Environmental and Health Implications of Waste Management Deficiency in Gwagwalada Town, FCT, Nigeria.

Aina Helen Omowumi, Sule Abdulkadir

Technical Department, American West African Agro Ltd

DOI: https://dx.doi.org/10.47772/IJRISS.2025.909000104

Received: 22 August 2025; Accepted: 27 August 2025; Published: 30 September 2025

ABSTRACT

This study is to assess the environmental and health implications of waste management deficiency in Gwagwalada Abuja (Nigeria). This research covers solid waste management in Gwagwalada (Federal Capital Territory) using ISWM (integrated solid waste management) as an assessment tool and the effect of waste management deficiency on the residence health". To achieve the objective of this study, quantitative data as well as qualitative data for household characteristics, waste composition, methods of waste disposal, waste management options, environmental and health implications of ineffective waste management on the residents of the study area were collected. Systematic random sampling techniques were used. Two types of analyses were conducted. The first is descriptive statistics which generate percentages and frequencies of respondents' socio-economic characteristics. Individuals' mean scores were computed for all the 400 respondents and used to examine the percentage of each respondent, tables and charts were used to show degree of each respondent. The second type of analysis conducted is logistic regression analysis to enable the researcher to test the hypothesis.it was revealed that the variables in the equation are significant at 0.001 less than p-value 0.05. It is understood that environmental impact of improper waste Management has significant relationship on health status of the resident of the study area. The study recommended that; Government provision of information and procurement practices to address problems associated with the lack of information about waste management options, to persuade consumers and firms to change their behavior, and to use procurement policies to foster demand for particular resource-conserving goods.

Keywords: health implication, waste management and solid waste

INTRODUCTION

Solid waste management is a growing challenge to many rapidly urbanizing areas in Africa. It is currently estimated that the rate of urban solid waste growth is faster than that of urbanization. Global estimates indicated that by 2002; 2.9 billion urban residents generated about 0.64 kg of waste per person per day and by 2012, this rose to 1.2 kg per person per day with a total urban population of 3 billion. Currently, it is projected that by 2025 there will be about 4.3 billion urban residents who on average will generate 1.42 kg of waste per day (Hoornweg and Bhada-Tata, 2012). It is known that solid waste has effects on health and it is one of the major reasons why solid waste management is a top environmental and public health issue. However, while several causal linkages between exposure to waste and health outcomes for particular types of waste are well established, others remain unclear or not prioritized as public health issues. In cases where the causal linkages are known, the full extent of the burden of ill health attributable to exposure might not be known. Part of the challenge in establishing causal linkages is the difficulty in unambiguously ascertaining the type, the dose and duration of exposure (Giusti, 2009). On the side of health outcomes, the challenge is the difficulty in ruling out other causes since other exposures in the environment might potentially cause the same outcomes (Hu and Shy,2001; Vrijheid, 2000). Additionally, some clinical outcomes such as cancers and other forms of degenerative disorders take long to manifest after exposure and loss to follow up of exposed individuals is a common challenge (Antwi, 2015 and Rushton, 2003).

One of the greatest problems facing humanity today is that of waste management. In all cities and rural areas, waste disposing poses the greatest environmental problem. The rate at which waste is generated surpasses the

rate at which it is evacuated. Upon these premises, one tends to wonder what could actually be responsible for this environmentally unfriendly character. Is it the orientation or the psychology of the people lack central waste dumps or is it a deliberate attempt to pollute the environment or perhaps the various authorities responsible for waste disposal cannot cope with the volume of waste generated (Antwi, 2015).

The rapid growth of population in the University of Abuja (mini campus) as people goes in pursuit of higher learning and exposure for a better tomorrow is posing a serious problem as regards waste generation in Gwagwalada where the mini campus is located. Dumping of refuse along street corners around the campus and their nearness to hostels, offices, lecture rooms and halls and the time lag in evacuating them constitutes another serious environmental health hazard in the study area. These refuse dumps serve as home for vermin such as flies, mosquitoes, cockroaches and other vectors of infectious disease (Tadesse and Kumie 2014).

The introduction of disposal containers and bins is the right step in solving or reducing this problem. However, these containers are often left to fill and spill garbage on the ground causing a very unpleasant sight. This results in irritation, not to mention the offensive odours coming from such garbage areas with the infestation of rats, cockroaches, insects, flies and other disease vectors and rodents. The need for this study arises as an urgency to update waste management strategies and also educate Gwagwalada residents on their attitude towards waste disposal and the dangers it can cause to health (Ryu 2015).

From the paragraphs above, it is of importance to assess the environmental and health implications of waste management deficiency in Gwagwalada Abuja (Nigeria).

LITERATURE REVIEW

During the past fifty years, cities in the developing world have undergone rapid urbanization. Between 1987 and 2015, the number of urban dwellers is expected to double. Nearly 90 per cent of this increase will take place in the developing world, where growth rates exceed 3 per cent a year, three times that of the developed countries (UN-HABITAT, 2011).

A positive correlation tends to exist between a community's income and the amount of solid waste generated. Wealthier individuals, who consume more than people on lower income, generate a higher rate of waste. The processes of accelerated population growth and urbanization into greater volume of waste generated.

2.1 Mechanism that brings about Adverse Health Outcomes and Adverse Health Impacts

The impact of solid waste on health is varied and may depend on numerous factors including the nature of the waste, duration of exposure, the population exposed, and availability of prevention and mitigation interventions (Boadi and Kuitunen, 2005; Abd El-Wahab, 2014 and Al-Delaimyet al., 2014). The impacts may range from mild psychological effects to severe morbidity, disability or death. The literature on health impacts of solid waste exposure remains weak and inconclusive in many cases due the difficulties encountered in accurately ascertaining exposure, controlling for confounders, accounting for duration of exposure and inability to follow up those exposed to ascertain outcomes that do not manifest in the short term (Antwi, 2015 and Rushton and Elliott, 2003). This notwithstanding, the literature review presented here sheds light on several pieces of evidence linking solid waste exposure and self-reported outcomes but also those where ascertainment of exposure and health outcomes were empirically confirmed.

While certain health impacts might be immediate, obvious to discern and directly linkable to the solid waste exposure, others may be occult, longer term and difficult to attribute the effects to a particular type of waste (Vrijheid, 2000; Tovalin, 1998 and Brinkel, Khan, Kraemer, 2009), this makes establishing the burden of disease attributable to solid waste and full epidemiologic spectrum of diseases emanating from the exposure a difficult undertaking often requiring large sample sizes and prolonged periods of follow-up (Rushton and Elliott, 2003). Surveillance data are lacking due to the complexity involved in measuring exposure and outcomes but also the limited programmatic focus and funding to this area. While estimating the exposure and the outcomes are difficult, available research allows us to conceptualize and draw linkages on how current solid waste exposures might be contributing to the observed ill-health at individual and population level. This may not only guide

designing of more elaborate studies but also guide policies and interventions.

