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Research Article

SOLID WASTE GENERATION AND MANAGEMENT AT NNAMDI AZIKIWE INTERNATIONAL AIRPORT, ABUJA: A HEALTH IMPACT ASSESSMENT

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Abstract

The rapid expansion of domestic and international mobility, driven by globalization, tourism, and trade, has significantly increased the demand for efficient and sustainable air transport systems. Consequently, the aviation industry has emerged as one of the fastest-growing sectors worldwide. Airports, as critical nodes in the air transport value chain, serve not only as transit hubs but also as complex service environments incorporating commercial, hospitality, and logistics activities. This functional diversification has led to a substantial increase in the volume and complexity of waste generated within airport environments.

Effective waste management in airports has therefore become a growing concern, particularly in developing countries where urban sanitation challenges are already pronounced. In Nigeria, for instance, urban environments are often characterized by poor sanitation conditions, with waste generation closely linked to population growth and increased human activity. Airports, due to their high passenger turnover and multifaceted operations, contribute significantly to municipal solid waste streams. These wastes arise from passenger activities, airline operations, food services, retail outlets, and ground handling services.

Given the increasing passenger traffic and expansion of airport infrastructure, the management of waste within airport premises has become a critical environmental and public health issue. Poor waste handling practices not only compromise environmental sustainability but also pose potential risks to hygiene, safety, and the overall passenger experience. Furthermore, the integration of modern airport facilities such as shopping complexes, conference centers, and hotels further amplifies waste generation challenges.

This study examines the dynamics of waste generation and management within airport environments, with particular emphasis on the implications for environmental sanitation and operational efficiency. It highlights the importance of adopting sustainable waste management strategies that align with global best practices to ensure airports remain safe, clean, and environmentally responsible. The paper underscores the need for improved policy implementation, infrastructure development, and stakeholder collaboration to address the growing waste management challenges associated with modern aviation activities.

Keywords: Airport Waste Management; Solid Waste; Aviation Industry; Environmental Sanitation; Sustainability

Introduction

The unprecedented growth in domestic and international movement of goods and services, worldwide tourism, and mobility becomes an integral factor in lives of people both for recreation and professional reasons. This would not be possible without exponential growth of air transport industry and associated services. As a result, commercial aviation today becomes one of the fastestgrowing industries in the world. With such growth it is important that aviation of any nature across the globe is safe, comfortable, eco-friendly, and imbibes universal hygiene principles in its overall operations. Airports play a vital role in the air transport industry value chain, acting as the interface point between the air and surface transport modes. However, substantial volumes of waste

are produced as a by-product of the actors' operations. In addition to their aviation-related functions, airports are increasingly evolving, and many airports now have shopping and hotel complexes, conference facilities, logistics areas and intermodal public transport hubs (Ferrulli, 2020). Nigerian cities have been described as some of the dirtiest, most unsanitary and the least aesthetically pleasing in the world (Gomez & Nakat 2017). It has been suggested that the quantity of wastes generated in the state is proportional to population size. As population increases so also waste generated also increases. The various activities that are performed at airports produce considerable volumes of waste (Parameshwar 2021). Thus, the issue of waste management within airports is becoming especially important due to the very significant increases in passenger numbers and the consequent volumes of waste that are generated.

According to Nathanson (2023) waste management once generated, wastes must be managed through reuse, recycling, storage, treatment, energy recovery, and disposal or other releases to the environment. Most municipal solid wastes are managed in land disposal units. For hazardous and industrial wastes, land disposal includes landfills, surface impoundments, land treatment, and farming and underground injection. In order to protect man's environment and promote his health, waste disposal and management should be more aggressively addressed in our society. Waste is

more easily recognized than defined. Something can become waste when it is no longer useful to the owner or it is used and fails to fulfill its purpose (Gaurlay, 2017). Solid waste is any useless unwanted or discarded materials that are not liquid or gas. It is a great mixture of substances including fine dust, metal, glass, paper and cardboards, textiles, vegetable materials and plastic characterize solid waste.

