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**EVALUATING THE ENVIRONMENTAL AND HEALTH  
CHALLENGES OF OPEN WASTE DUMPSITES IN KATSINA  
METROPOLIS**

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**ABSTRACT**

This study evaluated the environmental and health challenges associated with open waste dumpsites in Katsina Metropolis. Using a descriptive survey design, data were collected from 385 respondents across various residential locations. Demographic analysis indicated a relatively balanced gender distribution and a majority of respondents within the economically active age group, highlighting the perspectives of those most exposed to environmental hazards. The study found that a large proportion of residents live in close proximity to dumpsites, facing environmental risks such as air pollution, water contamination, soil degradation, and pest infestation. Common health challenges reported included respiratory diseases, malaria, typhoid, and skin infections. Inferential analysis revealed a statistically significant relationship between residential proximity to dumpsites and health outcomes, while correlation analysis demonstrated a moderately strong positive association between environmental pollution and health challenges. The findings underscore the urgent need for sustainable waste management practices, targeted public health interventions, and stricter policy enforcement to mitigate the environmental and health risks posed by open waste dumpsites in Katsina Metropolis.

**KEYWORDS:** Environment, health challenges, open waste, dumpsites.

## 1. INTRODUCTION

Open waste dumpsites in rapidly urbanizing cities present persistent environmental and public-health challenges that undermine urban livability and sustainable development. This literature review examines how improper solid-waste disposal including open dumping, uncontrolled burning, and poorly managed collection systems contributes to air, soil and water contamination, vectors of disease, and reduced quality of life for nearby communities. It situates Katsina Metropolis within broader national and global patterns of municipal solid-waste mismanagement, highlighting how limited infrastructure, weak enforcement of environmental regulations, inadequate funding, and low public awareness exacerbate local risks. The review is organized around three interrelated themes the environmental impacts of open dumpsites (pollution pathways and ecological degradation), public-health outcomes linked to waste exposure (vector-borne and respiratory conditions, waterborne diseases), and institutional and socio-economic drivers of poor waste management (policy gaps, financing, stakeholder behavior). By synthesizing empirical studies from Nigeria and comparable urban contexts, the review identifies recurring evidence and critical gaps in knowledge particularly the need for localized epidemiological data and evaluations of intervention effectiveness and sets the stage for a focused case study of Katsina Metropolis.

### 1.1 Global Perspectives on Solid Waste Management

Solid waste, often referred to as garbage, refuse, or rubbish, includes all discarded solid and semi-solid materials resulting from human activities (Yosola, 2019). Globally, cities generate approximately 2.01 billion tons of solid waste each day, which translates to about 0.74 kg per person. This burden disproportionately affects developing countries, where about 90% of solid waste is improperly disposed of, leading to serious environmental, public health, and safety concerns (Odetokun, 2022). Waste management, therefore, involves not only the collection and transportation of waste but also environmentally sustainable disposal practices. Individuals and communities are expected to prioritize waste reduction, treatment, and recycling before final disposal in order to protect both human health and ecosystems (Bello et al., 2020).

Poor waste management practices such as open dumping, open burning, inefficient collection systems, and minimal recycling contribute significantly to environmental pollution and deteriorating public health (Linda, 2021; Jallo, Kodiya, & Modu, 2021). Studies have shown that improper disposal of solid waste attracts diseases and worsens living conditions. This challenge is often worsened by weak environmental regulations, underfunding, inadequate institutions, and rapid urbanization (Odiana & Olorunfemi, 2021). Similarly, many global

cities still struggle with increasing volumes of municipal solid waste driven by industrialization, economic development, and population growth. The lack of sanitary landfilling facilities and poor waste-handling practices pose threats to both the environment and human health. In emerging economies, improper solid waste management is directly linked to unhealthy lifestyles, insufficient facilities, and ineffective policy implementation (Adamu et al., 2023). Higher levels of national development are associated with improved institutional frameworks, greater environmental awareness, stricter enforcement of waste laws, and enhanced technology. Such advancements reduce environmental pollution and improve the quality of life for citizens (Franklin & Ruth, 2012).

### **1.2 Solid Waste Management in Nigeria: Evidence from Empirical Studies**

In Nigeria, studies consistently highlight the poor state of waste management systems and their implications for human well-being. Amasuomo and Baird (2017) noted that inadequate waste management policies are at the core of Nigeria's waste challenges, drawing on descriptive analysis of reports, books, and agency records. Similarly, Shamaki and Shehu (2017), through primary and secondary data, found that 55.8% of waste generated in Sokoto State originated from households, 32.5% from commercial sources, and 11.7% from agriculture. Despite most residents using bins, disposal was largely done in drainage systems or unauthorized sites. In another study, Lekan (2018) examined challenges in urban housing waste management using 70 questionnaires and descriptive statistics. The findings showed that although residents understood the consequences of improper disposal, waste collection points were often too far, discouraging proper practices. Suleiman (2019), focusing on Daura Township in Katsina State, observed that residents frequently allowed waste to accumulate before eventual collection, with 22.82% disposing in authorized sites. Non-cooperation with agencies was also a barrier to efficiency. Studies on solid waste management in Nigeria consistently highlight the combined influence of socioeconomic factors, weak policy implementation, and infrastructural deficits on waste disposal practices and public health outcomes. David et al. (2020) showed that age, income, and education significantly shaped waste management behaviors in Ogun State, with over half of residents perceiving sanitation services as too expensive and 36.6% relying on open dumps. Similarly, Chukwueloka, Uzor, and Chukwurah (2021) demonstrated that effective waste management policies reduced drainage blockages and epidemic outbreaks. Extending this evidence, Chukwuebuka et al. (2022) analyzed municipal solid waste in 22 Nigerian cities and found that organic waste dominated (56%), followed by paper (13%), plastics (9%), glass and metals (3% each), textiles (2%), and other materials (14%), concluding that waste valorization efforts are