The schematic conceptual representation of the linkages between exposure to the various types of solid waste, the pathways to negative outcomes and final impact on health in this work involves only illustrative and not exhaustive. For ease of understanding, health impacts have been categorized into four. A framework for understanding the linkages between poor solid waste management and adverse health outcomes:

1. Infection transmission: This could be bacterial, viral and other disease-causing organisms

2. Physical bodily injury: These may include cuts, drowning, blunt trauma, and chemical or radiation injury. This may range from immediate skin or inhalation burns, to longer terms effects.

3. Non-communicable diseases- long term exposure may lead to cellular damage and development of cancer while others might result in bodily organ injury and damage.

4. Emotional/psychological effects (strong smells, unsightly waste as human body parts).

One type of solid waste may lead to more than one health outcome directly or through an intermediate mechanism for example through vectors and other individual level predisposing factors.\

Infections Transmission

Poorly managed medical waste is a major source of infection for patients, health care workers, waste handlers and public (Salkin, 2004). Where all medical waste is properly disposed of, the risk of infection to the public is limited, but remains substantial to providers and their clients. While protocols on handling medical waste exist in many settings, their implementation varies from one place to another depending on how stringently prevention of infection protocols are implemented and observed. Indeed, many health care personnel and medical waste handlers do not use personal protective gear (Tadesse, 2014 and Mashoto, 2013).

A variety of pathogenic organisms are transmitted from biological specimens, contaminated medical waste and sharp medical objects such as hypodermic needles. Hepatitis B infection is a common infection often transmitted through skin cuts, mucous membranes; needles stick injures and contaminated surfaces (Rachiotis, 2012). Although it is recommended that all used and disposable sharp equipment should be discarded in sharps containers, these are often not available, resulting into many health personnel getting needle stick injuries. The risk of transmission of infection from medical waste is substantial including hepatitis B, ebola and Hepatitis C among others (Gumodoka, 1997). Other important pathogens that can be transmitted from medical waste include pathogenic bacteria such as tuberculosis, anthrax, pneumonia, meningitis, and infections of the gastro-intestinal system. Evidence shows that workers who handle medical waste are at a higher risk of nosocomial infections (Rachiotis, 2012).

Decomposing organic waste is a rich medium or culture for growth of numerous micro-organisms, many of which are diseases causing if passed on to humans. Also, there is always a risk of transmission through vectors such as houseflies but also through human contacts as is the case with waste handlers who do not use protective wear and waste pickers who most of the time use bare hands (Adeyeba and Akinbo, 2002). Additionally, articles retrieved from waste may be sold to unsuspecting public without undergoing thorough cleaning hence posing a risk of infection transmission.

Gastro-intestinal infections such as typhoid fever, polio virus infection, hepatitis E infection, and cholera are often transmitted through contaminated food or water (Boadi and Kuitunen, 2005). Toilet ownership in Kenya, for example, is very low with 12% of all households not having any form of toilet (KNBS and ICF Macro, 2010). Even those households with a toilet, many are not connected to the main sewer line. These result in fecal matter being disposed of in open spaces while other households do not have any form of toilet and thus dispose of fecal matter as general waste, popularly referred to as flying toilets or discharged into rivers (Tumwebaze, 2013). Human fecal matter is a known source for pathogenic enteric parasites, typhoid fever infection, polio virus infection, hepatitis E infection, cholera and common gastroenteritis transmitted human contact, vectors or

contaminated water (Cabral, 2010). Studies have revealed high levels of pathogenic parasites in dump site waste confirming the risk waste handlers and pickers are exposed to (Adeyeba and Akinbo, 2012). This challenge of proper feacal matter management is not limited to households but also institutions such as hospitals and schools. There are reports of cholera outbreaks emanating from fecal waste coming from a hospital (Kone-Coulibaly, 2008).

Physical Body Injury

In many developing countries, the practice of sorting waste at source is almost non-existent even for high-risk waste such as sharps generated from medical facilities (Cointreau S 2006). Presence of sharp objects in waste poses a high risk of injury to both those who generate the waste, the handlers and pickers (Jayakrishnan, Cherumanalil and Bhaskar, 2013). Poorly disposed surgical blades, needles frequently injure medical workers, medical housekeepers and waste collectors of medical waste while sharp objects such broken glass injure domestic workers and waste handlers. Where waste is disposed of in open dump site accessible to pickers, the risk of injury from sharp objects is ever present (Rauf, 2013).

Urban floods are common in many cities. While poor urban physical planning may be largely to blame for the increasing phenomenon of urban floods, partly the problem can be attributed to rampant blockage of drainage systems by solid waste (Lamond, Bhattacharya and Bloch, 2013). Inappropriate disposal of waste, especially the non-biodegradable plastic paper bags result into these being swept downstream resulting in blockage of drainage systems, floods not only destroy property, but they have also claimed lives both on roads and homes and damage sewerage systems leading to widespread environmental contamination with human waste and associated risk of infection transmission (Guevart, 2006 and Ramin, 2009). Blocked drainage systems are also breeding sites for diseases transmitting vectors such as mosquitoes.

Injuries from chemicals can be in the forms of skin burns, inhalation burns, explosions and intoxication. Fumes from burning chemicals at dump sites or from incinerators may cause respiratory, allergies and other complications (Abd El-Wahab, 2014). Pharmaceutical and industrial chemicals are often not disposed of appropriately and at times get back into the market. Obsolete pesticides, old batteries, among others contain chemicals that are dangerous to human life yet are often disposed of just like common litter (Nweke, 2009). Medical waste may also include substances that are cytotoxic or carcinogenic. Improperly disposed substances and equipment may result is disastrous effects to the public as was the case with the caesium-137 irradiation accident from a disused radiotherapy unit in Goiania, Brazil (IAEA 1988).

Chronic Diseases (From long term exposure to chemicals and infections)

While many international protocols and guidelines on disposal of hazardous chemicals exist, these are not strictly adhered to especially in this part of the world. Environmental contamination with chemicals from industries is commonly endangering both humans and wildlife. It is a common practice for industries to discharge their waste into rivers. It is also common practice to dispose of e-waste on open dump site. These are often burnt to retrieve desired components and yet the fumes are hazardous (Needhidasanet al, 2014). The world is dependent on petroleum for energy and industrial applications. Disposal of petroleum waste is poor and yet has long lasting impact on humans and the eco-systems in general (Sempebwa and Carpenter, 2009). Medical and pharmaceutical chemical waste, often include antibiotics, vaccines, and radioactive substances. In Brazil, a disused and vandalized for scrap radiotherapy unit caused accidental and prolonged exposure to radiation from caesium-137 leaving many with severe health problems while others died (IAEA, 1988). Common industrial waste contains dangerous chemicals such as lead, arsenic and mercury among others (UNEP, 2007). These chemicals may affect health through direct contact while others are through accumulation in the food chain (Manay, 2008). Genotoxic substances cause changes in the internal cell structure. This change may or may not result in cancerous changes. However, there is strong evidence linking exposure to noxious substances and development of different types of cancer including lung cancer, bladder cancer, skin cancer and reproductive tract cancers among others (Pukkala, 2009). Similarly, radioactive substances and their radiation are known to cause cell damage and may result in different forms of cancer. Prolonged exposure and inhalation of noxious, irritant or volatile chemicals may lead to the respiratory system becoming hyper-sensitized and this may result into chronic obstructive pulmonary

disease (Ryu, 2015).