Refuse are waste materials that have been thrown away. The statutory definition of refuse is not based on the physical form of materials, that is, whether or not it is solid, as opposed to liquid or gas but on the fact that the material is a waste. Team (2022) defined refuse as all solid waste in the house and offices such as pieces of paper, leaves, garbage, ashes, rubbish and dead animals among others. It can also be defined as uwanted, discarded, non-liquid materials emanating from various activities of human. Refuse should be properly disposed of to prevent the spread of infections and health hazards in the society.

The rapid growth of cities in the developing world in recent decades has resulted in increased consumption of resources to meet the growing demands of urban population and industry. This situation leads to generation of large amount of waste (Kalensawo, Oke & Okofuwa, 2018). The dangers of indiscriminate waste disposal are all around the nooks and crannies of the country and the effects constitute nothing but negative effects to the inhabitants. The rate of health retrogression that are waste disposal related is so alarming as it can lead to: health hazard therefore, disease; environmental hazard; accident on our environment; social effects, and economic effects. Most of the aforementioned practices above were observed in cities where major airports are located,

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therefore there is need to assess the condition of refuse generation, storage and disposal with in the airport in order to understand and appropriately address the gap.

There are some socio- demographic factors that are capable of influencing or affecting the of refuse generation, storage, disposal and health effects.

Gender is a variable that has received consistent attention among researchers. Nathanson (2023) found that women were significantly more likely than men to be concerned with environmental problems. Females have been consistently shown to have higher environmental conscious behaviours than men. Furthermore, the common reason advanced for gender differences is the different socialization patterns between boys and girls. More often than not, girls are made to carry out most of all the sweeping and cleaning activities; they are called upon more than their male counterparts to perform maintenance tasks at home, work places including airport or in schools.

Statement of the Problem

The rapid growth of cities in the developing world in recent decades has resulted in increased rate of air transport and consumption of resources to meet the growing demands of people that enters the airport and this situation leads to the generation of large number of wastes.

The researchers observed that Places meant for motor parks, exit gates and gutters for drainage have been converted into refuse dump sites. Many of these wastes including sachet water nylon, rotten foods, discarded stationery items, broken plastics and bottles among several others, have found their ways back to nearby shops and passage ways when wind blows and rain falls, Rodents, flies, as well as foul odour that can cause nausea. It is therefore imperative to find out from the airport workers and passengers about refuse generation, storage and disposal and its perceived health consequences.

Purpose of the Study

The purpose of the study is to assess the Storage, Disposal and Health Effects of Refuse in Nnamdi Azikiwe International Airport Abuja. Specifically, the study sort to;

1. assess the types of Refuse generated at Namdi Azikiwe International Airport Abuja
2. examine the methods of storing refuse at Namdi Azikiwe International Airport Abuja
3. find out the health effects of improper refuse disposal in Namdi Azikiwe International Airport Abuja based on gender

Research Questions

The following research questions guides the study,

1. What are the types of Refuse generated at Namdi Azikiwe International Airport Abuja?
2. What are the methods of storing refuse at Namdi Azikiwe International Airport Abuja?
3. What is the health effects of improper refuse disposal at Namdi Azikiwe International Airport Abuja based on gender?

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Methodology

This study used a descriptive cross sectional survey design to assess generation, storage, disposal and the health effects of refuse in Nnamdi Azikwe International airport Abuja. Gemson (2020) used the design in a similar study. It is therefore appropriate in the present study.

The population for the study was all the 1, 574 workers in Nnamdi Azikiwe International Airport (Source: Office of the Head of administration; 2023). The sample size of this study was 383 determined using Cohen, Manion and Morrison (2011). However, simple random sampling by balloting was used to select the respondents. The researcher used a paper folded with yes or no method. The folded papers are put in a basin or table for the respondents to pick. Only those who picked yes were included in the study.

