTE MANAGEMENT PRACTICES IN ABEOKUTA SOUTH, NIGERIA.

Attah, Theophilus O.[1] and Alausa, Olalekan A.[2]

[1, 2]Department of Surveying and Geoinformatics, Federal polytechnic, Ilaro, Ogun State.

Email: [1]theophilus.attah@federalpolyilaro.edu.ng; [2]olalekan.alausa@federalpolyilaro.edu.ng

Abstract

Rapid urbanisation has continually led to waste increase, placing a demand on dynamic waste management for effectiveness. This research focuses on the examination of the potential geospatial distribution of waste dumpsites and the socioeconomic impacts on managing waste in Abeokuta South, Nigeria. Fourteen (14) dumpsites were observed and mapped using geospatial techniques, with buffer zones of 100m, 500m, and 1km indicators monitoring significant residents vulnerable to the hazards relating to dumpsite. Households falling within the exposure buffer zone are then visualize. Additionally, structured questionnaires were administered to residents within these distances to evaluate the influence of socioeconomic factors—particularly income and education levels—on waste disposal methods, including open burning, open dumping, incineration, and waste collection. Results revealed that many households in Abeokuta South reside within 100m proximity to a dumpsite, a proximity linked to increased respiratory health risks. Furthermore, the study shows that lower-income and less-educated households were more likely to engage in open dumping and burning. Among these respondents, 68% and 46% who practiced open dumping and open burning, respectively, were low-income earners. However, keeping waste for collection was the most widely practiced disposal method across all income groups. 44% of low-income, 50% of middle-income, and 6% of high-income households adopted this practice. These findings reveal that while household income levels significantly influence waste management behaviors, the strategic placement of waste bins can help mitigate improper disposal practices across different income groups.

Keywords: geospatial analysis, socioeconomic factors, waste disposal, waste management

INTRODUCTION

Waste management remains a persistent challenge associated with human activities, posing both social and environmental concerns (Jorge, 2024; Ogbeide & Henry, 2024). A 2016 World Bank report estimated that an individual generates an average of 0.74 kg of waste daily, though this varies significantly by region—from 0.11 kg in Sub-Saharan Africa to 4.54 kg in North America.

Globally, only a small portion of waste is either recycled or composted (19%), while 11% undergoes incineration. The report further projects that solid waste generation will escalate to 3.40 billion tonnes by 2050 due to urbanization and economic expansion (Cerqueti et al., 2021). As population growth fuels continuous migration to urban centers, inadequate waste management systems become a pressing issue (Kristyn & Liu, 2018). Poor disposal practices can lead to blocked drainage systems, fostering insect breeding in stagnant water and increasing flood risks during rainy seasons (Attah & Alausa, 2023). The insufficiency of the management system of waste has further led to uncontrolled burning of waste which has contributed significantly to air pollution and release of harmful substance (Mokuolu et al., 2021). The breakdown of organic waste is at a quicker rate during higher temperature season and thereby increase the unsuitable odour of dumpsites threatening nearby household health, hence, the need to assess the socioeconomic elements of the neighbouring household and the proximity of the dumpsite becomes pressing (Fraternali et al., 2024 ; Kaza et. al, 2018 ; Laurent et. al, 2014).

Okusanya et al., (2023) in their study combated the solid waste problem adding to the recycling of pet waste in developing countries like Nigeria, their study focused on designing and testing a PET bottle shredder to reduce the rapid accumulation of plastic waste worldwide. This machine is designed to break down recyclable plastics into smaller granules, providing a solution for small-scale plastic waste management. Ojo and Elesin, (2022) emphasize the health effect of waste mismanagement in their study, evaluating the disposal system of abattoir waste which has significant implications for both animal and human health, as well as environmental sustainability. They inferred that improper disposal can harm ecosystems and compromise the wellbeing of nearby communities. Effective management and disposal of abattoir waste are crucial to ensuring safety and protecting the integrity of the food supply, particularly meat consumption.

Chandel et al., (2024) and Singh, (2019) also unveiled that waste management efforts are hindered by a lack of reliable data, particularly in developing countries with limited monitoring infrastructure. Traditional small-scale studies provide limited insights, while regional strategies require comprehensive data. Fortunately, advancements in remote sensing and GIS technologies have enhanced regional waste management studies over the past few decades. These innovative tools facilitate efficient data collection, processing, and transmission, enabling more effective solid waste management (Chandel et al., 2024).

Remote sensing (RS) technology have continued to offer a cost-effective and efficient solution for identifying and monitoring landfills and solid waste disposal sites (Zulkifli et al., 2022). Satellite data often enable widespread coverage, reducing infrastructure costs, and facilitates targeted investigations. Also, Earth Observation satellites provide a wealth of image data, allowing researchers to track site changes over time using Geographic Information Systems (GIS). By integrating GIS and RS techniques, researchers now pinpoint suitable sites for solid waste disposal, minimizing environmental pollution and health risk range(Michael & Rienow, 2025; Fraternali et al., 2024).