hindered by funding shortfalls, weak policies, and limited integration of the informal sector. Nationally, Jazat, Akande, and Ogunbode (2023) reported increasing household waste mainly food remnants, plastics, papers, and metals often disposed of in open dumpsites, contributing to environmental degradation and public health risks. At the local scale, Mainasara and Dodo (2024) identified a strong link between poor waste management and reduced quality of life in Birnin Kebbi Metropolis, recommending stricter monitoring and regulatory enforcement. Rapid urbanization, inadequate infrastructure, and weak regulatory frameworks have further intensified waste management challenges in cities such as Katsina Metropolis (Agbeni et al., 2025; Okeke, 2025), where open dumping and uncontrolled burning remain widespread (Okeke, 2025). These practices release hazardous air pollutants including fine particulates, heavy metals, and persistent organic pollutants such as PCBs and PAHs posing serious respiratory and environmental risks (Idowu et al., 2025). The absence of sanitary landfills in major cities, including Abuja, reinforces open dumping as the dominant disposal method (Idowu et al., 2025). Beyond air pollution, leachate from dumpsites contaminates soil and groundwater, increasing exposure to heavy metals and waterborne diseases, particularly in communities dependent on shallow aquifers (Adizua et al., 2025; Abiye & Raimi, 2025). Empirical evidence from Lagos confirms adverse impacts on soil and water quality near dumpsites (Okeke, 2025), while residents in Igando-Alimoso and Port Harcourt report increased pollution, offensive odors, and heightened risks of vector- and waterborne diseases (Aliu, 2021; Okpara et al., 2021; Adizua et al., 2025). Despite widespread awareness of these hazards, economic constraints and limited disposal alternatives compel many urban residents to continue using open dumpsites (Olorunfemi, 2021).

### **1.3 Urbanization, Population Growth, and the Escalating Challenges of Solid Waste Management in Nigeria**

Rapid urbanization and population growth have intensified the challenges of municipal solid waste management in Nigeria. Butu and Mshelia (2014) reported that in Kano Metropolis, rapid urban expansion and demographic pressures have led to the indiscriminate use of major streets, open spaces, and waterways as dumpsites, thereby contributing significantly to environmental degradation. Similarly, Alakinde (2013) observed that Nigeria, like many developing nations, is experiencing unprecedented urban growth, with rising population figures exerting pressure on essential facilities such as water, electricity, roads, schools, and housing. This demographic surge has also worsened the generation and disposal of solid waste, often resulting in precarious conditions. Industrial activities further compound the problem, as they produce diverse waste streams ranging from metals, scraps, sawdust, paper,

and glass to hazardous and toxic substances (Omole & Alakinde, 2013). Kenneth and Huie (1983) classified solid waste into three categories: garbage, consisting of organic food waste; ashes, from cooking and heating processes; and rubbish, which may be combustible (e.g., paper, rags, wood, leaves) or non-combustible (e.g., glass, plastic, and metals). The growing scale of these waste categories reflects a global trend where urbanization, industrialization, and changing consumption patterns contribute to increased waste generation, posing significant environmental and public health concerns (Kadafa et al., 2013). In Nigeria, waste management challenges are particularly acute, as they are linked to poverty, poor governance, rapid urban growth, low standards of living, and limited environmental awareness. These issues accelerate indiscriminate waste disposal and intensify problems of air, water, and land pollution (Abila & Kantola, 2013; Adewole, 2009).

#### **1.4 Objectives of the Study**

The aim of this study is to evaluate the environmental and health challenges posed by open waste dumpsites in Katsina Metropolis and to propose sustainable strategies for effective waste management.

#### **Objectives of the Study**

The specific objectives of this research are to:

1. Assess the environmental impacts of open waste dumpsites on soil, water, and air quality in Katsina Metropolis.
2. Examine the health risks and diseases associated with residents' proximity to open waste dumpsites.
3. Identify institutional, policy, and community factors contributing to the persistence of open dumpsites in Katsina Metropolis.
4. Recommend sustainable waste management strategies to mitigate the environmental and health challenges identified.