Data was collected using a researcher designed questionnaire to capture socio-demographic characteristics, waste generation, storage, disposal and health effects of refuse. The instrument was presented to three experts for checking and corrections to ensure content and face validity. Also, the experts make scrutiny and also to ensure the content at the questions are aligned with the study objectives the final corrections made by the expert will be used to form the final questionnaire. In order to determine the reliability of the instrument, pilot test was conducted in Kano airport, twenty copies of the questionnaires was distributed to same respondents at interval of 1 week. The two sets of responses was correlated and the reliability score obtained was greater 0.7 which shows the questionnaire is reliable and was used for the study.

The data for this study was collected through the use of questionnaire. Five working days was used for data collection. Airport authorities were approach and explanation about the nature of the study was carried out. Study assistants were briefed on the modalities on how to administer the instrument. The respondents were also brief about the nature of the study and then informed consent for participation was obtained, those who are willing to participate the study were required to complete the questionnaire and it was retrieve immediately after completion, to ensure high return rate..

The questionnaires were cross checked for completeness and accuracy. Each questionnaire was assigned a code for facilitation of referral process, if needed while confidentiality is ensured. Data was analyzed using both descriptive and inferential statistical tools with aid of Statistical Package for Social Sciences (SPSS) version 20. For descriptive statistics; frequency, percentage, mean, and standard deviation were used. Data were summarized and presented using frequency tables, and set significant level at $p < 0.05$.

Permission was obtained from Nnamdi Azikwe International Airport. Informed written consent was sought from respondents before the beginning of data collection and also the purpose and nature of the study was explained while their questions were clarified. They were well informed about their rights to withdraw anytime, if they felt distress about the data collection process. Respondents' privacy and confidentiality was maintained throughout the research process.

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Results

Total of 383 questionnaires were distributed while 367 was returned valid. Therefore, the return rate of the study was (95.8%).

Research Question 1**:** What are the types of Refuse generated at Namdi Azikiwe International Airport Abuja?

Table 1: Types of Refuse generated at Namdi Azikiwe International Airport Abuja

S/N	Solid Waste generation	Generate (%)	Not-generate (%)
1	Waste papers	211 (57.5%)	156(42.5%)
2	Accumulated rags	253(68.9%)	114(31.1%)
3	Broken bottles and metals	101(27.5%)	266(72.5%)
4	Nylon and polythene bags	236(64.3%)	131(35.7%)
5	Food waste and fruits peel	162(44.1%)	205(55.9%)
6	Medical wastes such as used syringe and needles, cotton wool, bandages, infusion bags, giving sets, hand gloves, plaster, empty inject able drugs containers, blood bags, urine bags, catheters	105(28.6%)	262(71.4%)

Source: Field Survey, 2023

Table 1 above shows result related to types of refuse generated whereby more than half 253 (68.9%) of the respondents are generating accumulated rags waste, then 236 (64.3%) generating Nylon and polythene bags waste, and 211 (57.5%) generating waste papers while less than half 162 (44.1%) are generating food waste and fruits peel. But, very few 105(28.6%) are generating medical waste; this may happened as a result of the study area is a place where medical services are not rendering and also medical equipment's are not servicing.

Research Question 2: What are the methods of storing refuse at Namdi Azikiwe International Airport Abuja?

Table 2: Methods of storing refuse at Namdi Azikiwe International Airport Abuja

S/N	Solid waste storage	N	Mean	SD	Decision
1	Stored in polythene bags	367	3.03	1.04	Agreed

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2	Stored in waste baskets	367	2.49	1.09	Disagreed
3	Stored in drums	367	2.74	1.17	Agreed
4	Stored in dustbins	367	2.45	1.07	Disagreed
5	Stored in provided garbage bags	367	3.10	1.09	Agreed

Source: Field Survey, 2023

Table 2 above shows the mean rating of the respondents determine the methods of refuse storage.