Therefore, integrating relationship of Geographic Information Systems (GIS) and remote sensing technologies has rapidly improved the geospatial analysis using primary or secondary spatial data, thereby improving the output nature for an informed decision-making process. The growing influence of geospatial technology, and its ability to used alongside some other methods has greatly increased involvement in other studies. This doesn't exclude its application in waste dumpsite proximity analysis to other essential facilities, with often result in improved waste management strategies (Thaore et al., 2024; Ziraba et. al, 2016). This technology has also grown in functions with other features like hot spot analysis, spatial visualization of environmental impact analysis, and discovery of workable waste disposal plan (Chandel et al., 2024; Biluca et al., 2020). Recent research from different locations have highlighted the strength of geospatial tools in visualizing and determining waste distribution pattern, also unveiling effective management means for better locational hygiene and aesthetics, putting less attention on the socio economic effects (Fraternali et al., 2024; Medina-medina et al., 2024; Moyen Massa & Archodoulaki, 2024; Zulkifli et al., 2022; Biluca et al., 2020). Notably also, Aparicio-Ballena et al. (2024) and Pathak et al. (2024) and Fazzo et. al, (2023) and Siddiqua et. al, (2022) identified two major socioeconomic factors influencing waste management practice to include; income levels and educational attainment. Therefore, this study is underpinned on a mixed approach employed merging geospatial approach alongside socioeconomic evaluation for Abeokuta South, a location with limited attention of such research approach, with the goal of improving their waste management strategies.

Nigeria, like many developing countries, struggles with rapid urbanization which has greatly influenced waste production and disposal practice. This occurrence has resulted in significant threats affecting both environmental sustainability and public health (Ziraba et al., 2016). Despite the volume of attempts engaged to manage waste policies in Nigeria, the challenges seem to persist, and the situation remains dynamic (Moyen Massa & Archodoulaki, 2024). Abeokuta South in Ogun State an area with urban settlements whose waste disposal practice requires review for the purpose of effective practice, emphasizing the need for this study.

Although structural and financial measures have been implemented by the state and local governments as well as corporate partners to address this pressing issue, the problem still exists as urbanisation increases, particularly for the undereducated and low-income populations. This study aims to fill a critical gap by exploring the intersection of geospatial patterns of waste dumpsites and the socioeconomic factors influencing waste management practices in Abeokuta South, Nigeria.

Study Area

Abeokuta's area is estimated to be 40.63 km², the city falls within longitudes 3°17′E to 3°26′E and latitudes 7°10′N to 7°15′N. This city is positioned within areas having igneous rocks overlain by various sedimentary formations, located within Ogun State of Nigeria's rainforest region (Ojo et al., 2022). Abeokuta is the capital of Ogun state see figure 1, and remains a growing urban center withing the southwestern states of Nigeria, this is seen in it by rapid growth in population and

infrastructures (Michael & Rienow, 2025). From 2006 to 2024 population growth is projected to be about 38% (Aduwa, 2021). In these growth pattern of Abeokuta, the Southern part of this city remains the leading commercial and administrative domain, consisting of mixed tribal residents, allowing divers commercial activities, and high rate of industrial use of land, pointing to its role in economic growth drive. This effect has become obvious in its urbanization rate coupled with the increasing economic activity and migration from its proximity to Lagos state and its direct access to Lagos – Ibadan Highway playing a good bases for fast growing trade and commerce (Ganiyu, 2018).

The local population mainly consists of low-income families which results in substantial effects on waste management procedures. Differences in waste management practices among resident's stem from socioeconomic factors including income levels, education access and availability of services. The persisting threat to environment and health condition of the community is born out of insufficiency regarding waste management systems, seen in the growth of unofficial waste disposal sites in this region, having the larger part of these area affected (Akerele, et al. 2017). Urbanization comes with a lot of opportunities but in Abeokuta South, one of its disadvantages is seen on increasing issues faced in waste management. The lack of proper implementation and updating of urban plan has led to unmanaged construction leading to blighted infrastructure without adequate drainage and waste disposal. Some scholars particularly state that without strategic plans and better governance systems for managing urban areas, the scenario will worsen in terms of pollution and health issues for the people (Aliyu, et al. 2017).