## **2. Literature Review**

### **2.1 Impact of Urbanization on Solid Waste Management and Public Health in Developing Countries**

Urbanization has been identified as a major driver of increased solid waste generation in developing countries, where municipal waste management systems are often weak or poorly funded (Agunwamba, 1998; Onibokun & Kumuyi, 1999). In Nigeria, rapid population growth, rural–urban migration, and changing consumption patterns have resulted in large

volumes of solid waste that exceed the capacity of local governments to manage effectively (Omoleke, 2004; Ugwuanyi & Isife, 2017). Several studies have noted that poor governance, inadequate planning, and weak institutional frameworks contribute significantly to ineffective waste management in Nigerian cities (Egunjobi, 2005; Ngozi & Adebola, 2019). The widespread adoption of open dumpsites as a primary waste disposal method has led to indiscriminate dumping in residential neighborhoods, markets, and waterways, thereby increasing environmental and health risks (Sankoh et al., 2013). Improperly managed solid waste poses serious environmental health risks by serving as breeding grounds for disease vectors such as flies, mosquitoes, rodents, and cockroaches (Adewole, 2009; UNEP, 2006). These vectors are responsible for the transmission of infectious diseases including malaria, cholera, typhoid fever, hepatitis, meningitis, and diarrhea (Kola-Olusanya et al., 2011; Yongsi et al., 2008). Uncontrolled dumpsites emit offensive odors and hazardous gases such as ammonia and hydrogen sulfide, which negatively affect air quality and can cause respiratory illnesses among nearby residents (Marshal, 1995; Aatamila et al., 2010). Studies have shown that populations living close to dumpsites experience higher rates of headaches, nausea, stress, and respiratory disorders due to prolonged exposure to these emissions (Zanobetti et al., 2000). Certain population groups are particularly vulnerable to the health impacts of poor waste management. Children are at greater risk due to their developing immune systems and frequent exposure to contaminated environments, while pregnant women and the elderly are more susceptible to infection and chronic illness (Yongsi et al., 2008; Sankoh et al., 2013). Individuals living near dumpsites are also exposed to contaminated water sources, which increases the risk of water-borne diseases (Aatamila et al., 2010).

Waste workers and scavengers face significant occupational health hazards due to direct contact with hazardous materials, sharp objects, and infectious waste. Studies have reported higher incidences of injuries, parasitic infections, and respiratory diseases among waste collection workers compared to the general workforce (Poulsen et al., 1995; Nwanta & Ezenduka, 2010). Inadequate provision of protective equipment further exacerbates these risks. Direct handling of solid waste and exposure to contaminated dumpsites have been linked to the transmission of infectious and chronic diseases, particularly among waste workers and nearby residents (Ziraba et al., 2016). Poorly managed waste sites also contaminate surface and groundwater, facilitating the spread of water-borne diseases such as cholera, typhoid, and hepatitis (Kola-Olusanya et al., 2011). In addition, industrial and domestic wastes release volatile organic compounds and other toxic substances that pose

serious threats to human health and the environment. Gases produced from decomposing organic waste contribute to air pollution, while leachates from dumpsites contaminate soil and water resources, undermining environmental sustainability (UNEP, 2006).

## **2.2 Challenges of Solid Waste Management and Public Health Implications in Urban Nigeria**

Improper waste disposal has been linked to numerous health problems, including respiratory infections, gastrointestinal diseases, vector-borne illnesses, and skin infections (Adeleke, 2000; McMichael, 2000). Decomposing waste emits foul odors and provides breeding grounds for pests, while leachates serve as pathways for toxic substances to enter drinking water sources (Amadi, 2010). In Nigeria, waste disposal practices have historically been environmentally unsustainable. According to the United Nations Human Development Report (2012), approximately 58% of households dispose of waste at public dump sites, while others dump waste in valleys, bushes, streams, open gutters, or undeveloped land. Only about 5% of households benefit from organized waste collection services, highlighting systemic deficiencies in national waste management infrastructure.

Empirical studies across Nigeria consistently reveal poor waste management practices and their associated environmental and health impacts (Nabegu, 2012; Sam, 2002). Amadi et al. (2013) highlighted the prevalence of indiscriminate dumping and its contribution to ecological degradation in the Niger Delta. Similar concerns have been reported in urban centers such as Lagos, Abuja, and Kano (Gana & Ngoro, 2014; Nabegu, 2012). Specifically, in Ganye Local Government Area of Adamawa State, the increasing presence of open dump sites has raised concerns about environmental pollution and public health risks. The proximity of dump sites to water bodies such as the Ganye River violates established landfill guidelines and increases the likelihood of water contamination (EPA, 2003). Despite ongoing efforts by local authorities, limited success has been achieved due to inadequate planning, enforcement, and community participation. Consequently, the study by Zoaka, Sali, and Garba (2024) provides important empirical insight into the health and environmental impacts of open dump sites in Ganye town. Their findings highlight widespread public exposure to environmental hazards, poor awareness of proper waste management practices, and significant health challenges associated with traditional landfills, underscoring the urgent need for policy reform, public sensitization, and sustainable waste management strategies. Waste management strategies vary widely between developing and industrialized nations. While developed countries emphasize recycling, energy recovery, and sanitary landfills, many developing countries rely on open dumping due to financial, institutional, and technical

constraints (Gana & Ngoro, 2014; Kadafa et al., 2013). In Nigeria, inadequate regulatory enforcement, lack of public enlightenment, and poor consideration of geological and hydrogeological conditions exacerbate environmental pollution arising from waste disposal (Amadi et al., 2012a; Amadi et al., 2012b).

