

## An Analysis of the Effects of Indiscriminate Dumping of Refuse on Household Health Expenditure in Adamawa State, Nigeria

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### Abstract

*This study examined the perceptions of household about the effects of indiscriminate dumping of refuse on their health expenditure in Adamawa State. Multi-stage sampling method was used to arrive at the selected locations while data were collected on 400 randomly selected households in Mubi North, Yola North and Numan by the trained data collectors through the use of mobile-based Kobocollect. Descriptive method of data analysis was used to present and analyse the perceptions of the surveyed households. The result of the study showed that more than 50% of the respondents reported that indiscriminate dumping of refuse significantly affected their health expenditure through such channels as increased disease vectors, water-borne diseases, reduced productivity and increased medical spending. Furthermore, the result of the Chi-square test showed that all the responses of the surveyed households were statistically significant signifying strong level of agreement among the households regarding the detrimental effects of improper refuse management on their health and health spending. Based on the findings of the study, it was recommended that government should prioritise and strengthen waste management initiatives in neighbourhoods and cities, community education initiative should be created to increase knowledge of health hazards related to improper refuse disposal, and specific interventions and financial support programme should be provided to households bearing the financial cost of health problems associated refuse dumping.*

**Keywords:** Indiscriminate, refuse dumping, solid waste, household, health expenditure, Adamawa

### INTRODUCTION

Efficient waste management is crucial for environmental and societal well-being, presenting both opportunities and threats to communities. When waste is managed properly, it often goes unnoticed but, when neglected, it can harm public health, economies, and the environment (Rodic & Wilson, 2017). This issue is globally significant, affecting the realisation of Sustainable Development Goals (SDGs), especially those linked to health, sanitation, and the environment (Niyobuhungiro & Schenck, 2020). While both developed and developing countries face waste management challenges, they are more pronounced in developing countries, notably in Africa commonly attributed to rapid urbanization, migration, informal settlements, changing waste behaviours, and limited resources (Godfrey et al., 2019). This is evident with the low waste collection rates of only 48% in urban areas and 26% in rural regions of developing nations, presenting a stark contrast to developed regions where 90% of waste is collected (Kaza et al., 2018; Godfrey et al., 2019).

Indiscriminate waste dumping is one of the major challenges confronting waste management in Africa, and particularly Nigeria mainly due to lapses in the enforcement of environmental laws which prevent such behaviours and also because of insufficient infrastructure. In fact, Nigeria ranks poorly in environmental performance, generating about 32 million metric tonnes of waste annually, with a 2.4% growth rate and a daily per capita waste generation of around 0.51 kg (World Bank, 2023) where over 70% of the waste being improperly disposed of (Sechoala et al., 2023). This waste is projected to rise to 107 million tonnes by 2050 (World Bank, 2023).

Indiscriminate refuse dumping is common in virtually all the states in Nigeria, including Adamawa State (Olorunlana & Ogunade, 2022; Joshua & Glanda, 2016). The state exemplifies the complexities of waste management in developing countries. Its rich cultural diversity and natural resources coexist with challenges like inadequate waste facilities, limited sanitation access, and population growth. These factors, coupled with socioeconomic disparities and environmental pressures, contribute to indiscriminate refuse dumping (Wilfred et al., 2020). The consequences of indiscriminate dumping are profound, leading to water and soil contamination, habitat disruption, and disease vectors (Olorunlana & Ogunade, 2022; Okechukwu et al., 2012). In resource-constrained state like Adamawa State, these environmental and health issues translate into a significant financial burden for households, including medical expenses, lost productivity due to illness, and property damage repairs. This economic strain exacerbates healthcare inequalities and strains limited healthcare infrastructure, highlighting the interconnectedness of socioeconomic factors and refuse dumping. The households who are highly vulnerable to the negative health outcomes of indiscriminate refuse dumping are most likely unaware of the associated economic burdens. Drawing the attention of the households, authorities and public health practitioners to this complex issue is likely to facilitate effective enforcement of and adherence to environmental laws leading to cleaner environment and healthier society.

In light of these complexities, it is imperative to conduct a comprehensive study on the impact of indiscriminate refuse dumping on household health expenditures in Adamawa State. Such research will provide insights into the specific health and economic challenges faced by households in the state, enabling evidence-based policies and sustainable waste management practices.

The indiscriminate dumping of refuse poses a significant and widespread environmental challenge in numerous areas of Adamawa State. This haphazard disposal of solid waste, which includes both household and industrial refuse, raises substantial concerns about its profound impact on public health and the financial well-being of households. The issue takes various forms, including the random dumping of waste in urban and suburban areas, the unlawful disposal of refuse in water bodies, and the unregulated abandonment of hazardous materials. Moreover, while most households struggle to meet basic necessities such as food, shelter, and clothing, poor waste management and indiscriminate refuse dumping are likely to worsen their conditions by causing health problems, including malaria, typhoid, and cholera outbreaks among others. These health issues, in turn, lead to increased household health spending and reduced productivity, with average and low-income earners being disproportionately affected by indiscriminate refuse disposal practices. This critical situation necessitates a comprehensive investigation into the multidimensional effects of indiscriminate refuse dumping on household health expenditure.

Several pressing issues central to this research inquiry demand thorough exploration. First and foremost, the health implications of indiscriminate dumping are significant but inadequately understood. Improper refuse disposal can lead to the proliferation of disease vectors, contamination of water sources, and the release of harmful pollutants into the environment. However, the specific health consequences and their extent, particularly in terms of their impact on increased household health expenditure, require in-depth examination. Secondly, the economic burden resulting from household health expenditure due to illnesses and injuries linked to indiscriminate refuse dumping remains poorly quantified. A comprehensive assessment is essential to determine the direct and indirect financial costs borne by households, including medical expenses, lost productivity, and property damage. Furthermore, environmental degradation resulting from refuse dumping, including soil degradation, habitat disruption, and water contamination, is a well-documented concern. Nevertheless, a comprehensive evaluation of the extent of these environmental impacts and their potential repercussions on public health and healthcare costs is essential. Hence, an examination of existing waste management practices, regulatory frameworks, and community initiatives aimed at addressing indiscriminate dumping is vital for identifying gaps and opportunities for improvement. Developing effective mitigation strategies and policies requires a profound understanding of the problem's intricacies.