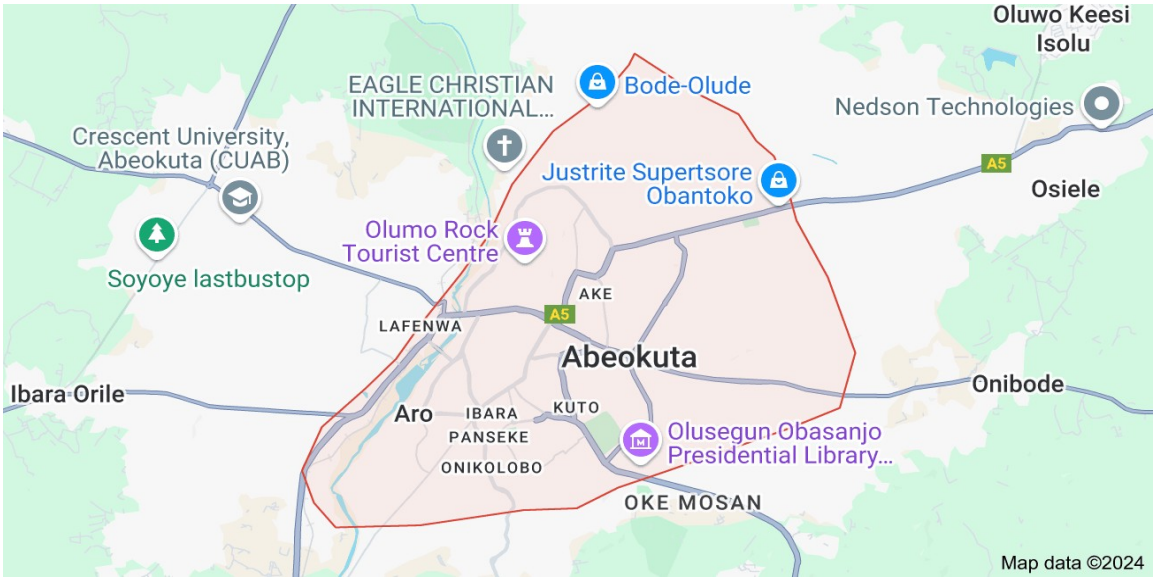

Figure 1: Abeokuta South
Source: (Google, 2024)

METHODOLOGY

Data Collection and Analysis

Geospatial socioeconomic data concerning the socioeconomics of the area was integrated with other descriptive details to achieve the goals of this research using a mixed method approach. The administrative district map of the Abeokuta built up area was downloaded from Grid3 which enabled the study area boundary delineation and the identification of spatial context of households for the analysis. A Geospatial socio-economic scan of the composition of 14 waste dumping sites in Abeokuta South was done using GPS devices as shown in Table 1, including the physical character of each dump site. This spatial and attribute data were processed and used to produce a thematic map of the study area showing the dumpsite location and the dumpsites concentration within the area of interest.

Geospatial technique such as buffering analysis was done within the ArcGIS 10.6 environment at the following set back distance 100m, 500m, and 1km, this unveils in quantitative manner location and proximity of households to dumpsites within the study area. Njoku et al. (2019) and Norsa'adah et al. (2020), in their study established a health risk range framework with waste health hazard buffer zones, this informed this buffer distance. These analyses serve as a basis for evaluating the level of concerned buildings in relation to waste exposure within the buffered area, making informed decision and strategies easy for mitigating purpose.

A geospatial analysis was carried out to cover the area occupied by dumpsites and their closeness to residential areas. Building on the study of Biluca et al., (2020) and Fraternali et al., (2024), which relates the waste dumpsite health dangers to distances of 0-100m, 500m and 1km,creating a 100m buffer zone around each dumpsite. This system allowed for the review of boundaries of residential areas and possible threats from poor waste disposal practices in the area.

A survey of 89 areas (purposively selected) in Abeokuta South was gotten to find out the living conditions causing waste disposal habits, giving useful information on neighbouring opinions, thoughts and actions to waste disposal. This survey studied the intra-connection between family income, educational background and waste disposal habits. Statistical review showed findings and connection, giving more details on complex connection of condition affecting disposal habits in the area.