Although regulatory frameworks such as the Nigerian Landfill Guidelines exist, compliance remains weak (Environmental Protection Agency [EPA], 2003). Dump sites are frequently located near residential areas, water bodies, and agricultural land, increasing exposure risks. Studies emphasize the need for cost-effective, environmentally sound waste management systems that protect soil and water resources while promoting public health (Olanrewaju & Ilemobade, 2009; Franchetti, 2013). Rapid urbanization and population growth have significantly intensified solid waste generation in Nigerian cities, placing enormous pressure on existing waste management systems. As cities expand without corresponding improvements in infrastructure and environmental planning, waste management has emerged as a critical environmental health challenge (Agunwamba, 1998; Omoleke, 2004). In many urban centers, including Ibadan in Oyo State, improper waste disposal practices such as open dumping, roadside refuse accumulation, and uncontrolled landfills have become commonplace.

### **2.3 Environmental Pollution and Its Health Implications**

Environmental pollution is intrinsically linked to a wide range of health challenges, including the transmission of infectious diseases such as typhoid and cholera, which are predominantly waterborne in nature (Zhao et al., 2015). In addition to communicable diseases, environmental pollution contributes significantly to the incidence of non-communicable diseases (NCDs), including cancer, asthma, and various congenital abnormalities observed among newborns (Reinhart & Townsend, 2018). The adverse health consequences of environmental pollution are particularly pronounced in low-income countries, where approximately 90% of pollution-related deaths occur. In these regions, air and water pollution remain the most prevalent forms of environmental contamination. Conversely, in rapidly developing economies, environmental pollution is increasingly driven by exposure to toxic chemicals and pesticides (Xu et al., 2018). Human activities especially those involving technological interventions that alter natural ecosystems—are major contributors to environmental pollution (Nadal et al., 2016). Additionally, pollution may arise from energy-related sources such as excessive light, heat, and noise, as well as from hazardous chemical substances of concern. These pollutants may consist of foreign energies or substances

introduced into the environment, or naturally occurring contaminants whose concentrations have been amplified by human activities (Gworek et al., 2016).

Water pollution also occurs in multiple forms and remains a major contributor to the spread of waterborne diseases (Joshi et al., 2016). Common waterborne illnesses associated with polluted water sources include typhoid fever, amoebiasis, and ascariasis. Many chemical elements become toxic when present beyond permissible concentrations; consequently, their release into air, water, or soil can lead to severe health complications. Pollutants are broadly classified into inorganic, organic, and biological categories. Organic pollutants largely consist of domestic, agricultural, and industrial wastes that negatively affect the health and survival of humans and animals. Inorganic pollutants primarily include potentially toxic elements (PTEs) such as mercury (Hg), lead (Pb), and cadmium (Cd). These substances of concern often accumulate within ecological and supply chains, causing widespread harm to living organisms (Majolagbe et al., 2017). Additionally, biological pollutants of anthropogenic origin such as viruses, bacteria, and other pathogenic microorganisms pose significant threats to environmental and public health (Marfe & Di Stefano, 2016). Potentially toxic elements (PTEs) are considered among the most significant environmental pollutants due to their non-degradable nature, high persistence, and inherent toxicity (Hahladakis et al., 2013, 2016). In their natural state, PTEs occur at low concentrations and are characterized by high atomic weight and density relative to water. Among various classes of environmental contaminants, PTEs have received considerable scientific attention because of their potential to cause severe ecological and health impacts (Mazza et al., 2015). Although these elements are typically present at trace levels in natural water sources, many PTEs remain highly toxic even at very low concentrations. Metals such as zinc (Zn), cobalt (Co), mercury (Hg), cadmium (Cd), and lead (Pb), as well as the metalloid arsenic (As), pose serious health risks when present in trace amounts. Once absorbed and metabolized by the human body, these elements tend to accumulate in soft tissues, thereby exerting toxic effects. Human exposure to PTEs occurs through multiple pathways, including dermal absorption, ingestion of contaminated food and water, and inhalation of polluted air (Damigos et al., 2016).

### **3. Research Method**

#### **3.1 Study Area**

This study focuses on Katsina Metropolis, the capital of Katsina State in northwestern Nigeria, which has a population over 600,000 and is experiencing rapid urbanization alongside inadequate infrastructure and waste management. Residents near open dumpsites,

healthcare professionals, and officials from the Katsina State Environmental Protection Agency were included in the study population, with stratified sampling employed to represent various respondent categories. The area's semi-arid climate, marked by a rainy season and a prolonged dry season, affects waste decomposition and leachate production.

**3.2 Statistical Analysis method**

Data collected were analyzed using descriptive and inferential statistical techniques. Frequency distributions and percentages were used to summarize demographic characteristics and perceptions of environmental and health challenges. Chi-square tests were applied to determine the relationship between proximity to dumpsites and reported health outcomes. Correlation analysis and linear regression were conducted to assess the strength and nature of the association between environmental pollution indicators and health challenges, with a significance level of 0.05.

**4. RESULT AND DISCUSSION**

4.1.1 Descriptive Analysis of Respondents

**Table 4.1: Age Distribution of Respondents.**

Age Group (Years)	Frequency	Percentage (%)
Below 20	48	12.5
20–29	131	34.0
30–39	109	28.3
40–49	63	16.4
50 and above	34	8.8
<b>Total</b>	<b>385</b>	<b>100.0</b>

The study indicates that the majority of respondents were aged 20 to 39, with 62.3% of the sample comprising young, economically active adults who are more likely to be exposed to environmental hazards like waste dumpsites. A smaller percentage of participants were under 20 (12.5%) or over 50 (8.8%), suggesting the study primarily reflects the working-age population’s views. The mid-age group (40–49 years) also contributes to the understanding of health outcomes related to environmental hazards. Younger adults are more aware of pollution risks, while older adults exhibit greater vulnerability. The findings suggest public health strategies focusing on educating youth about pollution risks to reduce exposure and develop targeted health interventions for age-specific issues related to waste dumpsites.