Psychological/Emotional impacts of solid waste

Residents living next to dumpsites are usually affected by stench, the sight of marauding scavenging animals and social stigma. In extreme cases, solid waste has been reported to contain human body parts or aborted fetuses which may be distressing and could affect the mental well-being of the residents and those involved in waste picking. Moreover, for those who live closer to the dumping sites, the nuisance of scavenging animals and birds may affect their emotional and psychological health (Vrijheid, 2000 and Al-Delaimyet al, 2014). Heavy metal poisoning has also been associated with mental disorders (Brinkelet al, 2009).

Challenges Facing Solid Waste Disposal Unit of Abuja Environmental Protection Board

Abuja, since its establishment as a Federal Capital, has experienced huge population growth. Population explosion in Abuja owes primarily to labour migration, which resulted from the movement or relocation of headquarters of private and public organizations to the city. According to official estimates, Abuja has been growing at 20 – 30% per year (FEPA, 1991).

Urban development problems in Abuja could therefore be viewed from both socioeconomic and environmental perspectives. As noted earlier, the location and relocation of government and private companies' headquarters have forced majority of workers to become resident in Abuja. The increasing socio-economic opportunities made available by the fact that the city is still under construction, facilitate ever increasing number or influx of young, unemployed men and women into Abuja. This development has spurred high economic cost of most services in the city. Cost of renting or leasing houses, shops, offices and spaces are higher in Abuja than anywhere else in Nigeria. Increasing population in Abuja has resulted in the proliferation of slums and shantytowns, most especially in adjourning villages. Therefore, squatter settlements and shantytowns spread rapidly in and outside the city limits. The proliferation of these shantytowns results in the unwieldy expansion of the city, which poses a major planning problem as the provision and management of roads, drainage and sewage systems among other infrastructure, proves very difficult. Furthermore, shantytowns cause increases in the incidence of urban poverty, diseases and epidemics, environmental pollution, urban conflicts and crime (Mabogunje, 2002).

Abuja Environmental Protection Board and local councils in Abuja and the central government's Federal Environmental Protection Agency have devoted considerable attention to waste disposal and the attainment of healthier environment in Abuja, a lot still needs to be done. Daily, waste disposal vehicles are deployed to the different districts to collect and dump waste or refuse in the three landfills available in the city. As cited above had noted currently in Abuja, a lot of heterogeneous waste is generated, and the volume and type have been on the increase both in the residential and business areas. NEST (1999) estimated that of the 4.5 million tons of waste generated in Nigeria in 1999, a little below 1.5 million tones was generated by each of Lagos, Abuja, Kaduna and Kano. In another study, NEST estimated that about 40 million tons of waste would be generated in Nigerian between 2005 and 2010 (FEPA, 1991). What this translates to mean in the case of Abuja and other major urban centers in Nigeria is that waste generation in Abuja, a year to the expected date, would be in the regions of 3 or 4 million tons. Given 3.5 percent estimated annual population growth rate, the tendency is that the estimate for the major cities and Nigeria at large may exceed projection (Mabogunje, 2002).

Using Purchasing Power Parity (PPP) method, it is believed that urban poverty, in Nigeria, may exceed the estimated 100 percent for between 2005 and 2010. As Jensen (1990: 13) had noted, following population pressure in most cities in the developing nations, the cost of waste disposal is expected to rise. This development would invariably lead to increasing government spending, if the environment must be made safer and devoid of waste. (Mabogunje, 2002).

As currently is, the nature of waste disposal in Abuja is mixed. Besides waste collection and dumping in the landfills, no attempt is made at sorting out biodegradable wastes from non-biodegradable waste before disposing waste, in most cases, through burning. Besides, government, public understanding of waste disposal and management is limited and, in most cases, jaundiced. Although governments, at different times, have used public private partnerships to carry out basic social services to the citizens, waste collection, management, and disposal

are contracted out to waste collection and disposal services. Graft, lack of monitoring and vested interests has prevented private involvement in the governance or management of waste disposal (Nigeria Police 2005).

As noted by the Director-General of the Federal Environmental Protection Agency (FEPA), of the 300 tons of waste generated in Abuja daily, only 40 percent was cleared. He attributed the reason for this low level of attention to lack of machinery and personnel. To this end, street corners, road junctions, and sundry places within the Federal Capital Territory have become refuse dumps, which constitute environmental hazard to the people (FEPA, 1991).

Atsegbu et al (2013) identified some factors as being responsible for penetrating the crises experienced in the management of waste and summarized them as follows: lack of adequate funding and excessive population, lack of trained/ professional waste managers, lack of effective monitoring and control, peculiarity of the Nigerians attitude towards the environment in general, lack of modern technology/ lethargy in implementation of efficient waste management methods. It can therefore be said that main challenges facing solid waste management include inadequate funds to support waste management, inadequate equipment to support waste storage, collection and disposal, crude open dumping and burning without air and water pollution control. From the review of the literature, it is important to note that solid waste collection and disposal are the critical issues in solid waste management. The various methods in disposing of solid waste are sanitary landfills, composting, recycling, incineration and ISWM (Reduce, reuse and recycle/incinerate/landfill) for managing solid waste. Solid waste management should be the primary responsibility of all (Felix, 2010). However, AEPB is challenged by factors such as inadequate funds to support waste management, inadequate equipment to support waste storage, collection and disposal and low collection coverage services.

STUDY AREA AND METHODOLOGY

Geographical Location of the Study Area

Gwagwalada the study area is headquarters of Gwagwalada Area Council which is one of the six Area Councils of the Federal Capital Territory (FCT) of Nigeria. It is located between latitude $8^{0}55^{/}$ and $9^{0}00^{/}$ North and longitude $7^{0}00^{/}$ and $7^{0}05^{/}$ East. Gwagwalada is located at the centre of very fertile agricultural area with abundant clay deposits to the Northwest (Chup 2000). Gwagwalada Area Council shares its boundaries with Abaji Area Council to the west; Kuje, to the East; and Kwali Area Council to the Southwest and Niger state to the North (figure 3.1)

Geology

Gwagwalada area is almost predominantly underlain by Precambrian migmatite, gneiss, granites and schist of the crystalline basement complex. Schist belt outcrops along the South – Western margin of the area and apart from this schist belt, which is the most unsatisfactory bedrock in the area, this area is ideal for building foundations and is free from geological hazards within the limits of present knowledge (Dawam, 2000).

Climate

The climate of the study area is the hot, humid tropical type and varies depending on the season. The relative humidity is low, and temperatures are lower compared with the Northern part of F.C.T. Although climate information on the Federal Capital Territory is rather scanty, data extrapolated from adjacent weather stations revealed that the highest temperature in this area occurs in the dry season between January and April. During this period, maximum temperature within the area ranges between 300C – 370C (Adakayi, 2000).