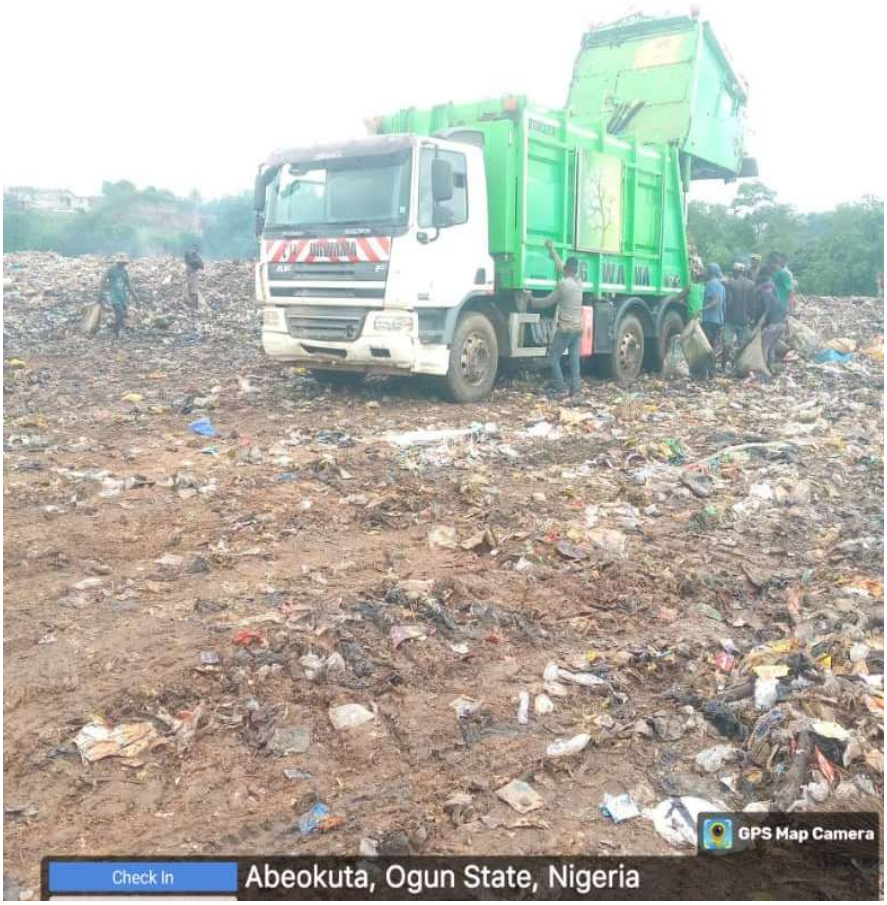

Figure 1A: View of Oke Itoko dumpsite.

Table 1: Coordinates and location of waste dumpsites

S/N	LOCATION COORDINATE		GEOGRAPHIC AREA	No of Dumpsites per Area
	EASTINGS	NORTHINGS		
1	536927	787469	Oluwo Junction	1
2	536617	788554	Great Nig. Insurance Panseke	1
3	536497	789617	Afro Junction Axis	1
4	538821	792478	Itoko Junction Axis	1
5	538804	792096	Oke Itoko	1
6	536683	791056	Totoro	1
7	539973	789803	Inec Office Axis	1
8	540523	790897	Rccg Church Area Abiola Way	1
9	537021	790211	Opp. Dental Centre, Nawairudeen	1
10	538910	790503	Opp. General Hospital, Oke-Ijeun	1
11	536535	789663	Iyana Ijeja	1
12	536853	791033	Ago Oba	1
13	537372	791086	Iyana Igbore	1
14	540468	788708	Ewang Junction	1

RESULTS AND DISCUSSION

The result generated after the analysis are shown belown, starting with Figure 2, revealing the dumpsite position and other features such as important places/landmark, minor roads, main roads, building, etc.

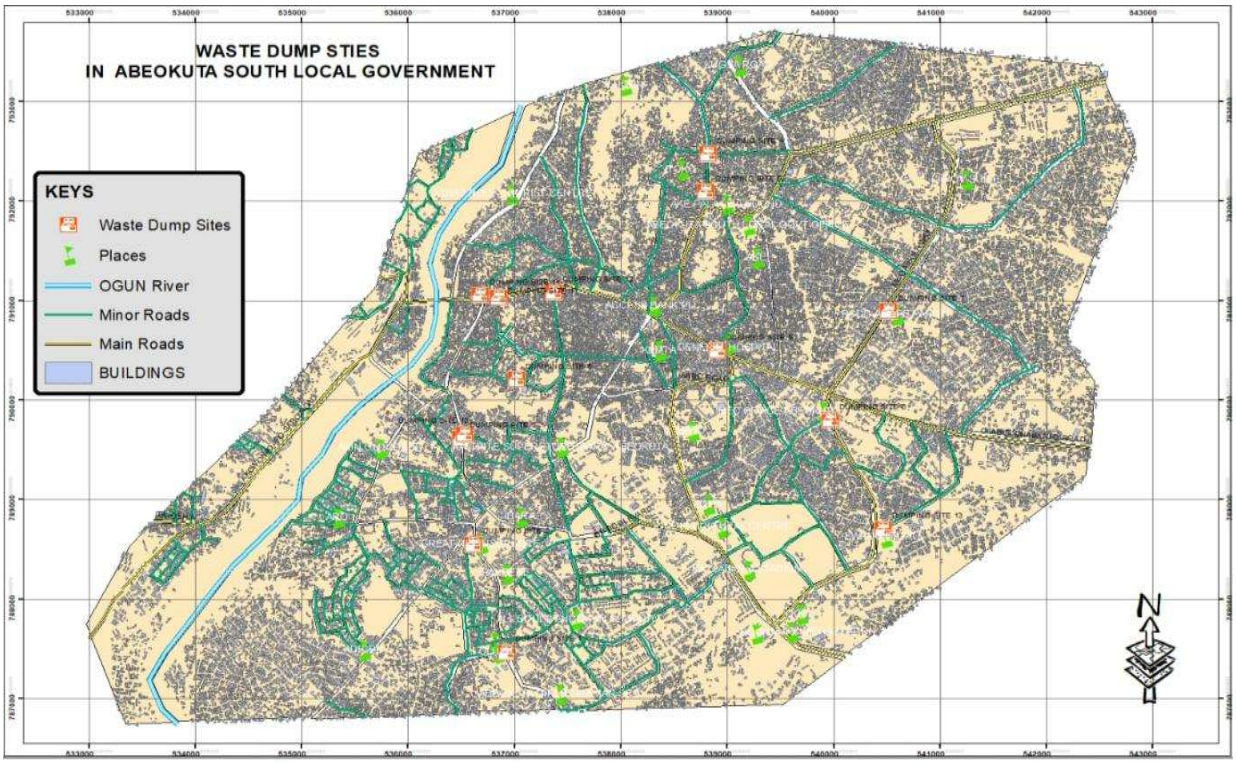

Figure 2: Map showing waste dumpsite location.