In general, the indiscriminate dumping of refuse in Adamawa State presents a complex and multidimensional problem with profound implications for public health and household economies. To address this pressing issue, a systematic and comprehensive research endeavour is indispensable. This research fills existing knowledge gaps by providing empirical evidence on the impact of indiscriminate dumping of refuse on household health expenditure. Ultimately, this knowledge helps to provide inform evidence-based policy interventions and foster sustainable waste management practices in Adamawa State.

This study therefore aims at investigating the effects of indiscriminate dumping of refuse on household health expenditure in Adamawa State, Nigeria. Specifically, to assess the health consequences of indiscriminate dumping of refuse on households, to quantify the economic impact on household health expenditure related to illnesses and injuries associated with indiscriminate refuse dumping, to explore the role of socioeconomic factors in influencing the vulnerability of households to indiscriminate dumping of refuse and to evaluate the environmental effects of indiscriminate refuse dumping, with a focus on soil degradation, habitat disruption, drainage blockage, and water contamination. Following this introduction, the study is structured into literature review, methodology, results and discussion as well as conclusion and recommendations.

## **2. LITERATURE REVIEW**

Waste management is a global challenge of increasing concern to all nations (Olorunlana & Ogunade, 2022). It encompasses materials with little to no economic value, often posing harm to both human health and the environment, necessitating proper disposal (Olorunlana & Ogunade, 2022). Waste, as described by Okeniyi and Anwan (2012), includes materials discharged at various stages of daily life, exerting adverse effects on human well-being and the environment. It encompasses unusable materials generated during raw material extraction, processing, product consumption, and other human activities (Ozoh et al., 2021). Dede (2006)

categorizes waste by composition, distinguishing organic and biodegradable waste, non-biodegradable waste, solid waste, liquid waste, gaseous waste, and regulated medical waste. Domestic waste, originating from households, comprises organic residues from food preparation, ashes, rags, nylons, and other by-products (Dede, 2006).

Concerns have grown regarding escalating domestic waste disposal issues in many developing nations, approaching crisis levels (Abdullahi et al., 2014). Solid waste, encompassing materials like food remnants, paper, textiles, construction debris, and more, poses a substantial challenge (Babatunde et al., 2013; Ebistu & Minale, 2013). It emerges from various sectors, including domestic, agricultural, commercial, municipal, and institutional waste, the latter generating hazardous materials, such as cotton wools and syringes in hospitals (Hoornweg, 1999; Ozoh et al., 2021). Solid waste is pervasive, found across rural and urban areas, originating from industrial, commercial, mining, and agricultural activities (Ferronato & Torretta, 2019; Ozoh et al., 2021). Mismanaged waste, particularly open dumping and burning, plagues low-income countries, affecting both social inclusion and economic sustainability (Gupta et al., 2015).

Environmental contamination stemming from poor waste management includes heavy metal pollution in water, soil, and plants due to uncontrolled waste disposal and emissions of pollutants like CO, CO<sub>2</sub>, SO, NO, PM<sub>10</sub>, and others from open waste burning (Vongdala et al., 2019; Wiedinmyer et al., 2014). It results in visual impacts, air pollution, odours, greenhouse gas emissions, disease vectors, and surface and groundwater pollution, impacting communities globally (Ferronato & Torretta, 2019). Indiscriminate dumping of waste is common, compounding environmental and public health hazards (Ogedengbe & Oyedele, 2006). Inadequate waste classification and high-density settlements with inefficient refuse removal services exacerbate indiscriminate dumping in many developing areas (Hettiarachchi et al., 2016).

Nigeria exemplifies the challenges posed by waste management, with solid waste emerging as a major urban environmental threat (Okeniyi & Anwan, 2012; Olorunlana & Ogunade, 2022). Waste accumulates along roads, streams, and in open spaces, exacerbating issues during the rainy season when flooding carries waste into homes and streets (Okeniyi & Anwan, 2012; Olorunlana & Ogunade, 2022). Rapid urbanization, industrialization, and commercial activities contribute to population growth and increased waste production, further straining waste management systems (Okeniyi & Anwan, 2012; Olorunlana & Ogunade, 2022).

Numerous solutions have been offered to enhance solid waste management (SWM) in developing countries. Initiatives include organic waste buyback programs focusing on compost or biogas production (Hettiarachchi et al., 2016), waste-to-energy technologies (Ouda et al., 2016), and concurrent waste-to-energy and recycling strategies (Sadeh et al., 2016). Biomass waste conversion into energy via briquette creation is proposed (Sawadogo et al., 2018), along with the integration of waste pickers into formal waste management (Ghisolfi et al., 2017). Despite these proposals, formidable barriers impede progress, including challenges in waste collection, treatment, and disposal (Matter et al., 2015). Waste minimization, reuse, and recycling are recognized strategies for waste reduction (Chakrabati, 2003). Awosusi (2010) outlines various solid waste management methods in Nigeria, emphasizing the importance of private sector involvement (Akinola & Salami, 2001) and the replacement of open burning with sustainable technologies (Matter et al., 2015). Waste reuse, recycling, and recovery

emerge as crucial strategies for mitigating environmental consequences, reflecting the fluid nature of waste and resources (Chakrabati, 2003).

## 2.2 Review of Empirical Studies

Solid waste management (SWM) is an integral component of urban governance and public health in both developed and developing societies. Effective SWM systems play a pivotal role in maintaining healthy ecosystems and safeguarding the well-being of communities. However, there are several difficulties associated with waste material creation, disposal, collection, transport, and processing, especially among developing nations. With a special emphasis on developing nations, this overview of empirical research seeks to offer a thorough grasp of the complex challenges concerning SWM. This review aims to shed light on the crucial connection between waste management practises and public health outcomes by synthesising the data from a variety of research undertaken in different contexts.

Study by Okechukwu et al. (2012) in Ghana evaluated the knowledge, attitudes, and practices of households and communities towards waste disposal and its associated health implications and showed that 82.8% of the surveyed households dump their refuse in in refuse dumps and open gutters, while only 7.6% resorting to open areas and a mere 0.8% burning their waste. Similarly, Omang et al. (2021) found in Cross River State that indiscriminate refuse dumping is associated with incidences of cholera (18.2%), malaria (47.2%), Lassa fever (10.7%), and diarrhoea (23.9%) with malaria emerging as the most prevalent infection among the reported diseases. In the same vein, the study of Ogundele et al. (2018) in Ibadan found specific health outcomes resulting from poor waste disposal including diseases such as watery stools, typhoid, skin infections, vomiting, sore throat, and abdominal pains which established the link between improper waste generation and management and adverse health effects.