**Table 4.2: Proximity of Residence to Dumpsite.**

<b>Distance to Dumpsite</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Less than 500m	168	43.6
500m–1km	124	32.2
Above 1km	93	24.2
<b>Total</b>	<b>385</b>	<b>100.0</b>

The survey found that 43.6% of respondents live within 500 meters of open waste dumps, and over 75% within 1 kilometer, highlighting substantial exposure to environmental dangers like air pollution and water contamination. Those living closer to dumps face higher health risks, while those further away may have lower exposure. The results emphasize the need to investigate the relationship between proximity to dumpsites and health problems, influencing urban planning and public health policies. Ongoing health monitoring and targeted campaigns are crucial for nearby residents, and local authorities should consider relocating waste sites and creating buffer zones to mitigate health and environmental effects, promoting sustainability in Katsina Metropolis.

#### 4.1.2 Descriptive Analysis of Environmental and Health Challenges

**Table 4.3: Environmental Impacts of Open Waste Dumpsites.**

<b>Environmental Impact</b>	<b>Frequency</b>	<b>Percentage (%)</b>
<b>Air pollution (odor/smoke)</b>	146	37.9
<b>Water contamination</b>	102	26.5
<b>Soil degradation</b>	78	20.3
<b>Pest infestation</b>	59	15.3
<b>Total</b>	<b>385</b>	<b>100.0</b>

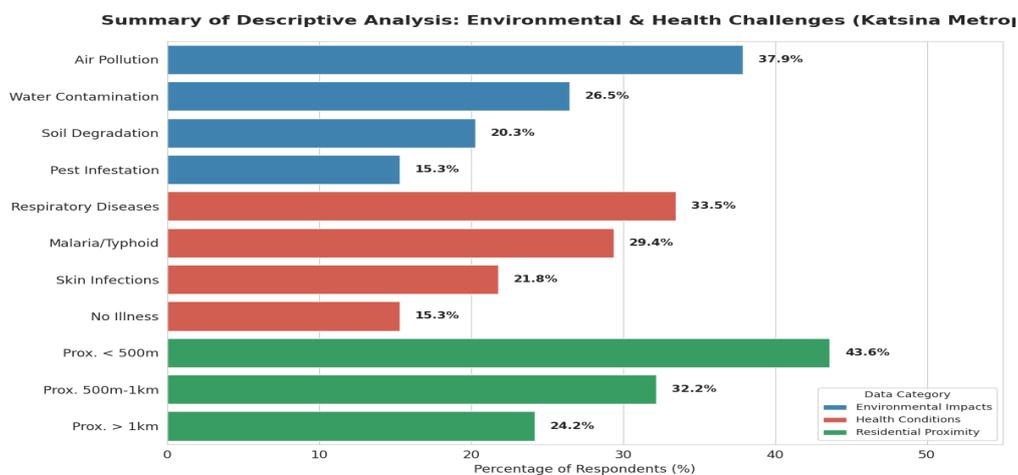
The analysis of environmental impacts from open waste dumpsites in Katsina Metropolis indicates that air pollution is the most reported issue, affecting 37.9% of respondents, due to emissions from decomposing waste and burning. This pollution poses respiratory health risks and highlights the need for controlling airborne pollutants. Water contamination was noted by 26.5% of respondents, primarily from leachate and runoff affecting domestic water sources, leading to diseases like cholera. Additional challenges include soil degradation, reported by 20.3%, which impacts agriculture, and pest infestations affecting 15.3% of respondents. These findings underscore the urgency for integrated waste management strategies to mitigate health risks and promote sustainable urban living in the area.

**Table 4.4: Health Problems Associated with Dumpsites**

Health Condition	Frequency	Percentage (%)
Respiratory diseases	129	33.5
Malaria/Typhoid	113	29.4
Skin infections	84	21.8
No noticeable illness	59	15.3
<b>Total</b>	<b>385</b>	<b>100.0</b>

The data on health problems associated with open waste dumpsites in Katsina Metropolis indicate that respiratory diseases were the most commonly reported condition, affecting 129 respondents or 33.5% of the sample. This finding reflects the significant impact of air pollution, primarily from odors, smoke, and particulate matter released from decomposing and burning waste. Prolonged exposure to such pollutants can lead to chronic respiratory issues, including asthma, bronchitis, and other lung-related conditions, particularly among vulnerable populations such as children and the elderly. The high prevalence of respiratory diseases underscores the urgent need for interventions that reduce airborne pollutants and improve air quality in communities near open dumpsites.

Malaria and typhoid were reported by 29.4% of participants, linked to poor sanitation from open dumpsites that foster disease vectors and contaminate water sources. Skin infections affected 21.8%, with over 84% facing health risks due to contaminated waste. These findings highlight the urgent need for preventive measures by health authorities, including medical screenings, health education, protective gear provision, and improved waste management practices to enhance quality of life in Katsina Metropolis.