The study identified 14 waste locations, as shown in Table 1 with their coordinates. A map was generated to visualize the distribution of waste dumpsites in Abeokuta South.

Proximity of Households to Waste Dumpsites

The figure 3 buffer zone of 100m was established in Njoku et al. (2019) to enable quantification of the household within this first range of exposure to waste influenced hazard. The buffer zone becomes less noticeable due to its relatively small size of 100m analysis area compared to the larger study area, making it only discernible in digital format.

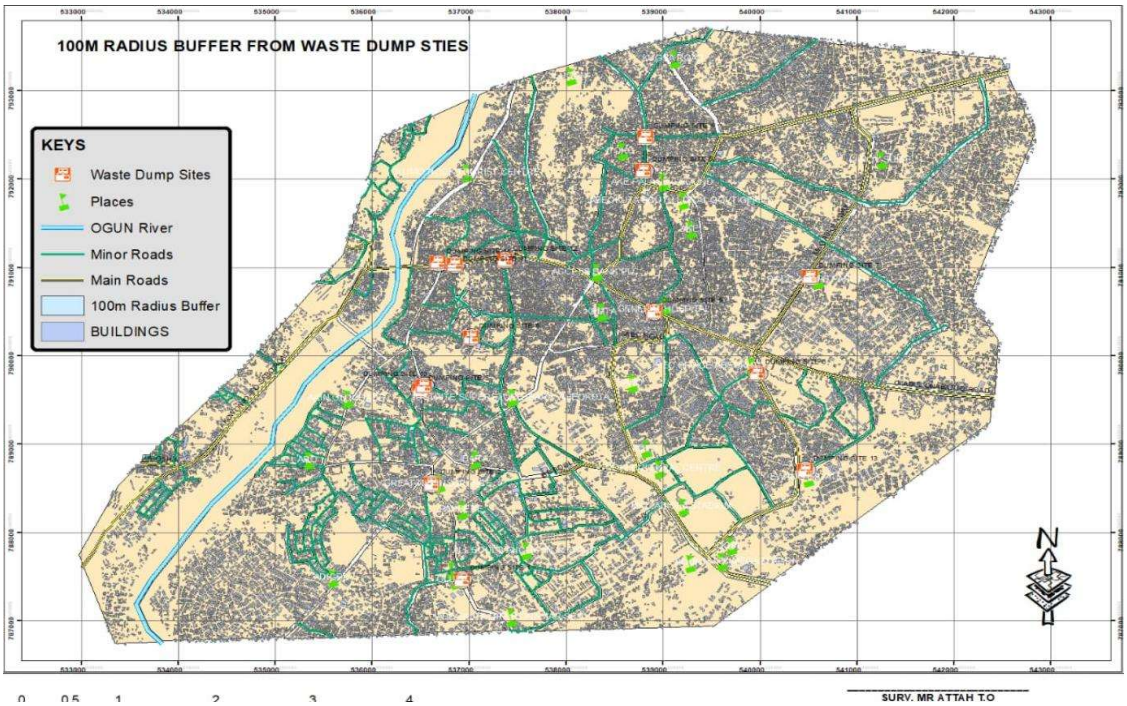

Figure 3: Map showing 100m buffer zone proximity from waste dumpsite to households

The circular image within the figure 4 revealed household falling within this range of analysis, this can then serve as a basis health status evaluation of the populace within this range of exposure.