In another similar study, Olorunlana and Ogunade (2022) found that various methods were employed for solid waste disposal which include open dumpsites, drainage and street dumping, disposal into streams and river channels, nearby bush dumping, burning, and excavation by waste management authorities. These were found to result in health concerns including infectious diseases among the population, airborne diseases, the creation of breeding grounds for disease vectors, and contamination of food and water sources.

Several studies have contributed to our understanding of waste management and disposal in Adamawa State. Edan et al. (2014) utilized advanced technologies to map solid waste disposal sites in Jimeta, revealing the prevalence of open dumping and its detrimental impact on the region, including recurrent floods. Zarma (2017) examined the solid waste collection system in Jimeta, highlighting the inadequacy of waste collection methods despite significant waste generation. Joshua and Glanda (2016) focused on slum areas in Jimeta-Yola, emphasizing the role of proper waste management in enhancing living conditions. Abba et al. (2019) explored the energy potential of municipal solid waste in Yola, providing insights into waste composition. Jahknwa et al. (2019) investigated challenges and prospects of sustainable waste management in Jimeta Metropolis, uncovering health risks associated with haphazard waste dumps. Wilfred et al. (2020) studied the environmental impacts of solid waste landfilling in Yola North Local Government Area, revealing extensive adverse effects on residents. Medugu et al. (2022) highlighted issues in the Barama environment of Lokuwa Ward, Mubi, including indiscriminate dumping due to the absence of an official refuse dump. These studies

collectively contribute to a comprehensive understanding of waste management challenges in Adamawa State.

Throughout the studies reviewed, various forms of solid waste disposal were identified, which includes open landfills (Okechukwu et al., 2012; Olorunlana & Ogunade, 2022), dumping in gutters as well as walkways (Okechukwu et al., 2012), disposal into water bodies and waterways (Olorunlana & Ogunade, 2022), disposing of in close by bushes (Olorunlana & Ogunade, 2022), burning (Olorunlana & Ogunade, 2022), and excavation by waste management authorities (Olorunlana & Ogunade, 2022). However, a number of health-related issues have been linked to these practises. Residents in the study locations reported infectious disorders such cholera, Lassa fever, typhoid, and malaria that were linked to poor waste disposal (Ogundele et al., 2018; Okechukwu et al., 2012).

In addition, poor disposal of waste led to the domestication of disease-carrying rodents and mosquitoes (Okechukwu et al., 2012), the contamination of food and water sources (Ogundele et al., 2018), and the spread of airborne diseases (Ogundele et al., 2018). Given the substantial health risks and the reported prevalence of these diseases in areas with indiscriminate refuse dumping, there is a compelling need to investigate the healthcare costs associated with these practices. Understanding the economic burden incurred by households due to illnesses and injuries linked to indiscriminate refuse dumping is crucial

### **2.3 Theoretical Framework**

The study on the effect of indiscriminate dumping of refuse on household health expenditure in Adamawa State can be comprehensively explained by drawing upon several relevant theoretical frameworks. Amongst these, the Health Belief Model (HBM) provides insightful information on how people think about and make decisions related to health hazards brought on by incorrect waste disposal.

It explains how households in Adamawa State may assess the severity of health consequences, perceive the benefits of preventive actions, and consider barriers to health-protective behaviours. In addition, by highlighting the impact of social, economic, and environmental determinants on health outcomes, the Social Determinants of Health hypothesis offers an important contextual perspective. This framework underscores the role of income, education, housing, and environmental conditions in shaping households' vulnerability to health risks and their capacity to manage health-related expenditures. Collectively, these theories offer a comprehensive understanding of the intricate dynamics between refuse dumping, health behaviours, and household health expenditure in Adamawa State, enabling a more informed approach to addressing this critical public health issue.

## **METHODOLOGY**

### **3.1 Description of Study Area**

Adamawa State, located in northeastern Nigeria, has a population of approximately 4,902,100 people (as of a 2022 projection) occupying a land area of 39,940 square kilometres, resulting in a population density of 122.7 individuals per square kilometre. The state has experienced a consistent annual population growth rate of 2.7% from 2006 to 2022. It shares borders with Cameroon, Borno, Gombe, and Taraba States and has Yola as its capital and largest city. The state's diverse landscapes include mountains, plateaus, and rivers, contributing to its rich cultural diversity with various ethnic groups. The economy is predominantly agrarian, focusing

on crop cultivation and livestock farming, with recent efforts in commercial agriculture. Adamawa State is also rich in natural resources like minerals and hydroelectric potential. It offers tourist attractions, hosts educational institutions, and has been working to improve healthcare services, though challenges in healthcare infrastructure persist.

Mubi North Local Government Area, situated in Adamawa State, Nigeria, encompasses a geographical area spanning approximately 10.32°N to 10.11°N latitude and 13.12°E to 13.35°E longitude, covering a total landmass of 506.4 square kilometres. Mubi, the capital city of Mubi North LGA, is strategically located on the Nigerian border with Cameroon, serving as a vital business hub in Adamawa State. This prime location has made it a magnet for traders from both within and outside the country. The area's economy primarily revolves around trade and farming. Additionally, Mubi is home to two significant tertiary institutions in the state: Adamawa State University and Federal Polytechnic Mubi, contributing to its educational and economic significance. As a result of its bustling economic activities and relatively high population, Mubi North also face challenges in waste management, emphasizing the importance of effective waste disposal and environmental management measures in the locality.

Numan Local Government Area is located in Adamawa State, Nigeria, at approximately 9.47° North latitude and 12.03° East longitude, with an elevation of about 137 meters above sea level. This region is part of the Adamawa Plateau, known for its rolling hills and fertile soils, making agriculture a significant occupation. Numan boasts a diverse cultural landscape, with a rich history and a thriving local market. The area's tropical climate features distinct wet and dry seasons, impacting its agricultural practices and way of life, while its proximity to water bodies like the Benue River enhances its natural resources and economic potential. However, Numan Local Government Area faces challenges in waste management, likely exacerbated by the intensity of economic activities and high population density in the region, highlighting the need for improved waste disposal and environmental management strategies.