Using the criterion mean of 2.50, the results of the data analysis revealed that three (3) out of five (5) items listed were recorded mean values greater than the criterion mean, thus can be regarded to be agreed. Storing refuse in provided garbage bags recorded higher mean value of 3.10, then, storing refuse in polythene bags (mean = 3.03) and, storing refuse in drums (mean = 2.74). But, storing refuse in waste baskets (mean = 2.49) and storing refuse in dustbins (mean = 2.45) were recorded mean values less than the criterion mean and regarded as disagreed.

The standard deviation which showing the rate of dispersion of the scores indicated that storing refuse in drums (1.17) had the greatest spreads of scores.

Research Question 3: What is the health effects of improper refuse disposal at Namdi Azikiwe International Airport Abuja based on gender?

Table 3: Health effects of improper refuse disposal at Namdi Azikiwe International Airport Abuja based on gender

Health effects	**Gender**		**x^2**	**p – value**	**Decision**
	Male	**Female**			
Affect human health and the environment			**0.507**	**0.48**	**Insignificant**
Agreed	154(85.1%)	163(87.6%)			
Disagreed	27(14.9%)	23(12.4%)			
It is toxic			**4.716**	**0.03**	**Significant**
Agreed	147(81.2%)	166(89.2%)			
Disagreed	34(18.8%)	20(10.8%)			
Contaminate land, air and water			**24.617**	**<0.01**	**Significant**
Agreed	129(71.3%)	170(91.4%)			
Disagreed	52(28.7%)	16(8.6%)			
Create unsanitary conditions			**16.588**	**<0.01**	**Significant**
Agreed	130(71.8%)	165(88.7%)			

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Disagreed	51(28.2%)	21(36.5%)			
Lead to pollution of the environment			**12.718**	**<0.01**	**Significant**
Agreed	128(70.7%)	160(86.0%)			
Disagreed	53(29.3%)	26(14.0%)			
Lead to outbreaks of vector-borne disease			**7.94.3**	**0.01**	**Significant**
Agreed	125(69.1%)	152(81.7%)			
Disagreed	56(30.9%)	34(18.3%)			
Spread disease by rodents and insect			**13.655**	**<0.01**	**Significant**
Agreed	110(60.8%)	146(78.5%)			
Disagreed	71(39.2%)	40(21.5%)			

Source: Field Survey, 2023

Chi – square test was conducted to determine the health effects of improper refuse disposal based on gender, the result in table 4.4 above indicates that only one (1) out of seven (7) items listed was insignificant at 0.05 confident interval; it indicates that (89.2%) of female which is more than male (81.2%) agreed toxic is one of the health effects of improper refuse disposal, and record significant value of $p = 0.03$. However, the result shows statistical significant ($p<0.01$) relationship between gender and contamination of land, air and water as health effect of improper refuse disposal which female (91.4%) highly agreed than male (71.3%). For creation of unsanitary conditions effect, female (88.7%) highly agreed than male (71.8%) with statistical significant ($p<0.01$). Also, health effect of environmental pollution; female (86.0%) agreed than male (70.7%) with $p<0.01$. Moreover, female (81.7%) highly agreed than male (69.1%) that outbreaks of vector-borne disease is one of the health effects of improper refuse disposal, and indicate statistical significant relationship ($p=0.01$). Similarly, Female (81.7%) and Male (69.1%) agreed that improper refuse disposal invites rodents and insect which can spread diseases; it shows statistical significant of $p<0.01$.

Discussion of Major Finding

The finding of this study indicates that more than half (68.9%) of the respondents are generating accumulated rags waste, (64.3%) generating Nylon and polythene bags waste, and (57.5%) generating waste papers while (44.1%) are generating food waste and fruits peel. This finding corroborated with study in Kansai International Airport by Glenn, et al., (2018) found that the wastes comprise kitchen waste, wood waste, non-recyclable paper, rags, steel and aluminium cans, unbroken glass and plastic bottles, newspaper (non-advertising), magazines, high quality paper, copier paper, paper generated in offices, and non-confidential documents as well as cardboard. Similarly, Mehta (2015) availed bottles and cans, newspaper and mixed paper, plastic cups and service ware, food

waste, food soiled paper, as well as paper towels were the deplaned aircraft waste which originating from aircraft flights.