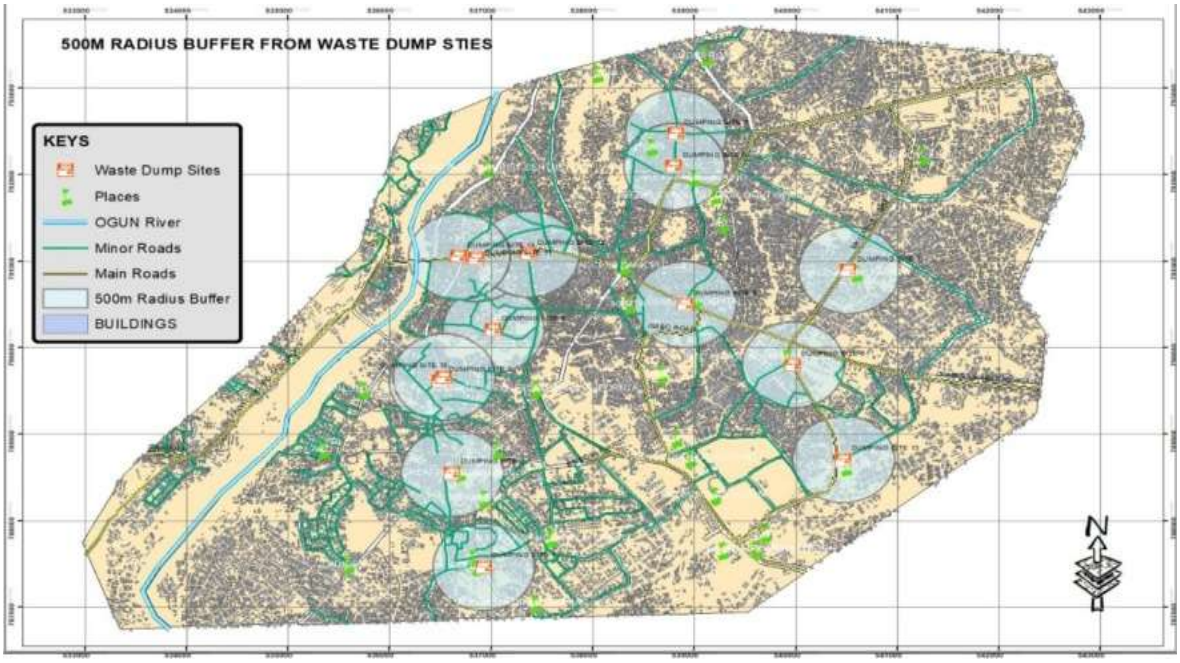

Figure 4: Map showing 500m buffer zone proximity from waste dumpsite to households

In figure 5, the overlapping rate of the buffer zone shows their proximity to each other, and by implication means there is a need to revive the locational analysis of the dumpsite within this metropolis.

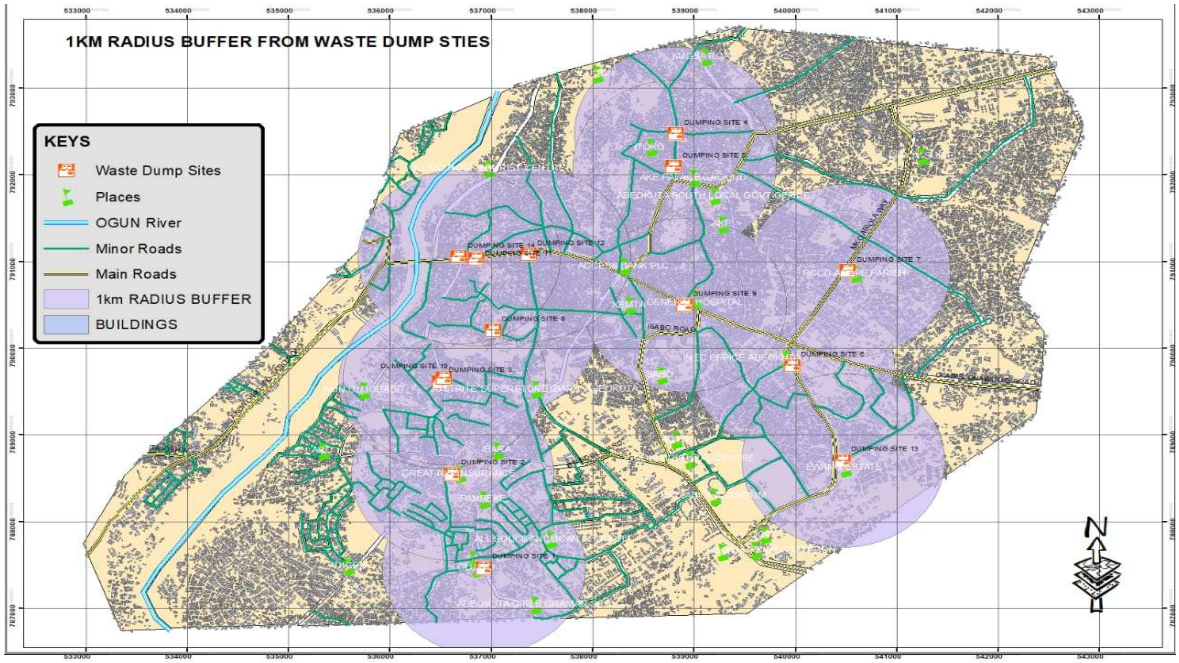

Figure 5: Map showing 1km buffer zone proximity from waste dumpsite to households.

Discussion 1

The spatial analysis sighted over half of the total households in Abeokuta South living within 100m, 500m and 1km of waste dumpsites, exposing them to environmental and health hazards. Importantly, the buffers of 100m and 500m drawn around the sites of dumping cover a large amount of built-up area, which suggests possible residential exposure. Expanding upon this spatial analysis, the results of Njoku et al. (2019) are further evidence of the potential health risks of living close to waste dumpsites. According to their research, 78% of residents exposed to the increased air quality contamination (due to the landfill) within 100-500m of the waste were found to suffer from severe consequences linked to the activities of the landfill, and residents living closest to these sites had a significantly higher incidence of respiratory illnesses, it is inferred that a significant proportion of households in Abeokuta South, particularly those within 100-500m of waste dumpsites, are at risk of exposure to waste dumpsite hazards associated with improper waste disposal.