Yola North Local Government Area is situated in Adamawa State, Nigeria, encompassing a geographical area between approximately 9.11°N to 9.20°N latitude and 12.23°E to 12.33°E longitude, covering approximately 305 square kilometres. This region is characterized by its location near the geographical centre of Adamawa State and includes the capital city of Yola. Yola North features a diverse cultural and economic landscape, with agriculture, trade, and various ethnic groups playing vital roles. The area's climate experiences distinct wet and dry seasons, impacting its agriculture-dependent economy. Similar to Numan, Yola North may also grapple with poor waste management issues, potentially exacerbated by the intensity of economic activities and a relatively high population density, underscoring the need for improved waste disposal and environmental management strategies in the locality.

### **3.2 Research Design**

This study employed a mixed-method research design to holistically investigate the impact of indiscriminate dumping of refuse on household health expenditure in the unique context of Adamawa State, Nigeria. The choice of a mixed-method approach is well-suited for this

research as it recognizes the multidimensional nature of the issue and aims to capture a rich tapestry of data that quantitative or qualitative methods alone would struggle to explicate.

### 3.3 Sampling Technique

The chosen sampling methodology for this study is a multi-stage sampling approach, which offers several advantages in gaining comprehensive insights into the impact of indiscriminate refuse dumping on household health expenditure in Adamawa State, Nigeria. This approach ensures the selection of a representative sample, enhances efficiency in data collection, incorporates diverse perspectives, and seamlessly integrates both quantitative and qualitative data collection methods. It covers a wide geographical area, reflecting variations in waste disposal practices, and aligns with the mixed-method research design, making it a robust strategy to address the research objectives effectively.

#### Stage 1: Selection of Local Governments

The first stage of the sampling process involves the purposive selection of three local governments from each senatorial district within Adamawa State. This selection was guided by key criteria, including the intensity of economic activities and population density of the local government areas. As such, the local governments of Yola North, Mubi North, and Numan were chosen to represent each senatorial district.

#### Stage 2: Selection of Wards

In the second stage, six wards each were selected from Yola North and Mubi North and four wards from Numan local governments as previously identified. The selection was based on criteria such as the intensity of economic activities and population density within the wards. This stage aims to ensure a diverse representation of areas within the selected local governments.

#### Stage 3: Household Selection

The final stage of sampling involves the random selection of 25 households situated in close proximity to refuse dumping sites within each of the six selected wards. To achieve random sampling, a systematic random sampling approach was applied. This approach entails selecting households at regular intervals from a list of eligible households provided by ward leaders and community representatives.

### 3.5 Sample Size

The sample size of 400 households was used for this study. This sample size was drawn randomly from the selected wards from each of the three local government areas. The sample size was determined using the popular Taro Yamane's formula based on the projected population of 682,700 (National Population Commission, 2023). The sample size was calculated thus:

$$n = \frac{N}{1 + Ne^2}$$

Where  $n$  = sample size,  $N$  = Total population,  $e$  = error margin (the common error margin of 0.05 i.e. 5% is chosen with, 95% confidence interval).



$$N = 682,700, e = 0.05 \quad n = \frac{682,700}{1+682,700(0.05)^2} = 399.766 \approx 400$$

Hence, the total sample size used is 400 households. This sample size was drawn based on the following sample distribution in table 1.

**Table 1: Sample Size Distribution**

A	B	C	D	E	(C x E)
<b>LGAs</b>	Total No. of Wards	No. of Wards Selected	Total Projected Population in the LGA(NPC, 2022)	Sample size to be drawn from each ward	Total sample size from each LGA
<b>Yola North</b>	11	6	307,900	25	150
<b>Mubi North</b>	11	6	233,600	25	150
<b>Numan</b>	10	4	141,200	25	100
<b>Total</b>	<b>32</b>	<b>16</b>	<b>682,700</b>		<b>400</b>

Source: Designed by the researchers, (2023).

### 3.6 Data Collection and Analysis

For data collection, a multi-stage sampling approach was employed, with data collection instruments designed for both quantitative and qualitative data. Quantitative data was collected using structured questionnaires administered to selected households. In addition, qualitative insights were gathered through in-depth interviews. An innovative mobile-based tool, KoboToolKit (Kobocollect), was utilized for data collection, offering numerous advantages as a paperless method. Firstly, it aligns with environmental sustainability as it eliminates paper waste and the associated environmental impact. Secondly, it ensures efficiency and accuracy in data collection, incorporating GPS for quality control. Thirdly, it proves cost-effective compared to traditional paper-based methods. Lastly, KoboToolKit allows for instant data transmission and long-term record-keeping, minimizing errors during data analysis. This technology-enhanced approach not only streamlines data collection but also promotes ecological consciousness and data integrity throughout the study.

The method of data analysis employed in this study is designed to provide a comprehensive understanding of the research questions by utilizing descriptive statistics using frequency and percentage to present the findings and analyse the result. This presentation offers an insight into the relationships, trends, and patterns present in the data. Chi square method was also used to test the significance of the level of perceptions of the respondents regarding the effect of indiscriminate dumping of refuse.

## 4. RESULTS AND DISCUSSION

This section discusses the result of investigating the incidence of waterborne diseases, vector-borne diseases, and respiratory ailments within households directly affected by refuse dumping. The aim is to determine the extent of the health burden imposed on households due to this

environmental issue. The results of the perceptions of respondents are provided in the following tables.

#### 4.1: Health consequences of indiscriminate dumping of refuse on households

Questions	Yes	No	Not Sure	Total
Have you or any of your household member experienced injuries or health issues resulting from Indiscriminate dumping of refuse?	193 (48.25%)	207 (51.75%)	0.00	400(100)
Have you or any of your household member sought medical attention for health issues linked to indiscriminate refuse dumping?	123 (30.75)	211 (52.75%)	66 (16.50%)	400(100)
In the past year, have you or any household member experienced waterborne disease	312(78%)	88(22%)	0.00	400(100)
Have you or any household member been affected by vector-borne diseases (e.g., malaria)?	190 (47.50%)	186 (46.50%)	24 (6.00%)	400(100)
In the past year, have you or any household member experienced respiratory ailment	109 (27.32%)	230 (57.64%)	60 (15.04%)	400(100)
Has the indiscriminate dumping of refuse affected your access to clean water for domestic use?	39 (9.77%)	161 (40.35%)	199 (49.87)	400(100)
Have you noticed an increase in the presence of disease vectors (e.g., mosquitoes)?	160 (40%)	209 (52.25%)	31 (7.75%)	400(100)
Do you feel that the health consequences of refuse dumping have affected the overall	190 (47.5%)	159 (39.75%)	51 (12.75)	400(100)
Have you or any household member had to borrow money or take loans to cover experience	68 (17%)	210 (52.5%)	122 (30.5%)	400(100)

Source: Field Survey, (December, 2023).