The current study also found that garbage bags (mean = 3.10), polythene bags (mean = 3.03) and, drums (mean = 2.74) were the methods of refuse storage. This buttressed Park (2020), he discovered galvanized steel dust bin with close fitting cover is a suitable receptacle for storing solid waste. Reng (2016) observed that in Lagos metropolis specially designed large solid waste bins and used for solid waste storage. Oreyomi (2020) suggested that storage containers/bins should be placed or located within the reach of the residents/community members intended to be served; that the containers must be placed in such a way as to be accessible to the collection crew and their vehicles; that the proper maintenance of the containers must be ensured and that the container must be durable.

For health effects of improper refuse disposal on gender, the finding indicates that gender has statistical significant relationship with toxic ($p = 0.03$), contamination of land, air and water ($p<0.01$), creation of unsanitary conditions effect ($p<0.01$), environmental pollution ($p<0.01$), outbreaks of vector-borne disease ($p=0.01$) and spread of diseases ($p<0.01$). This finding supported by Nathanson (2023) hazardous of improper waste disposal has the potential to negatively affect human health and the environment, which is why it's so strictly regulated. Team (2022) posited that improper disposal of municipal solid waste creates unsanitary conditions in turn can lead to pollution of the environment and to the outbreaks of vector-borne disease that is, disease spread by rodents and insects. Addo, et al., (2015) identify improper waste disposal led to cause of numerous diseases in the communities such as catarrh, cough and chest pains. Diarrhea, intestinal worms, typhoid fever and cancer were perceived as diseases resulting from the wastes at the dumpsites. Etea, et al (2021) explored risk perceptions and experiences of Ginchi town residents living near Aba-Semer municipal solid waste open dumpsite in Ethiopia. Residents were mainly victims of respiratory-related health problems and emotional stresses.

Implications of the Study

1. Types of Refuse generated constitute a public health problem due to its prevalence; and have several social and economic implications. If solid waste is not addressed, it adversely affects the quality of life, and generally affects the health of the society and the World in general. And over time, it imposes an economic burden on the airport as well as on the public health system. 2. The evaluation of the study outcome will help Government, Non-Governmental Organisations (NGOs), Educators, and Researchers, to obtain a baseline evidence to forecast future coverage of solid waste and health promotion activities that could facilitate management of solid waste within the airport, state and the nation at large.

Conclusion

The management of solid waste constitutes one of the most immediate and serious environmental problems facing governments in Nigeria and other African cities. The conventional municipal solid waste management approach,

based on collection, storage, transportation and disposal seem to have failed to provide efficient and effective services to all urban residents and work places including airport. This provides health effects to the people living around. Therefore, this aimed to examine the storage, disposal and health effects of refuse in Nnamdi Azikiwe International
Airport Abuja.

Based on the finding of this study, it is concluded that the types of Refuse generated in the study area were accumulated rags waste, nylon and polythene bags waste, waste papers, food waste and fruits peel. Also, garbage bags, polythene bags and, drums were the major methods of refuse storage in Nnamdi Azikiwe International Airport Abuja. It also discovered that gender has statistical significant relationship with toxic ($p = 0.03$), contamination of land, air and water ($p<0.01$), creation of unsanitary conditions effect ($p<0.01$), environmental pollution ($p<0.01$), outbreaks of vector-borne disease ($p=0.01$) and spread of diseases ($p<0.01$).

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Health campaign on better waste disposal methods and educating the both passengers and staff of the airport in order to appreciate the health problems associated with indiscriminate waste disposal and the enforcement of sanitation laws by the appropriate authorities.
2. There is need for a landfill gas (LFG) utilization system, proper daily covering of waste and odour diluting agents are necessary to reduce the problems of the passengers staying closer to the landfill site.
3. It also suggests a subsidized waste collection and disposal service provided Generally recommend the involvement of public, private sector, NGOs and use of technology to achieve any meaningful efficient solid waste management are also explored.

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