This study by Norsa' adah et al. (2020) have shown that living or staying near dumpsites have serious health issues or problems. The people exposed to dumpsites have high risk of developing health issues such as sore throat, diabetes and hypertension as revealed in Kyari et al., (2024). This

highlights the urgent need for effective waste management strategies to reduce these health risks. In Abeokuta South, people living within 100m, 500m and 1km to these dumpsites are at high risk of facing these health issues or problems

The results presented in Tables (2, 3, and 4) and Figures (6 and 7) reveal a significant correlation between household income levels and waste management practices in Abeokuta South. Specifically, the data indicate that lower-income households (earning below N70,000) are more likely to engage in improper waste disposal practices, such as open dumping. Notably, 68% (20 respondents) of the 29 respondents who practiced open dumping were low-income earners, while 27% (8 respondents) were middle-income earners, and only 3% (1 respondent) were high-income earners.

Conversely, higher-income households (earning N200,000 and above) tended to adopt proper waste management practices, such as incineration. Among the 13 respondents who practiced incineration, 54% (7 respondents) were middle-income earners, and 23% (3 respondents) were high-income earners.

Interestingly, storing waste for collection was practiced across different income levels. Among the 16 respondents who stored waste for collection, 44% were low-income earners (7 respondents), while 50% were middle-income earners (8 respondents), and only 6% were high-income earners (1 respondent). This suggests that, although household income level influences waste management practices, strategic waste bin placement for effective waste collection can help mitigate improper waste disposal practices across income levels.

The results also reveal that residents without formal education tend to engage in improper waste management practices, such as open dumping and open burning, compared to residents with formal education. It is noteworthy that among the 28 and 26 respondents who engaged in open dumping and open burning, 64% and 46%, respectively, had no formal education. However, the study also found that a significant number of residents with formal education still participated in improper waste disposal methods, such as open burning and open dumping. Specifically, 29% of those who practiced open dumping and 27% of those who practiced open burning had attained primary or secondary school education. This indicates that while formal education is an important factor in encouraging proper waste management, it is not the sole determinant. Additional factors, such as access to waste management infrastructure and socioeconomic conditions, also significantly influence waste disposal behaviour.

Relationship between Waste Management Practice and Socio-Economic Factors

Table 2: Showing location and composition of waste dumpsite

LOCATION	TYPE OF WASTE	WASTE MANAGEMENT
Oluwo Junction	Household's waste batteries, old electronics, used papers etc.	Open Dumping
Great Nig. Insurance Panseke	Commercial waste Rags, broken furniture, used card boards, cans, Cartons etc.	Store For Collection for Recycling
Afro Junction	Majorly Construction debris, packaging materials & household wastes	Store For Collection for Recycling
Itoko Junction	Majorly Households waste like Broken glass, bottles old clothes	Open Dumping
Oke Itoko	Household's batteries, old electronics, used papers e.t	Open Dumping
Totoro	Clay waste& plastics waste majorly	Land Filling
Inec Office	Rags, broken furniture, used card boards, cans, Cartons	Incineration (Burning)
RCCG Church Abiola Way	Rags, broken furniture, used card boards, cans, Cartons etc.	Store For Collection for Recycling
Opp. Dental Centre, Nawairudeen	Majorly Households waste	Incineration (Burning)
Opp. General Hospital, Oke-Ijeun	Hospital waste & house hold waste	Store For Collection for Recycling
Iyana Ijeja	Industrials waste like scrap metals and production left overs	Open Dumping
Ago Oba	broken furniture, Rags used card boards, cans, Cartons	Open Dumping
Iyana Igbore	Majorly Households waste	Incineration (Burning)
Ewang Junction	Majorly Households waste	Store For Collection for Recycling

Table: 3 Relationships between Income Level and Waste Disposal Practice

Income Level(monthly)	Open Dumping	Incineration	Store for Collection	Open burning	Others	Total
Low Income (below N70,000)	20	3	7	10	1	41
Middle Income (N70,000 to 200,000)	8	7	8	10	1	34
High Income (200,000 and above)	1	3	1	2	1	8
Total	29	13	16	22	3	83

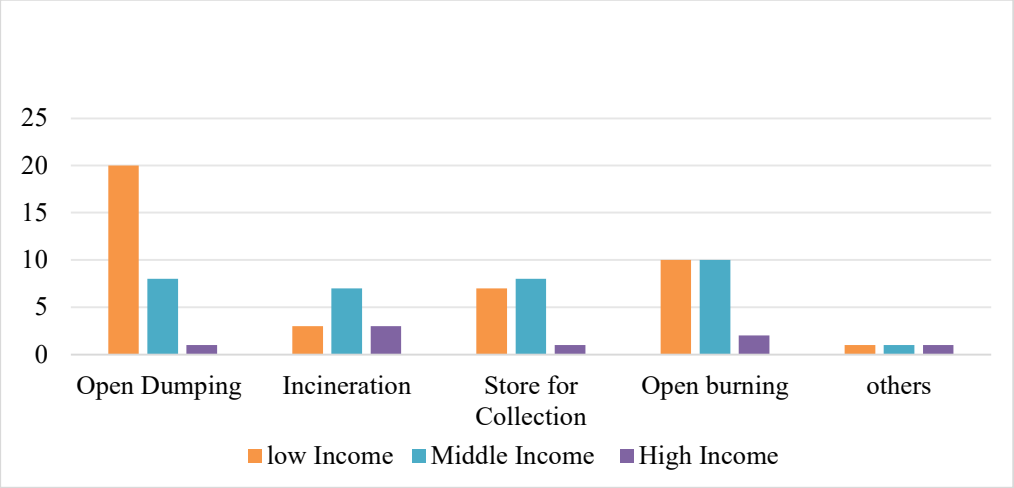

Figure 6: Bar chart showing Relationship between waste management practices and income level