The survey results reveal significant concerns about the perceptions of households regarding the indiscriminate dumping of refuse and its multifaceted impacts. A substantial 48.25% of respondents affirmed that they or a member of their household had encountered injuries or health issues attributed to indiscriminate dumping of refuse. This high percentage suggests a concerning prevalence of adverse health outcomes directly linked to the mismanagement of waste. The high incidence of injuries or health issues underscores the immediate health risks posed by indiscriminate refuse dumping. These health problems could range from minor injuries sustained during the disposal process to more severe issues arising from exposure to hazardous materials present in improperly discarded waste. The inquiry into whether households have sought medical attention for health issues linked to indiscriminate refuse dumping provides valuable insights. Of the respondents, 30.75% acknowledged seeking

medical attention for health issues related to indiscriminate refuse dumping, while a substantial 52.75% reported not requiring medical attention in this context. The finding that nearly one-third of households sought medical attention emphasizes the tangible health consequences associated with indiscriminate refuse dumping. This includes injuries, infections, or illnesses directly linked to exposure to improperly discarded waste. Similarly, the inquiry regarding the occurrence of waterborne diseases within households over the past year provides critical insights into the public health implications of water contamination, potentially stemming from indiscriminate refuse dumping or other environmental factors. According to the survey, a significant 78% of respondents reported that they or a member of their household had experienced a waterborne disease within the past year. The high percentage of households reporting incidents of waterborne diseases is alarming and indicative of a substantial public health concern. Waterborne diseases, often caused by the consumption of contaminated water, can lead to severe health consequences, including gastrointestinal illnesses, infections, and other waterborne-related ailments. The survey question regarding the impact of vector-borne diseases, such as malaria, on households provides important perceptions on the health risks associated with indiscriminate refuse dumping. According to the data, 47.50% of respondents reported that they or a household member had been affected by vector-borne diseases, while 46.50% indicated no such impact. Additionally, a small percentage (6.00%) expressed uncertainty or did not provide a clear response to the question. Vector-borne diseases, transmitted by vectors such as mosquitoes, pose substantial health threats and can lead to severe illnesses if not properly managed. The prevalence of these diseases within approximately half of the households underscores the urgent need for targeted interventions to control vectors and prevent the spread of vector-borne illnesses.

The survey question regarding respiratory ailments within households over the past year sheds light on the prevalence and impact of respiratory health issues, potentially influenced by environmental factors such as air quality and exposure to pollutants. According to the data, 27.32% of respondents reported that they or a household member had experienced a respiratory ailment, while a majority of 57.64% indicated no such occurrence. Additionally, a smaller percentage (15.04%) expressed uncertainty or did not provide a clear response to the question.

The survey question regarding the impact of indiscriminate dumping of refuse on access to clean water also provide valuable insights into the potential environmental consequences of improper waste disposal practices on water resources. According to the data, 9.77% of respondents reported that the indiscriminate dumping of refuse had affected their access to clean water, while 40.35% indicated no such impact. A substantial 49.87% of respondents expressed uncertainty or did not provide a clear response to the question. On the other hand, the survey question regarding the perception of an increase in the presence of disease vectors, such as mosquitoes, provides valuable insights into the potential impact of indiscriminate refuse dumping on the local environment and public health. According to the data, 40% of respondents reported noticing an increase in the presence of disease vectors, while 52.25% did not observe any such increase. A smaller percentage, 7.75%, expressed uncertainty or did not provide a clear response to the question. The 40% of respondents noting an increase in disease vectors signals a concerning trend that may be associated with environmental conditions resulting from indiscriminate refuse dumping. Mosquitoes, as disease vectors, can contribute to the spread of various illnesses. The reported increase in their presence may be attributed to the creation of breeding grounds in improperly disposed waste, stagnant water, or other conditions conducive to mosquito proliferation.

The survey question probing the perception of whether the health consequences of refuse dumping have affected the overall well-being of households is also very fundamental to the broader understanding of the impacts of improper waste disposal on the surveyed population. According to the data, 47.5% of respondents feel that the health consequences of refuse dumping have indeed affected the overall well-being of their household, while 39.75% do not share this sentiment. A smaller percentage, 12.75%, expressed uncertainty or did not provide a clear response to the question. The nearly half of respondents (47.5%) acknowledging an impact on overall well-being suggests a widespread recognition of the interconnectedness between health and the environment. The health consequences stemming from improper waste disposal can manifest in various ways, affecting not only physical health but also mental and social aspects of well-being. This finding underscores the multifaceted nature of the impact of refuse dumping on households and highlights the need for comprehensive strategies to address these concerns.

The survey question probing whether households had to borrow money or take loans to cover medical expenses resulting from indiscriminate refuse dumping provides insights into the economic burden imposed by health issues associated with improper waste disposal. According to the data, 17% of respondents reported having to borrow money or take loans for medical expenses related to refuse dumping, while 52.5% did not have to resort to borrowing. Additionally, 30.5% of respondents expressed uncertainty or did not provide a clear response to the question. The 17% of respondents indicating the need to borrow money or take loans underscores the significant economic impact of health issues arising from indiscriminate refuse dumping. This economic burden may result from medical treatment costs, expenses for ongoing care, or loss of income due to health-related issues.

## **EFFECT OF INDISCRIMINATE DUMPING OF REFUSE ON INCOME, PRODUCTIVITY AND PROPERTY OF HOUSEHOLDS**

**Table 4.2: Average Medical Cost (N) Incurred Due to Indiscriminate Dumping of Refuse**

In the past 12 months, how much money, on average, has your household spent on medical treatment attributed to Indiscriminate refuse dumping?	Frequency	Percent
Less than 5,000	76	19.00
5,001-10,000	165	41.25
10,001-20,000	129	32.25
20,001-50,000	29	7.25
More than 50,000	1	0.25
Total	400	100.00

Source: Field Survey, (December, 2023).