Temperature drops during the rainy season to its lowest level in August during which temperatures may be as low 200C – 300C. The rainfall is moderate with annual totals ranging approximately 1,100mm to 1,650mm. Rainfall starts by March but is sometimes late, increasing gradually to a peak in August; it then declines by the end of September or October. It is about 60% of the annual rainfall during the month of July, August and September. This climate favour crops like maize, guinea corn, millet, cassava, rice and yam, which are grown in this area. Another climatic characteristic of this area is the frequent occurrence of squall lines heralded by

thunderstorms, strong winds and rainfall of high intensity. This climate phenomenon often causes serious damage to buildings (Adakayi, 2000).

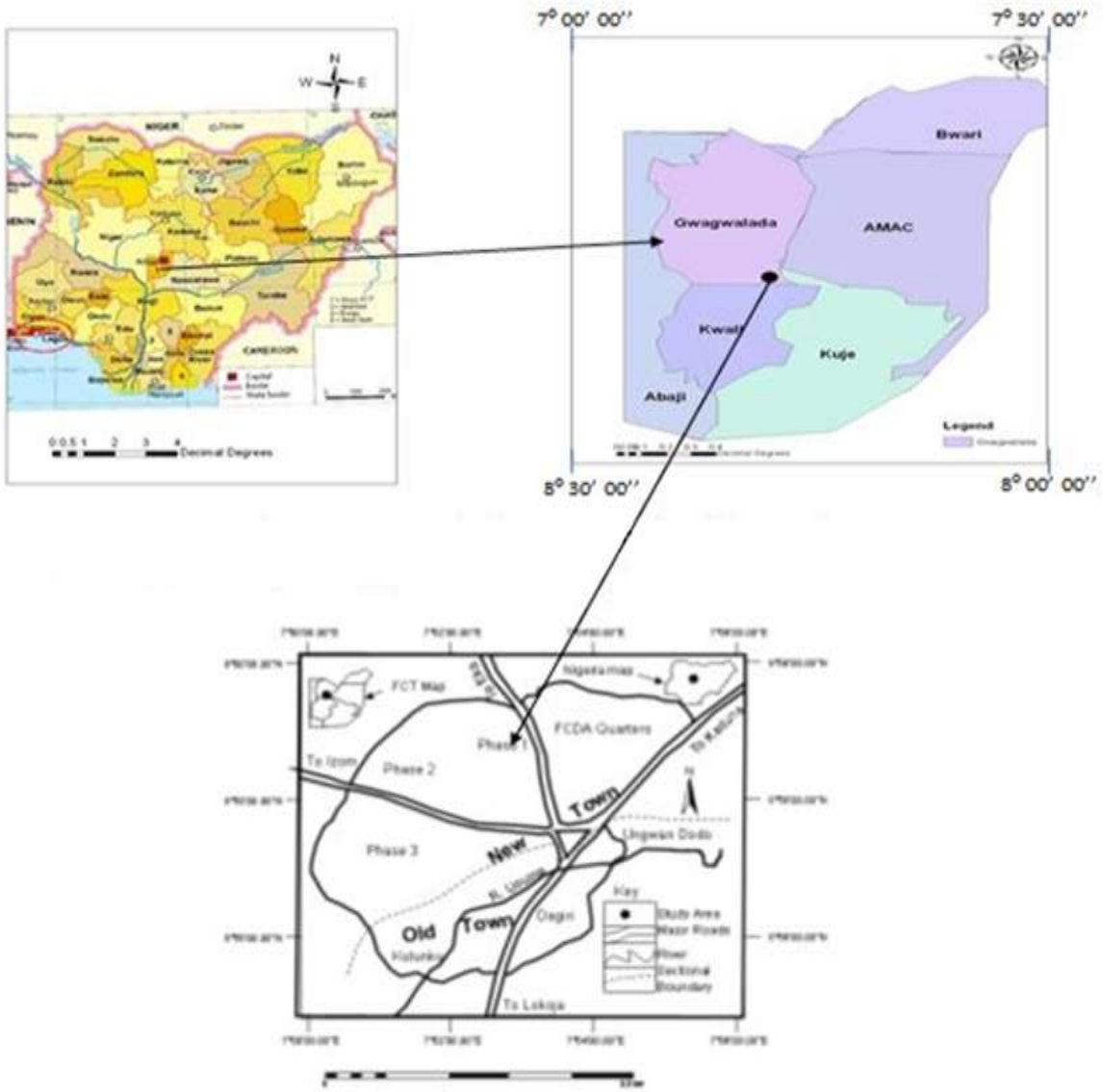

Figure 3.1: Map of Nigeria, FCT and Gwagwalada Area Council

Population

Gwagwalada Area Council official population figure was 157,770 people as at 2006 has since become obsolete. Gwagwalada town population was estimated to be 240,000 as at the year 2014 (Gwagwalada leaflet, 2016). The concentration of the population is largely due to the influx of migrants from other parts of the country (Dawam, 2000)

Socio-Economic Activities

The people are mostly farmers; they practice both rain fed and irrigation farming, other farmers also engage in other non-agricultural activities such as wood cutting, poultry, black smiting and others in order to add to the family income. Apart from this, there are civil servants who work in various ministries, industries and institutions as secondary occupations (Gwagwalada leaflet, 2014).

METHODOLOGY OF THE STUDY

Reconnaissance Survey

This acquaints the researcher with the study area and likely problems to anticipate in the execution of the research work. During the survey different sections of the area and the types and ways of waste disposal and housing population were identified in order to aid the sample size selection. The base map of the study area was updated during this period. The survey was carried out between 18th to 20th April 2018.

Types and Sources of Data

Quantitative data as well as qualitative data as required for achieving the working objective of this study included data on household characteristics, waste generation, methods of waste disposal, waste management, and health implication of improper waste management on the resident of the study area. Data for this study was derived from field observation, administration of questionnaires, and personal interviews.

Primary Data

Primary sources were used through interviews, and administration of structured questionnaires.

Secondary Data

Secondary data was used through past research works, internet search, records from Department of Urban and Regional Planning of FCDA, Development Control of Abuja Metropolitan Management Agency, records from Environmental Sanitation Department of Gwagwalada Area Council, Abuja Environmental Protection Agency, Environmental Journals and unpublished post graduate dissertations on solid waste managements.

Methods of Data Collection

Interviews

This method of data collection was used to obtain opinions of respondents on the environmental and health implications of waste management deficiency in the study. Personal interview was carried out with the community leader, youth leader, women leader, religious leaders and officials of relevant authorities.

Questionnaire Design

Questionnaires are a tool for data collection from a large number of people in a short period of time; the results of the questionnaire can easily be quantified by either the researcher or through the use of a software package; can be analyzed more ‘scientifically’ and objectively than other forms or methods. The major issues to be sought from the questionnaire are assessment of the patterns of waste disposal and collection; examination of the patterns of waste disposal and collection; assessment of the health implications of improper waste disposal; and to identify various ways which could help to enhance proper waste management that will promote healthy environment.