**Figure 4.1: A comprehensive descriptive analysis of the environmental and health landscape.**

The chart provides a comprehensive descriptive analysis of the environmental and health landscape within the Katsina Metropolis, categorizing data into three primary dimensions: environmental impacts, health conditions, and residential proximity to potential hazards. The environmental impact data highlights Air Pollution as the most significant concern, cited by 37.9% of respondents, followed by Water Contamination at 26.5% and Soil Degradation at 20.3%. These figures suggest a community grappling with the physical consequences of urbanization or industrial activity, where the quality of basic life-sustaining resources like air and water is being compromised. The relatively lower but still notable percentage for Pest Infestation (15.3%) indicates that while biological nuisances are present, the community's primary perceived threats are chemical or particulate in nature. When examining the health conditions reported by the residents, there is a clear and troubling correlation between the high levels of air pollution and the prevalence of respiratory diseases, which affects 33.5% of the population surveyed. This makes it the leading health issue in the region, closely trailed by Malaria and Typhoid at 29.4%, which are likely linked to the aforementioned water contamination and drainage issues. Skin infections also represent a significant portion of the health burden at 21.8%. Most telling is the fact that only 15.3% of respondents reported "No Illness," meaning the vast majority of the sampled population nearly 85% is dealing with at least one environmental-related health challenge. This underscores a public health crisis where the environment is a primary driver of physical morbidity.

The third category, residential proximity, offers vital context for why these percentages are so high, showing that 43.6% of respondents live within 500 meters of a hazard source. An additional 32.2% live between 500 meters and 1 kilometer away, meaning over three-quarters of the population resides in close enough proximity to experience direct environmental fallout. The data suggests an "inverse distance" relationship, where the closer people live to these sites, the higher the reported impact on their health and environment. With only 24.2% of people living more than 1 kilometer away, the chart paints a picture of a densely packed metropolitan area where residential zones and hazardous environmental factors are insufficiently buffered from one another, necessitating urgent urban planning and public health interventions.

## Chi-Square Test

### Relationship between proximity to dumpsites and health problems

**Table 4.5: Chi-Square Test Result.**

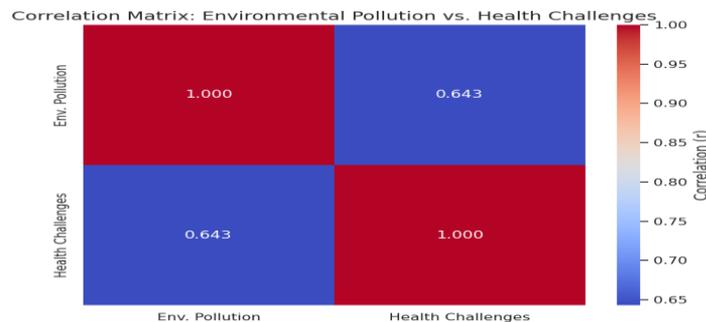
Test	Value	df	Sig. (p-value)
Chi-Square	21.47	4	0.001

The chi-square test result shows a value of 21.47 with 4 degrees of freedom and a significance level (p-value) of 0.001. This result indicates a statistically significant relationship between residents' proximity to open waste dumpsites and the health problems they experience. Since the p-value is less than the conventional threshold of 0.05, we reject the null hypothesis that there is no association between proximity to dumpsites and health outcomes. In other words, the likelihood of observing such an association by chance is very low, confirming that spatial proximity to dumpsites meaningfully affects residents' health status.

The significant chi-square value highlights the vulnerability of populations living closer to dumpsites. Residents within shorter distances are more frequently exposed to environmental hazards such as air and water pollution, pest infestations, and contaminated soil. These exposures contribute to the prevalence of respiratory diseases, malaria, typhoid, and skin infections observed in the population. This finding highlights the significance of geographical and spatial factors in environmental health studies, which affect risk exposure and health outcomes in communities. It calls for public health planning and urban management in Katsina Metropolis, emphasizing interventions near dumpsites, such as waste containment and health monitoring for residents. Public health campaigns should promote protective behaviors, and policy measures should establish zoning regulations to minimize exposure. The chi-square result indicates that proximity to waste sites is a key determinant of health risks, informing preventive and policy actions to mitigate the effects of open waste dumpsites.

## Recommended Analysis 2: Correlation Analysis

### Environmental pollution and health challenges



**Figure 4.2: Correlation Matrix**

The visualizations analyze the link between environmental stressors and public health via a Standard Linear Regression model. A scatter plot indicates a positive linear trend: as the Environmental Pollution Index rises, the Health Challenges Index also increases. The regression equation  $Y = -0.16 + 0.69X$  shows that a unit increase in pollution leads to a 0.69 unit rise in health challenges. With an  $SR^2$  of 0.477, it explains 47.7% of health outcome variance, and a p-value of  $<0.001$  signifies statistical significance. A Correlation Matrix calculated the Pearson coefficient ( $r$ ) at 0.643, indicating a moderate positive correlation, affirming that environmental degradation contributes significantly to health morbidity in the area.