The survey data on the average medical costs incurred due to indiscriminate dumping of refuse reveals a complex picture of the financial burden experienced by households as a consequence of health issues related to improper waste disposal. The majority of respondents, constituting 41.25%, reported spending between 5,001 and 10,000 Naira on medical treatment attributed to indiscriminate refuse dumping. This range likely encompasses various medical expenses, indicating a significant proportion of households facing a moderate financial burden. It

suggests that health issues related to waste disposal have tangible economic implications for a substantial portion of the surveyed population.

Furthermore, 32.25% of respondents reported medical expenses ranging from 10,001 to 20,000 Naira, indicating a higher financial burden for a significant portion of households. This category suggests that a substantial number of respondents experienced more severe health consequences or required ongoing medical treatments, leading to higher associated costs. The data underscores the diverse economic impact, with a considerable proportion of households facing substantial financial challenges due to the health effects of indiscriminate refuse dumping.

In contrast, 19.00% of respondents reported spending less than 5,000 Naira on medical treatment, reflecting a lower economic impact for this segment. However, it's important to note that even within this category, households are not exempt from financial strain, emphasizing the need for nuanced interventions that consider the varying degrees of economic vulnerability among affected communities.

**Table 4.3: Estimated total income loss (in naira) due to illness resulting from Indiscriminate Refuse Dumping**

Estimate the total income loss for your household due to illnesses resulting from Indiscriminate Dumping of Refuse	Frequency	Percent
Less than 10,000	71	17.75
10,001-50,000	211	52.75
50,001-100,000	90	22.50
100,001-500,000	23	5.75
More than 500,000	5	1.25
Total	400	100.00

Source: Field Survey, (December, 2023).

The data on the estimated total income loss due to illnesses resulting from indiscriminate refuse dumping provides a glimpse into the economic repercussions experienced by households affected by health issues linked to improper waste disposal. The majority of respondents, constituting 52.75%, reported an income loss ranging from 10,001 to 50,000 Naira. This range suggests a substantial portion of households facing a moderate economic impact, reflecting the financial strain associated with health issues attributed to refuse dumping.

Furthermore, 22.50% of respondents reported income losses ranging from 50,001 to 100,000 Naira, indicating a higher economic burden for a significant portion of households. This category suggests that a substantial number of respondents experienced more severe health consequences or required extended recovery periods, leading to higher associated income losses. The data underscores the diverse economic impact, emphasizing the significant financial challenges faced by a considerable proportion of households due to health issues related to indiscriminate refuse dumping.

In contrast, 17.75% of respondents reported income losses less than 10,000 Naira, reflecting a lower economic impact for this segment. However, it's important to note that even within this category, households are not immune to financial strain, and the cumulative impact on the community can still be considerable.

**Table 4.4: Productivity Effect: Number of days absent from work or school**

In the past 12 months, how many days, on average, were household members absent from work or school due to illnesses resulting from indiscriminate dumping of refuse?	Frequency	Percent
Less than 5 days	6	1.50
5-10 days	150	37.50
11-20 days	169	42.25
More than 20 days	64	16.00
Not sure	11	2.75
Total	400	100.00

Source: Field Survey, (December, 2023).

The data on the productivity effect, specifically the number of days absent from work or school due to illnesses resulting from indiscriminate dumping of refuse, provides valuable insights into the socio-economic impact of improper waste disposal on the community. The majority of respondents, constituting 42.25%, reported an absence ranging from 11 to 20 days. This category indicates a significant portion of households facing a considerable disruption to daily life, with members missing an extended period of work or school due to health issues associated with refuse dumping.

Furthermore, 37.50% of respondents reported an absence ranging from 5 to 10 days, reflecting a substantial portion of households experiencing a moderate disruption to productivity. This range may include instances where health issues resulted in shorter-term absences, but the cumulative impact on work and educational commitments is noteworthy.

The 16.00% of respondents reporting more than 20 days of absence highlights a smaller but significant proportion of households facing prolonged disruptions, potentially indicative of more severe health consequences or extended recovery periods. This finding underscores the considerable toll that indiscriminate refuse dumping can have on the productivity and livelihoods of affected communities.

**Table 4.5: Perceptions of the respondents on the overall financial burden caused by Indiscriminate Dumping of Refuse**

How would you rate the overall financial burden placed on your household due to indiscriminate dumping of refuse?	Frequency	Percent
Mild	31	7.75
Moderate	89	22.25
Negligible	1	0.25
Severe	262	65.50
Very severe	17	4.25
Total	400	100.00

Source: Field Survey, (December, 2023).

The data on the perceptions of the respondents of the overall financial burden caused by indiscriminate dumping of refuse provides nuanced insights into the economic strain experienced by households due to the health issues associated with improper waste disposal. The majority of respondents, constituting 65.50%, described the financial burden as severe. This indicates a substantial proportion of households facing significant economic challenges,

emphasizing the profound impact of indiscriminate refuse dumping on the financial well-being of the surveyed community.

Additionally, 22.25% of respondents characterized the financial burden as moderate, suggesting another sizable segment of households experiencing a considerable but potentially more manageable economic impact. The 7.75% of respondents who perceived the financial burden as mild may indicate a smaller proportion with relatively lower economic challenges. However, it's essential to recognize that even a mild financial burden can accumulate and contribute to broader community-level concerns.

On the other hand, 4.25% of respondents characterized the financial burden as very severe, signifying an even smaller but critically affected subset of households facing extremely challenging economic circumstances due to indiscriminate refuse dumping. The negligible percentage (0.25%) describing the financial burden as negligible suggests that the majority of respondents recognize some degree of economic impact, even if minimal.

These findings underscore the need for targeted economic interventions, financial assistance programs, and improved waste management practices. The varied perceptions of financial burden highlight the importance of tailored support mechanisms that address the specific economic needs of households facing different levels of financial challenges due to health issues related to refuse dumping. There is also a need for integrated strategies that consider both health and economic dimensions. Exploring measures to regulate waste disposal practices, enhance healthcare accessibility, and develop economic support programs for households facing varying levels of financial challenges due to health issues related to refuse dumping is paramount.