The questionnaire designed for the research had three sections. ‘Section-A’ comprised items related to socio-economic and demographic characteristics of the respondents such as sex, age, education, income, marital status, employment status, length of stay, household size among others. ‘Section-B’ and ‘Section-C’ comprised items on respondents’ perception on pattern of solid waste disposal, health implications of improper waste disposal. Data on respondents’ perception of behavioral pattern towards solid waste disposal will be obtained. See Appendix1

Sampling Procedure and Sample Size Selection

The study area comprises of eighteen (18) settlements (see table 3.2) out of which six settlements were selected based on systematic random sampling.

Table 3.2: Estimated number of settlements and the number of questionnaires to be administered within the study area

No.	Name of Settlements	Estimated No. of Housing	Questionnaire Administration
1	Angwan-Bassa	720	49
2	Agwan Fulani	425	29
3	Agwan-Gwari	620	42
4	Agwan-Yorubawa	355	24
5	FCDA Quarters	870	59
6	Phase 11	2,921	197
Total	**—**	**5,911**	**400**

Source: Department of Land, Planning and Survey, Gwagwalada Area Council, (2015)

The sample size was derived using Yamane (1961) sample size Formula

n = N / 1+ N(e)2

Where n = Corrected sample size

N = population size,

e = margin of error (0.05%)

n= 5911

1+ 5911(0.05)2

n=400

Similarly, to estimate number of questionnaires per settlements

N= population per settlement X400

Total over no of settlements

For example Agwan-basa = 720 X 400= 49

5911

Agwa-Fulani = 425 X 400= 29

5911

Agwan Gwari = 620 X 400= 42

5911

Agwa-Yorubawa =355 X 400= 24

5911

FCDA Quarter = 870 X 400= 59

5911

Phase2 = 2921 X 400= 197

5911

From the above formula and calculations, the sample size consists of 400 respondents for each case study. Large sample numbers are also recommended to ensure a higher statistical accuracy and confidence level (UNEP, 2009b; Gomez et al., 2009). According to Jacob et al. (1990) a large sample is much more likely to be representative of the population. In other words, the larger the sample sizes the smaller the error and the greater precision of the results (Cohen, 1988).

Questionnaire Administration

The questionnaire will be administered to each selected settlement based on the sample size of each selected settlement population. The questionnaire will be administered to household heads in each selected settlement on a system random sampling techniques based on the number of houses in the selected settlements. Some of the government officials in environmental department of Gwagwalada Area Council and staff of selected health centres within the study area will be interviewed and some questionnaire will be administered in order to complement the information.

Method of Data Analysis

Two types of analyses will be conducted. The first will be descriptive statistics which will generate percentages and frequencies of respondents' socio-economic characteristics. Individuals' mean scores will be computed for all the 400 respondents and used to examine the percentage of each respondent responds, tables and charts will then be used to show degree of each respondent responds. The second type of analysis to be conducted will be logistic regression analysis.

Validity and Reliability of the Study

Pre-testing of questionnaires will be conducted to ensure clarity, relevance, and consistency.

Triangulation will be applied by combining multiple data sources (survey, interviews, field observations, and secondary reports) to enhance data credibility.

A pilot study will be carried out in one community before full data collection to refine the research instruments.

Ethical Considerations

Informed Consent: All respondents will be briefed on the purpose of the study, and their voluntary participation will be ensured.

Confidentiality: Personal data will be kept anonymous, and responses will be used strictly for research purposes.

Data Presentation and Analysis

This chapter focuses on presentation and analysis of data using the method enunciated in chapter three. In this chapter, data is presented in a tabular form, frequency distribution and in a simple percentage. In conducting this research, 400 questionnaires were administered, and all were completed and returned. The data collected through the questionnaires will be presented and further analyzed.

Table 4.1. Socio Economic Characteristics of Respondents

Sex of respondent	Frequency	Percent
Male	168	42

Female	232	58
Total	**400**	**100**
Marital status	**Frequency**	**Percent**
Married	184	46
Single	108	27
Divorced	32	8
Widow/Widower	76	19
Total	**400**	**100**
Level of Education	**Frequency**	**Percent**
No formal education	40	10
Primary school	88	22
Secondary school	136	34
Tertiary education	136	34
Total	**400**	**100**
Monthly income	**Frequency**	**Percent**
Below 18,000	64	16
18,000 - 30,000	88	22
30,001 - 50,000	124	31
50,001 and above	124	31
Total	**400**	**100**

Source: Author's field work 2018

Sex of respondent

The table above shows that the number of females is higher with 232 respondents, representing 58.0% of the respondents than the male with 168 respondents representing 42.0%. This result shows those females take care of waste at home compared to male. This shows that females are more involve in waste disposal than male. Majority of male leave home early for their various occupation to enable them to feed their family and mostly come back late.

Marital status of respondent

From table 4.2, the respondents married are 184 (46.0%), single respondents are 108 (27.0%), and widow/widower is 76 (19.0%) while divorce is the least respondents with 32 representing 8% of the total respondents. The findings show that 46% of the respondents are married, that also increasing the population due to birth rate, this will result in increase in waste generation. As mentioned in UN-HABITAT, (2003) nearly 90 per cent of this increase will take place in the developing world, where growth rates exceed 3 per cent a year, three times that of the developed countries.

Educational level of respondent

The table above shows that secondary and tertiary education has the highest number of respondents with 136 each representing 34.0% each of the total respondents. It is followed by primary school with 88 respondents, representing 22% of the total respondents while no formal education has 40 (10%) respondent this relates with

Gwagwalada leaflet, 2014 that there are civil servants who work in various ministries, industries, and other institutions and it has major higher institutions such as university of Abuja, FCT school of nursing and many primaries and secondary schools. The findings have implications on the health-related issue because 32% of the total respondents will be vulnerable to health-related problems.

Respondent's monthly income

From the table above, the least income of respondents is ₦18, 000 representing 16% of the total respondents, 88 of the respondents representing 22% said their monthly income is between ₦18, 000 – ₦30, 000 while respondents with incomes between ₦31, 001 – ₦50, 000 are 124 representing 31% of the total respondents and those earning ₦51, 000 and above are 124 representing 31% of the total respondents. Implications of the findings is the more the income the more waste is generated this is clear as majority of the population earn between ₦31,000 – ₦50,000 and ₦50,000 and above as revealed by Sridhar and Baker, 2004 that; a positive correlation tends to exist between a community's income and the amount of solid waste generated. Wealthier individuals, who consume more than people on lower income, generate a higher rate of waste.