Table:4 Relationships between Education Level and Waste Disposal Practices

Education Level	Open Dumping	Incineration	Store for Collection	Open burning	Others	Total
Non formal Education	18	5	7	12	1	43
Primary/Secondary School	8	4	6	7	1	26
Tertiary	2	4	5	7	2	20
Total	28	13	18	26	4	89

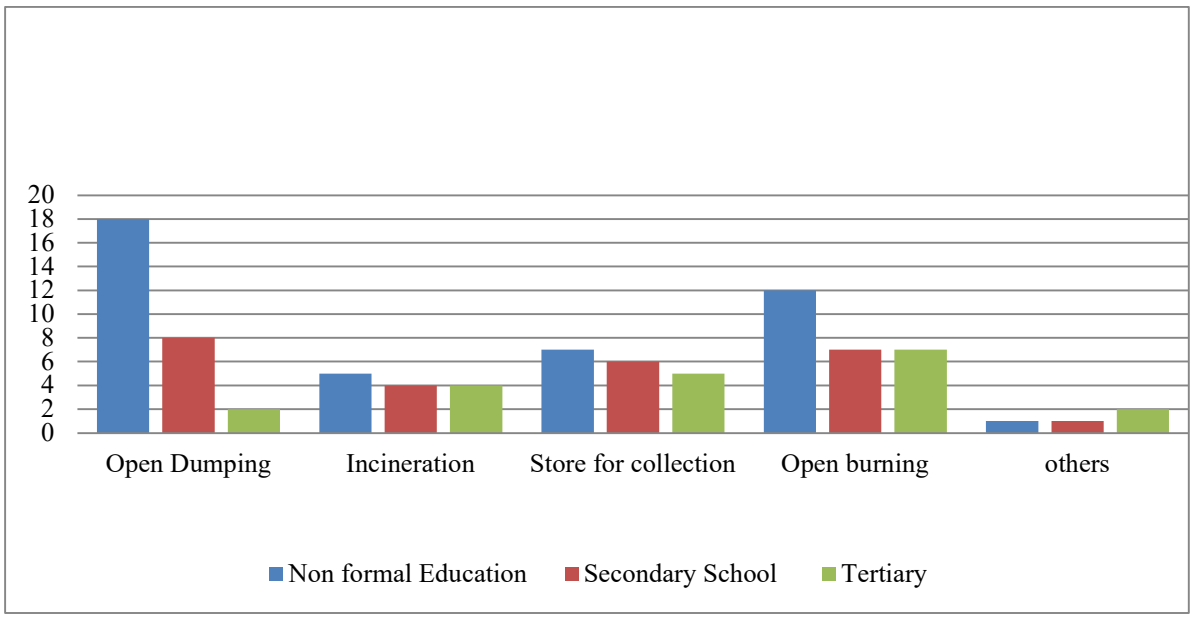

Figure 7: Bar chart showing Relationship between waste management practices and Education

CONCLUSION

This research reveals a concerning disparity in the distribution of waste dumpsites in Abeokuta South, with numerous households situated in close proximity (100-200 meters) to these sites. Consequently, residents in adjacent areas face heightened environmental and health risks, particularly from air and water pollution emanating from the dumpsite, which can lead to severe health complications. Furthermore, the study's findings indicate a strong correlation between socioeconomic factors and waste disposal practices. Households with lower socioeconomic status and limited formal education tend to engage in improper waste disposal methods, whereas higher-income households with better educational backgrounds are more likely to adopt responsible waste management practices. These findings underscore the urgent need for multifaceted policies, improved waste management infrastructure, and community engagement strategies to effectively address the challenges of waste management in Abeokuta South.

RECOMMENDATIONS

The following recommendations can be used to tackle the waste management issues in Abeokuta South:

1. *Improved Waste infrastructure*: With the aid of geospatial technology, the government and waste management authorities should Identify important locations to place waste bins across Abeokuta for proper disposal of solid waste.
2. *Strategic landfill Selection*: A suitable selected Landfill is important to the society which helps to minimize environmental and health hazards and this selection can be done with the use of geospatial technology to analyze a suitable site with the consideration of factors such as closeness to water bodies, residential areas, topography and route.
3. *Public Awareness and Education*: Improper Waste disposal can be minimized and eradicated in the society by Setting up a program to educate the residents on the hazards that comes with dumping refuse in flood or any indiscriminate burning of waste. Creating awareness and educating the citizen on proper way to dispose their solid waste will promote sustainable waste management and it will change the resident's perspective on waste disposal.

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