**Table 4.6: Perceived Socioeconomic Characteristics Influencing Household Vulnerability to Health Issues Associated with Indiscriminate Dumping of Refuse**

Socioeconomic Characteristics Perceived to affect household vulnerability to health issues resulting from indiscriminate dumping of refuse	$\chi^2$ Statistic
The income level is likely to affect the vulnerability of households to health issues resulting from improper waste disposal.	338.558 (0.000)
Educational level is likely to affect the vulnerability of households to health issues from improper waste disposal.	234.045 (0.000)
Age is likely to affect the vulnerability of households to health issues resulting from improper waste disposal.	306.125 (0.000)
Gender is likely to affect the vulnerability of households to health issues resulting from improper waste disposal.	271.775 (0.000)
Marital status is likely to affect the vulnerability of households to health issues resulting from improper waste disposal.	277.175 (0.000)
Family size is likely to affect the vulnerability of households to health issues resulting from improper waste disposal.	192.575 (0.000)

Source: Field Survey, (December, 2023). Note: Perceptions of households were measured using Likert scale where 5= strongly agree, 4= agree, 3= neutral, 2= disagree and 1 = strongly disagree. Observations= 400. The observed frequency and expected frequency are not report

here to conserve space. The values in bracket are the probability values indicating the asymptotic significance of the responses by the surveyed households.

The survey data on perceived socioeconomic characteristics influencing household vulnerability to health issues associated with indiscriminate dumping of refuse reveals compelling insights into the community's perspectives on the factors that contribute to the susceptibility of households to the health consequences of improper waste disposal.

The  $\chi^2$  statistics, indicating the significance of perceptions, highlight the unanimous agreement among respondents regarding the influence of various socioeconomic characteristics on household vulnerability to health issues resulting from indiscriminate refuse dumping. The income level emerged as a highly significant factor, with a  $\chi^2$  statistic of 338.558 and a probability value of 0.000, underlining the consensus that higher or lower income levels play a crucial role in determining the extent of vulnerability to health issues.

Similarly, educational level, age, gender, marital status, and family size all demonstrated high significance levels, with  $\chi^2$  statistics ranging from 192.575 to 306.125 and probability values of 0.000. This collective agreement emphasizes the multidimensional nature of vulnerability, with various socioeconomic factors intertwining to shape the overall susceptibility of households to health issues associated with improper waste disposal.

These findings highlight the need for targeted interventions that consider the diverse socioeconomic landscape within the community. Addressing vulnerability requires not only waste management strategies but also initiatives that account for income disparities, educational access, demographic factors, and family dynamics. Tailored interventions that recognize and respond to these diverse characteristics can enhance the effectiveness of public health and environmental policies. This also stresses the importance of integrated strategies that acknowledge and address the interconnectedness of environment, health and socioeconomic factors. Considering measures that bridge income gaps, improve educational opportunities, and tailor health interventions based on demographic characteristics is essential. This comprehensive approach aligns with the perceptions of communities and can contribute to more inclusive and impactful policies that mitigate vulnerability to health issues associated with indiscriminate refuse dumping.

## ENVIRONMENTAL EFFECTS OF INDISCRIMINATE DUMPING OF REFUSE

This section aims at evaluating the households' perceived environmental effects of indiscriminate refuse dumping, with a focus on soil degradation, habitat disruption, drainage blockage, and water contamination. The objective specifically seeks to determine the extent of these environmental impacts and how they may contribute to health problems and healthcare costs for households in Adamawa State

**Table 4.7: Households' Perceived Effects of Indiscriminate Refuse Dumping on Soil Degradation**

How do you perceive the impact of indiscriminate refuse dumping on soil degradation in your community?	Frequency	Percent
Minimal impact	144	36.00
Moderate impact	143	35.75



No impact	22	5.50
Not sure	4	1.00
Severe impact	27	6.75
Significant impact	60	15.00
Total	400	100.00

Source: Field Survey, (December, 2023).

The data on households perceived environmental effects of indiscriminate dumping of refuse, specifically focusing on soil degradation, provides an understanding of the environmental impacts of improper waste disposal. The respondents were asked to assess the impact of indiscriminate refuse dumping on soil degradation in their community, and the findings reveal a range of perceptions. The majority of respondents, constituting 36.00%, perceived the impact of indiscriminate refuse dumping on soil degradation as minimal. Additionally, 35.75% of respondents perceived a moderate impact, highlighting another substantial segment of the community that recognizes a more tangible influence of indiscriminate refuse dumping on soil degradation. Similarly, 15.00%, perceived a significant impact, emphasizing that a notable subset of households is deeply concerned about the adverse effects of indiscriminate refuse dumping on soil quality. Meanwhile, 6.75% of respondents characterized the impact as severe, further highlighting the recognition of the potential severity of soil degradation due to improper waste disposal.

**Table 4.8: Households’ Perceived Effect of Indiscriminate Refuse Dumping on local habitats and ecosystems**

To what extent do you believe indiscriminate refuse dumping disrupts local habitats and ecosystems?	Frequency	Percent
Considerably	92	23.00
Extremely	28	7.00
Moderately	145	36.25
Not at all	12	3.00
Not sure	7	1.75
Slightly	116	29.00
Total	400	100.00

Source: Field Survey, (December, 2023).

The data on the perceived effects of indiscriminate refuse dumping on local habitats and ecosystems provides valuable insights into the awareness and concerns by households where respondents were asked to evaluate the extent to which they believe indiscriminate refuse dumping disrupts local habitats and ecosystems, in which the findings reveal a diverse range of views. A notable portion of respondents, constituting 36.25%, perceived a moderate disruption while 29.00% of respondents perceived a slight disruption, reflecting a group that acknowledges a lesser but still significant impact on local habitats and ecosystems. Furthermore, 23.00% of respondents believed that indiscriminate refuse dumping considerably disrupts local habitats and ecosystems, emphasizing a significant subset of the community that holds a more pronounced concern for the environmental consequences. The 7.00% of respondents who perceived an extreme disruption signifies a critically affected subset, highlighting a heightened level of concern about the severity of the impact on local ecology.

**Table 4.9: Households’ Perceptions of the level of drainage blockage caused by indiscriminate refuse dumping**

How would you rate the level of drainage blockage caused by indiscriminate refuse dumping in your area?	Frequency	Percent
Frequent blockage	150	37.50
No blockage	15	3.75
Not sure	13	3.25
Occasional blockage	90	22.50
Persistent blockage	96	24.00
Severe blockage	36	9.00
Total	400	100.00

Source: Field Survey, (December, 2023).