Age Distribution of Respondents

The pie chart below shows the age distribution of the population

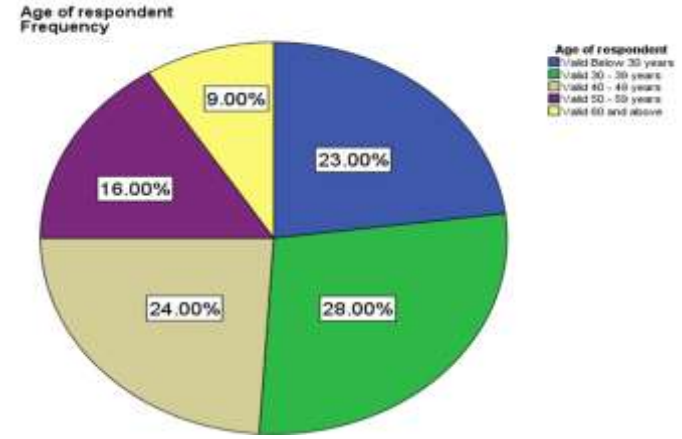

Figure 4.1: Showing the age of respondents

Source: Fieldwork 2019

Figure 4.1 shows that the respondents within the age of 30 – 39 are higher with 28.00%, it is followed by 50 – 59 years (24.00%) while 60 and above has the least percentage of 9%. The outcome shows that 30 – 39 years and 40 – 49 years as well as 50 – 59 years have family, as a result tend to generate more waste that below 30 years and 60 years and above. The findings reveal that majority of the respondents are within the active age 30 – 39 years (28%), 40 – 49 years (24%) 30 below (23%) thereby tend to generate more waste that those of 50 and above.

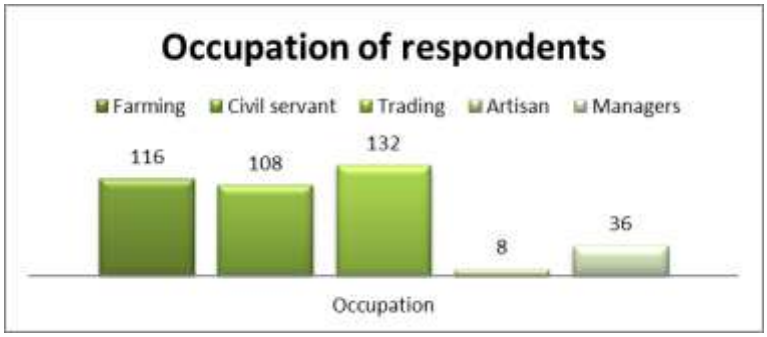

Figure 4.2 Occupation distribution of the study area

Source: Fieldwork 2019

From figure 4.2 trading is the major occupation of the respondents in Gwagwalada with 132 respondents representing 33% of the total respondents, Farming become the second occupation of the respondents with 116 representing 29%, followed by civil servant with 108 respondents representing 27% of the total respondents, Managers have 36 (9%) respondents while artisan is the least respondents with 8 (2%) of the total respondents. The findings revealed that trading activities dominated the Gwagwalada area council with 132 respondents. Farming (116) activities the second major occupation, this reveal the seasonal increase of waste due to variation in food demand as (Savage, 1993; Oyediran, 1994 and Show, 2000) pointed out. This is crystal clear that more waste will be generated due to trading activities in the area. A good example is the huge waste deposit around the market.

Composition of Waste and Method of Collecting Waste before Disposal.

Major composition of waste

The major composition of waste shows the types of waste generated in the study area.

Table 4.2 Major composition of waste

Major composition of waste	Frequency	Percent
Domestic waste	196	49
Industrial waste	104	26
Agricultural waste	16	4
Others	84	21
Total	400	100

Source: Fieldwork 2019

Table 4.2 describes the composition of waste whereby 196 of the respondents said it was domestic waste, this represents 49% of the total respondents while 104 of the respondents said is industrial waste with 26%. 84 respondents, representing 21%, said it is agricultural waste while 16 respondents said other types of waste representing 4% of the total respondents. The result corroborate with the work Savage, 1993; Oyediran, 1994 and Show, 2000 which says in Nigeria, municipal domestic waste have heavy content of food waste, leaves, polythene, rags, tins and bottles, to be highlighted here is that the composition of domestic waste in Nigeria varies from season to season and from the food items in great demand.

Means of Waste Collection

This tells us where the respondents Keeps their waste before evacuation.

Table 4.3: Means of Waste Collection by Respondents

Means of keeping waste	Frequency	Percent
Refuse bag	132	33
Drum	96	24
Refuse bin	104	26
other-specify	68	17
Total	400	100

Source: Fieldwork 2019

From the table 4.3 above, respondents using Refuse bags to evacuate their waste have the highest frequency of 132 (33%), Refuse bin have 104 (26%), while the respondents using drum to evacuate their refuse have 96 (24%) and the least is others with 68 respondents, representing 17% of the total respondents. The findings revealed that there is no sorting of waste at the household level, because both biodegradable and non-biodegradable are dumped into a single container as against Madu (2001) recommendation that Two bins be created for each household for biodegradable and non-biodegradable waste.

Waste separation before disposal

Waste separation before disposal shows respondents' view on separation of waste based on their composition before disposing them.

Table 4.4: Separation of waste before disposing

Separation of waste before disposing	Frequency	Percent
Yes	168	42
No	232	58
Total	400	100

Source: Fieldwork 2019

Table 4.4 shows the response of respondents on their view on separation of waste before disposing it. 232 respondents say NO they don't separate their waste before disposing, this figure represents 58% of the total respondents. The importance for waste separation before disposal cannot be over emphasis, because it allows the respondents to sort out the biodegraded and non-biodegraded waste as recommended by Muda 2001. From the response, it shows that 58% don't sort the waste before disposing it. And the absence of sorting is termed hazardous as outline in the work of Bassey et'al 2006. Boadi and Kuitunen 2005 finds out that lack of sorting waste before disposal exposes people to cholera while Caral 2010, Adeyeba and Akinbo 2012 say it exposes people to typhoid.

Method of waste disposal

Method of waste disposal shows how the respondents wastes are being taking care of.

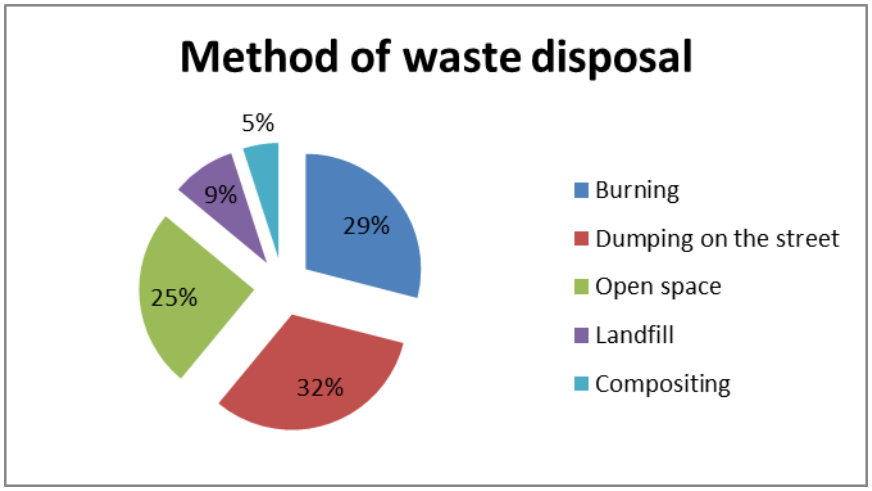

Figure 4.3: Method of waste disposal

Figure 4.3 above shows that 116 of the respondents representing 29% of the total respondents said they burn their waste, while 128 respondents dump their waste on the street this represents 32% of the total respondents, and 25% of the respondents disposed of their waste on an open abandoned space. 5% dispose of their waste by

decomposition while 9% said their waste is disposed of by landfill. The result corroborates with the work of Zurbrugg and Schertenleib, (1998), that Solid waste management in most developing countries is often characterized by inadequate service coverage, operational inefficiencies of services, limited utilization of recycling activities, inadequate management of non-industrial hazardous waste and inadequate landfill disposal. Throughout history, there have been basic methods of managing waste: dumping it, burning it, finding another use for it (reuse and recycling), and not creating the waste in the first place (waste prevention).