## 4.2 DISCUSSION OF FINDINGS

The research findings reveal a critical intersection between urban geography and public health, primarily driven by the proximity of residential areas to open waste dumpsites. With over 75% of respondents living within 1 kilometer of a dumpsite and 43.6% living less than 500 meters away the vast majority of the population is in a high-exposure zone. This spatial arrangement is directly linked to the high prevalence of morbidity, as only 15.3% of the sampled population reported "no illness," leaving nearly 85% of residents suffering from environment-related health challenges. The Chi-Square test ( $p = 0.001$ ) confirms that this relationship is not coincidental; living closer to these sites significantly increases the likelihood of health problems. This creates a "proximity-risk" cycle where the density of the metropolis forces residential growth into hazardous zones, thereby multiplying the public health burden on the community.

Environmental degradation in the metropolis is primarily driven by air pollution (37.9%) and water contamination (26.5%), leading to significant health issues such as respiratory diseases (33.5%) and vector-borne illnesses like malaria and typhoid (29.4%). The deterioration of the environment contributes to long-term health and economic instability, with a strong positive correlation ( $r = 0.643$ ) observed between pollution and health outcomes. The study indicates that 47.7% of health challenges are linked to environmental quality, underscoring the urgent need for enhanced waste management and remediation efforts, particularly for the young adult population (62.3% aged 20–39) in Katsina Metropolis.

## 5. CONCLUSION

The study concludes that open waste dumpsites in Katsina Metropolis constitute a major environmental and public health challenge. The majority of residents live in close proximity to these sites, exposing them to air, water, and soil pollution, as well as pest infestations, which significantly contribute to health problems such as respiratory diseases, malaria, typhoid, and skin infections. The statistical analysis confirms that spatial proximity to dumpsites is a critical determinant of health risks.

Overall, the findings underscore the urgent need for improved waste management systems, proper planning and zoning of residential areas, and public health interventions. Without effective strategies to mitigate these environmental hazards, the health and well-being of the community remain at high risk, particularly for economically active young adults and vulnerable groups such as children and the elderly.

## 6. RECOMMENDATION

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

1. Open waste dumpsites should be relocated to areas away from residential zones or properly managed with sanitary landfill practices to minimize environmental and health hazards.
2. Measures such as soil decontamination, water treatment, and air quality monitoring should be implemented to reduce pollution levels around existing dumpsites.
3. Targeted awareness campaigns, preventive healthcare programs, and regular medical screenings should be provided to residents living near dumpsites.
4. Residents should be educated on proper waste disposal practices and encouraged to participate in local clean-up initiatives to reduce environmental exposure.

5. Local authorities should enforce environmental regulations, establish buffer zones between dumpsites and residential areas, and ensure compliance with waste management laws.

## REFERENCES

1. Aatamila, M., Verkasalo, P. K., Korhonen, M. J., Viluksela, M. K., Pasanen, K., Tiittanen, P., & Nevalainen, A. (2010). Odor annoyance near waste treatment centres: A population-based study in Finland. *Journal of the Air & Waste Management Association*, 60(4), 412–418. <https://doi.org/10.3155/1047-3289.60.4.412>
2. Abila, B., & Kantola, J. (2013). Municipal solid waste management problems in Nigeria: Evolving knowledge management solutions. *World Academy of Science, Engineering and Technology*, 78, 313–318.
3. Abiye, T., & Raimi, M. O. (2025). Assessing groundwater contamination near dumpsites in Port Harcourt using water quality index (WQI): Insights from seasonal and distance-based variations. *International Journal of Hydrology*, 9(1), 35–44.
4. Adamcová, D., Radziemska, M., Ridošková, A., Bartoň, S., Pelcová, P., Elbl, J., & Vaverková, M. D. (2017). Environmental assessment of the effects of a municipal landfill on heavy metal distribution. *Chemosphere*, 185, 1011–1018.
5. Adamu, M. T., Muhammed, K., Enahoro, C. I., Fatima, M., & Makama, M. S. (2023). Domestic solid waste management in Nigeria: A public health dilemma. *Life Sciences: An International Journal*, 1(1), 23–28.
6. Adeleke, A. (2000). *Health and safety in the office: Towards effective management*. Integrated Safety Systems.
7. Adewole, A. T. (2009). Waste management towards sustainable development in Nigeria: A case study of Lagos State. *International NGO Journal*, 4(4), 173–179.
8. Adizua, O. F., Anele, E. T., & Adibe, F. C. (2025). Impact of refuse dumpsites on groundwater quality in Southern Nigeria. *International Journal of Water Research*, 3(1), 1–10.
9. Agbeni, K. E., Ajoge, H. N., Promise, E. C., Samuel, S. B., Evelyn, O. O., Franklyn, O., Kazeem, O., & Bernice, A. B. (2025). Environmental pollution and public health implications of poor solid waste management in Nigeria. *International Journal of Economics and Management Review*, 4(2), 45–59.
10. Agunwamba, J. C. (1998). Solid waste management in Nigeria: Problems and issues. *Journal of Environmental Management*, 22(6), 849–856.