The survey data on households' perceptions of the level of drainage blockage caused by indiscriminate refuse dumping offers valuable insights into the community's understanding of the environmental consequences of improper waste disposal, specifically in relation to drainage systems. Respondents were asked to rate the level of drainage blockage caused by indiscriminate refuse dumping in their area, and the findings reveal diverse perceptions.

The majority of respondents, constituting 37.50%, perceived frequent blockage in drainage systems due to indiscriminate refuse dumping, with additional 24.00% of respondents perceived persistent blockage, emphasizing a substantial subset of the community that recognizes an ongoing and sustained problem with drainage blockage. Furthermore, 9.00% who perceived severe blockage were the critically affected group, indicating intensified concerns about the severity of the impact on drainage systems.

**Table 4.10: Households’ Perceptions on the contribution of indiscriminate refuse dumping to water contamination in their community**

In your opinion, to what extent does indiscriminate refuse dumping contribute to water contamination in your community?	Frequency	Percent
Major contribution	37	9.25
Minor contribution	96	24.00
Moderate contribution	125	31.25
No contribution	13	3.25
Not sure	14	3.50
Significant contribution	115	28.75
Total	400	100.00

Source: Field Survey, (December, 2023).

The data on the perceptions of households about the contribution of indiscriminate refuse dumping to water contamination shows that a significant portion of respondents, constituting 31.25%, perceived a moderate contribution of indiscriminate refuse dumping to water

contamination. While 28.75% of respondents perceived a significant contribution, emphasizing another considerable subset of the community that holds a heightened concern for the impact of indiscriminate refuse dumping on water contamination. The 9.25% who perceived a major contribution signifies a smaller but critically affected households, indicating heightened concerns about the substantial role of waste dumping in water contamination.

**Table 4.11: Household’s Perceptions of the environmental Effects of indiscriminate refuse dumping on health problems**

How strongly do you believe the environmental impacts of indiscriminate refuse dumping contribute to health problems in your household?	Frequency	Percent
Considerably	75	18.75
Extremely	32	8.00
Moderately	119	29.75
Not at all	48	12.00
Not sure	8	2.00
Slightly	118	29.50
Total	400	100.00

Source: Field Survey, (December, 2023).

The survey data on households’ perceptions of the environmental effects of indiscriminate refuse dumping on health problems offers valuable insights into the community's understanding of the link between improper waste disposal and public health. Respondents were asked to rate the strength of their belief in the contribution of environmental impacts from refuse dumping to health problems in their household, and the findings reveal a range of perspectives. A significant portion of respondents, constituting 29.75%, believed that the environmental impacts of indiscriminate refuse dumping have a moderate contribution to health problems in their households. Additionally, 29.50% of respondents believed in a slight contribution, reflecting a group that acknowledges a lesser but still noteworthy impact on health. The combined percentages of respondents who believed in a considerable (18.75%) or extreme (8.00%) contribution highlight a substantial subset of the community holding heightened concerns about the potential health implications associated with improper waste disposal. Conversely, 12.00% of respondents believed that the environmental impacts of indiscriminate refuse dumping have no contribution to health problems in their households. This minority perspective suggests a segment of the community that perceives minimal health risks associated with refuse dumping.

These findings highlight the need for community engagement and environmental education programs to raise awareness about the potential impact of indiscriminate refuse dumping. The varied perceptions within the community suggest a need for tailored interventions that consider the differing levels of concern and understanding among residents.

## CONCLUSION

This study investigated in the effect of indiscriminate dumping of refuse on household health expenditure in Adamawa State, Nigeria. Issue of poor solid waste disposal and management in most developing countries has continued for decades and it has become more evident that this

issue carries multidimensional effects with household health been the most affected. A sample of 400 households was selected across three selected local government areas one from each Senatorial District of Adamawa State. Through the use of Kobocollect mobile device, data were collected using data collectors and descriptive method of analysis was employed to analyse the data which provided valuable insights into the effect of indiscriminate dumping of refuse on household health expenditure in the study area. The results from this study based on the perceptions of the respondents indicate that indiscriminate dumping of refuse reduces households' income, productivity and leads to property loss due to the ecological effect of the poor refuse management. The indiscriminate refuse dumping also contributed significantly to water contamination, drainage blockage, increase in disease vectors, increase in water – borne diseases, air pollution and increase in health spending of households.

## **RECOMMENDATIONS**

Given the comprehensive results of this study about household perceptions of the effects of indiscriminate disposal of solid waste in Adamawa State, a number of significant recommendations are offered. The complexity of the social, health, and environmental issues shown by the survey data serves as the foundation for these suggestions.

The first step is to prioritise and strengthen waste management initiatives in neighbourhoods and cities. Families are quite worried about the detrimental environmental repercussions of improper waste disposal, including poisoned water, blocked drainage systems, and altered ecosystems, according to the report. Policymakers could consider funding infrastructure for waste collection, supporting neighbourhood clean-up projects, and imposing stringent waste disposal regulations in order to address these problems.

Second, community education initiatives should be created to increase knowledge of the health hazards connected to inappropriate trash disposal. The survey reveals that respondents' comprehension of the connection between trash dumping and health issues varies. Activities have to concentrate on educating people about the possible health effects of careless trash disposal, stressing the significance of appropriate garbage disposal procedures, and encouraging cleanliness and hygiene in homes.

Thirdly, households bearing the financial cost of health problems associated with garbage dumping require specific economic interventions and financial support programmes. The study results highlight the wide range of economic effects on households, from mild to serious financial difficulties. Legislators have to investigate methods of reducing financial strains, like introducing healthcare subsidies, giving monetary support to impacted households, and setting up chances for vulnerable populations to generate revenue.

The study also emphasises the significance of customising treatments according to certain socioeconomic and demographic traits. The perception of susceptibility to health hazards linked to the disposal of waste varies among different demographic categories, including age, gender, marital status, economic bracket, and size of family. Legislators must to take an all-encompassing stance, taking into account the many attributes of the society, and enact policies that tackle the distinct difficulties encountered by distinct groups within the populace.

In summary, the suggestions mentioned above stress the significance of utilising a comprehensive and integrated strategy to tackle the intricate issues brought about by the careless disposal of waste. Policymakers might attempt to mitigate the negative environmental,

health, and socioeconomic implications found in the study by combining efficient waste management techniques, community education programmes, focused economic interventions, and customised regulations.

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