frequency of waste disposal by the respondents

Frequency of waste disposal gives details of how often respondents dispose of their waste.

Table 4.5: frequency of waste disposal

frequency of waste disposal	Frequency	Percent
Daily	132	33
Twice a week	108	27
Weekly	88	22
Others-specify	72	18
Total	400	100

Source: Fieldwork 2019

The table above shows how often the respondents dispose of their waste. 33% of the respondents say they dispose of waste every day, while 27% said it's been disposing twice a week. 22% of the respondents say they dispose of waste weekly while others have 18% of the total respondents.

Means of waste evacuation

This gives information on how kept waste are being disposed/evacuated.

Table 4.6: Means of waste evacuation

Means of waste evacuation	Frequency	Percent
Self	164	41
AEPB	152	38
Voluntary organization	36	9
Others-specify	48	12
Total	400	100

Source: Fieldwork 2019

Table 4.6 above shows the means at which the respondents evacuate their waste. Majority of the respondents 164 (41%) respondents said the evacuation waste by themselves by paying people (popularly called Baba Bolla) to evacuate the waste. AEPB is another means of waste evacuation in Gwagwalada, it has a frequency of 152 representing 38% of the total respondents. Other means have 48 (12%) while 36 of the respondents said its voluntary organization representing 9% of the total respondents. Implication of this finding is exposure to solid waste, and it is constant risk waste handlers are faced and most the waste handlers are not professional as mentioned by Oguntoyinbo, (2012), that the process of picking waste exposes such people to many risks including infection, respiratory complications from fumes and injury from sharp objects. Abd El-Wahab, (2014),

further confirm the work of Oguntoyinbo, (2012) that in many of the developing countries, municipal waste (which is a mixed bag of waste) is handled by cheaply hired workers with limited protective gear and limited appreciation of the risk involved in handling solid waste.

Waste management options and it's effectiveness

Appropriateness of waste management option

Appropriateness of waste management option shows how respondents rate the work of waste management agency in the study area.

Table 4.7: Appropriateness of waste management option

Appropriateness of waste management option	Frequency	Percent
very appropriate	68	17
Appropriate	180	45
Inappropriate	108	27
Very inappropriate	44	11
Total	400	100

Source: Fieldwork 2019

Table 4.7 shows that response of the respondents on how appropriate the method of parking refuse from the collection centre is. 45% of the total respondents say it is appropriate, 27% say it is inappropriate, 17% of the total respondents say it is very appropriate, while 11% say it is very inappropriate.

Major problems of waste management deficiency

Respondents give details on the major problem which leads to waste management deficiency in their area.

Table 4.8: The major problems of waste management deficiency

Major problems of waste management deficiency	Frequency	Percent
Dumping refuse in an open place	168	42
Inadequate authorized dump sites	92	23
Infrequent clearing of dump sites	20	5
Inadequate number of personnel to handle waste	104	26
The question of who should be responsible for waste management	12	3
Total	396	99
Missing System	4	1
Total	400	100

Source: Fieldwork 2019

The table above shows the major problems generally associated with disposal of waste. 168 respondents say dumping refuse in an open place is the problem associated with waste disposal, 92 respondents say the major

problem is inadequate authorize dumping sites, 20 respondents are of the view that infrequent clearing of dump sites, 104 respondent believe that the major problem of waste disposal is inadequate number of person to handle waste, while 12 of the respondent are of the opinion that the major problem associated with disposal of waste is the question of who should be responsible for waste management. Four respondents decided to skip the question, which results in 4 missing in the system as indicated from SPSS analysis. Inadequate number of personnel to handle waste and this agree with the work of Hester and Harisan 2002. Some respondents are of the opinion that it is due to inadequate authorized dump site as mentioned by Bianchi 2005 and Schertenleib 1998.

Health and Environmental Implications of Ineffective Waste Management Options

Experiences of health challenges

Experiences of health challenges gives details of respondents who agreed to have suffer one or more health challenges due to waste management deficiency.

Table 4.9: Experiences of health challenges

Experiences of health challenges	Frequency	Percent
Yes	376	94
No	24	6
Total	400	100

Source: Fieldwork 2019

The table above shows that some of the respondents have experienced health challenges because of improper waste disposal with 376 respondents. The number represents 94% of the total respondents while only 24 (6%) of the respondents say they never experience health challenges as a result of improper waste disposal. Majority of the respondents have suffered little or severe health challenge which correspond with the work of Boadi and Kuitunen, 2005; Abd El-Wahab, 2014 which states that the impact of solid waste on health is varied and may depend on numerous factors including the nature of the waste, duration of exposure, the population exposed, and availability of prevention and mitigation interventions.

Diseases suffered due to improper waste disposal

Diseases due to improper waste disposal show the type of illness suffered by respondents due to waste management deficiency. The table below shows the distribution of diseases due to improper waste disposal in the study area.

Table 4.10: Diseases suffered

Diseases suffered	Frequency	Percent
Waist pain	4	1
Chest pain	4	1
Injury	12	3
intestinal infections	20	5
Acute respiratory infections	44	11
Skin infection	28	7

Bone and muscle disorders	12	3
Diarrhea	16	4
Typhoid	96	24
Malaria	126	30
Cholera	20	5
Total	376	94
Missing System	24	6
Total	400	100

Source: Fieldwork 2019

Table 4.10 above shows that malaria is the major disease that affects the people in the study due to improper waste disposal with 126 respondents representing 30% of the total respondents. Typhoid is the second with 96 (24%) then acute respiration infections become third with 44 respondents the least is waist and chest pain with 4 respondents each representing 2% of the total respondents. The highest disease due to improper waste dump is malaria with 30% of the total respondents, this agrees with Ream 2014, Ziraba (2010). Typhoid 24% and acute respiration infection 11% are another major disease due to exposure to improper waste dump. This correlates with the work of Needhidasan et'al 2014, Dagen 2003 and Oguntoyinbo 2012.

Test Of Hypothesis and Decision-Making Logistic Regression

Test of hypothesis and decision-making Logistic Regression how many cases are in the analysis.