11. Aliu, I. R. (2021). Socio-environmental and health effects of waste dumpsites in Igando-Alimoso, Lagos. *Journal of Applied Sciences and Environmental Management*, 25(6), 1073–1080. <https://doi.org/10.4314/jasem.v25i6.28>
12. Alakinde, M. K. (2013). Urbanization and environmental stress in Nigeria. *Journal of Environmental Studies*, 7(2), 45–57.
13. Amadi, A. N. (2010). Assessment of groundwater quality near waste disposal sites in Nigeria. *Journal of Environmental Science*, 15(3), 326–337.
14. Amadi, A. N., Nwankwoala, H. O., Dan-Hassan, M. A., Eze, C. J., & Okoye, N. O. (2013). Review of waste management techniques in the Niger Delta. *Journal of Emerging Trends in Engineering and Applied Sciences*, 3(1), 12–24.
15. Amasuomo, E., & Baird, J. (2017). Solid waste management trends in Nigeria. *British Journal of Environmental Sciences*, 5(6), 25–37.
16. Awosusi, A. O. (2010). Environmental problems and waste management in Ado-Ekiti. *African Research Review*, 4(3b), 331–343.
17. Babayemi, J. O., & Dauda, K. T. (2009). Evaluation of solid waste generation and disposal options in Nigeria. *Journal of Applied Sciences and Environmental Management*, 13(3), 83–88.
18. Butu, A. W., & Mshelia, S. S. (2014). Municipal solid waste disposal and environmental issues in Kano Metropolis. *British Journal of Environmental Sciences*, 2(1), 1–16.
19. Chukwuebuka, C. O., Chinelo, A. N., Nixon, N. N., Charles, C. A., & Juliet, C. I. (2022). Energy and material recovery from municipal solid waste in Nigeria. *Clean Technologies and Recycling*, 2(4), 282–307.
20. Egunjobi, L. (2005). *Issues in environmental management for sustainable development in Nigeria*. Springer.
21. Environmental Protection Agency (EPA). (2003). *Nigeria landfill guidelines: Best practice environmental guidelines*. EPA.
22. Franklin, R., & Ruth, M. (2012). Growing up and cleaning up: The environmental Kuznets curve redux. *Applied Geography*, 32(1), 29–39.
23. Gana, T., & Ngoro, R. (2014). Waste management practices in Nigeria. *West African Journal of Industrial & Academic Research*, 12(1), 112–127.
24. Idowu, A., Afolabi, O. T., Obafemi, D. T., & Adepoju, O. A. (2025). Health risk assessment of persistent organic pollutants near dumpsites. *Air Quality, Atmosphere & Health*, 18(3), 455–469. <https://doi.org/10.1007/s11869-025-01694-8>

25. Jazat, J. P., Akande, J. A., & Ogunbode, T. O. (2023). State of solid waste disposal in Iwo and Ibadan Metropolis. *Frontiers in Sustainability*, 3, 1022519.
26. Kadafa, A. Y., Latifa, A., Abdullahi, H. S., & Suleiman, W. A. (2013). Comparative assessment of municipal solid waste management services. *Nature and Science*, 11(6), 154–164.
27. Mainasara, N., & Dodo, F. E. (2024). Effects of solid waste management on quality of life in Birnin Kebbi Metropolis. *FUDMA Journal of Earth and Environmental Sciences*, 1(2), 35–45.
28. Nabegu, A. B. (2012). Relationship between municipal solid waste categories in Kano Metropolis. *Journal of Environment and Earth Science*, 2(4), 63–67.
29. Odetokun, B. O. (2022). Solid waste management and environmental pollution in Dutsin-Ma, Katsina State. *Fuoye Journal of Management, Innovation and Entrepreneurship*, 1(1), 44–52.
30. Odiana, S., & Olorunfemi, I. (2021). Overview of solid waste management challenges in Nigeria. *Jordan Journal of Earth and Environmental Sciences*, 12(1), 36–43.
31. Okeke, C. C. (2025). Addressing the menace of poor waste management in Nigeria. *Daily Trust*.
32. Okpara, D. A., Kharlamova, M., & Grachev, V. (2021). Proliferation of irregular dumpsites in the Niger Delta. *Sustainable Environment Research*, 31(1), 4.
33. Olorunfemi, D. Y., Adeola, F. O., & Alade, T. (2021). Health hazards associated with residence around open dumpsites. *Environmental Health Insights*, 15, 1–10.
34. Omole, F. K., & Alakinde, M. K. (2013). Solid waste management challenges in Ibadan Metropolis. *International Journal of Education and Research*, 1(4), 1–12.
35. Sankoh, F. P., Yan, X., & Tran, Q. (2013). Environmental and health impacts of solid waste disposal. *Journal of Environmental Protection*, 4, 665–670.
36. Shamaki, B., & Shehu, A. A. (2017). Assessment of solid waste management in Sokoto Metropolis. *Journal of Agriculture and Environment*, 13(2), 159–167.
37. Suleiman, I. L. (2019). Assessment of solid waste management in Daura Township, Katsina State. *FUDMA Journal of Sciences*, 3(2), 237–244.
38. United Nations Environment Programme (UNEP). (2006). *Informal solid waste management*. UNEP.
39. World Bank. (2019). *What a waste 2.0: A global snapshot of solid waste management*. World Bank Publications.

40. Yosola, A. O. (2019). Reducing the impact of solid waste management using geospatial analytics. *GRID3 Nigeria Concept Note*.
41. Zoaka, Y. D., Sali, H., & Garba, Y. B. (2024). Impacts of open dumpsites in Ganye Town, Adamawa State. *Sapientia Foundation Journal of Education, Sciences and Gender Studies*, 6(2), 145–153.