Table 4.11: Classification Table[a]

Classification Tablea look at the proportion of cases classified correctly.				
Observed		Predicted		
		Sex of respondent		Percentage Correct
		Male	Female	
Sex of respondent	Male	92	72	56.1
	Female	56	176	91.9
Overall Percentage				84.7

Classification Table[a] look at the proportion of cases classified correctly.

Source: Fieldwork 2019

Table 4.12: Variables in the Equation

Variables in the Equation	B	S.E.	Wald	Df	P-value	Odd ratio
Constant	0.347	0.102	11.56	1	0.001	1.415

Significant at .05

Source: Fieldwork 2019

Table 4.13: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	423.556a	0.25	0.516

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

H_0: Environmental and health implication of waste management deficiency in Gwagwalada town are not significant.

Source: Fieldwork 2019

Logistic regression was performed to ascertain the environmental impact of improper waste management and health status of residents in the study area. Table 4.12 above shows that the variables in the equation are significant at p-value 0.001. Table 4.13 (Model summary table) explains that 51.6% Nagelkerke (R2) of the variance in environmental and health implications of waste management deficiency are correctly classified with overall percentage of 84.7%. It is quite understood that waste management deficiency has significant relationship on environment and health status of the residents in the study area. We therefore reject H_0 and accept H_1 which stated that environmental and health implication of waste management deficiency in Gwagwalada town is significant. The result concurs with UNEP, (2007) that the health effects of solid waste include:

1. Skill Disorders – fungal infection, allergic dermatitis, pruritic and skill cancer.
2. Respiratory Abnormalities – bacterial upper respiratory tract infections (Pharyngitis, Laryngitis and Rhinitis), chronic bronchitis and asthma.
3. Abdominal and Intestinal Problems – bacterial enteritis, helminthiasis, amoebiasis, liver cancer, kidney and renal failure.
4. Dental Disorders – Dental carries and dental pain.
5. Ear Infections – otitis media and bacterial infection.
6. Skeletal Muscular System – back pain
7. Central Nervous System – Impairment of Neurological development, peripheral nerve damage and headaches.
8. Eye infections – Allergic conjunctivitis, bacterial eye infections.
9. Blood Disorders – Iron deficiency anemia.
10. Others – Malaria, Chicken pox, septic wounds and congenital abnormalities, cardiovascular diseases and lung cancer

This result also agrees with the work of (Boadi and Kuitunen, 2005; Abd El-Wahab, 2014 and Al-Delaimyet al., 2014) that the impact of solid waste on health is varied and may depend on numerous factors including the nature of the waste, duration of exposure, the population exposed, and availability of prevention and mitigation interventions, hence the impact may range from mild psychological effects to severe morbidity, disability or death.

Integrated Sustainable Waste Management is a holistic framework for municipal solid waste that goes beyond end-of-pipe disposal. It is defined by the U.S. Environmental Protection Agency as “a complete waste reduction,

collection, composting, recycling and disposal system." An effective ISWM system evaluates local conditions and mixes the most suitable waste-management activities to protect human health and the natural environment. ISWM recognises that unplanned waste handling and uncontrolled dumping can pollute water, attract vermin, cause flooding, and raise greenhouse gas emissions. There is lack of plans for waste disposal in Gwagwalada town result to serious health problems.

SUMMARY, RECOMMENDATIONS AND CONCLUSION

Summary

This research is to assess the environmental and health implications of waste management deficiency in Gwagwalada. The research covers composition of waste method of disposal, management option of waste and its effect on environment and health. It was discovered that trading (33%) and farming (29%) are the major occupation in Gwagwalada. These major occupations generate more waste daily, while faming is based on seasonal variation. The major composition of waste is domestic waste. The major method of waste disposal is by dumping on the street or by dumping it on an open abandoned space such as roadsides, drainages, market areas, residential areas which are of great threat to human health and the physical environment. Abuja Environmental Protection board is the major waste management option in the study area, the major problem that results in waste management deficiency is dumping of refuse in an open space without taking it to collection centre where it can be managed effectively. The highest disease due to improper waste dump is malaria with 30% of the total respondents. Acute respiration infection is another major disease due to exposure to improper waste dump with 11%. Finally, Logistic regression was performed to ascertain the environmental impact of improper waste management on health status of residents in the study area.it was revealed that the variables in the equation are significant at 0.001 less than p-value 0.05. It is quite understood that environmental impact of improper waste management has significant relationship with the health status of the resident of the study area.

Conclusion

In conclusion it is quite understood that waste management deficiency has significant relationship on environment and health status of the residents in Gwagwalada town.

Recommendation

1. At the household-level proper segregation of waste has to be done and it should be ensured that all organic matter is kept aside for composting, which is undoubtedly the best method for the correct disposal of this segment of the waste. In fact, the organic part of the waste that is generated decomposes more easily, attracts insects and causes disease. Organic waste can be composted and then used as fertilizer.
2. Policy instruments: State and Territory Governments have adopted a range of policy instruments to manage waste as well as meet their targets to reduce the amount of waste being disposed of of to landfill, including:
    a. Waste management regulations — to control various aspects of the collection, transportation and disposal of waste.
    b. Market-based instruments — to provide incentives to charge the waste generating and disposal behaviour of households and firms (and include landfill levies, advance disposal and recycling fees, deposit-refund schemes and subsidies).
    c. Extended producer responsibility and product stewardship schemes — to promote shared responsibility between industry and the community.
    d. Government provision of information and procurement practices — to address problems associated with the lack of information about waste management options, to persuade consumers and firms to change their behavior, and to use procurement policies to foster demand for particular resource-conserving goods.

REFERENCE

1. Abd El-Wahab E. W. (2014). Adverse health problems among municipalities workers in Alexandria

(Egypt).Int J Prev Med. 2014;5(5):545–56. PubMedPubMed Central Google Scholar.
2. Adeyeba O. A andAkinbo J. A. (2002). Pathogenic intestinal parasites and bacterial agents insolid wastes. East Afr Med J. 2002;79(11):604–10. View Article Pub Med Google Scholar.
3. Al-Delaimy W. K, Larsen C. W and Pezzoli K. (2014). Differences in health symptoms among residents living near illegal dump sites in Los Laureles Canyon, Tijuana, Mexico: a cross-sectional survey. Int J Environ Res Public Health. 2014;11(9):9532–52. View ArticlePubMedPubMedCentralGoogle Scholar.
4. Antwi S. O (2015). Exposure to environmental chemicals and heavy metals, and risk of pancreatic cancer. Cancer Causes Control. 2015;26(11):1583–91. View ArticlePubMedPubMedCentralGoogle Scholar
5. Atsegbua, L. A. (2013). Environmental Law in Nigeria, Theory and practice, Lagos, Ababa, Pp 102-103
6. Boadi K. O. and Kuitunen M. (2005). Environmental and health impacts of household solid waste handling and disposal practices in third world cities: the case of the Accra Metropolitan Area, Ghana. J Environ Health. 2005;68(4):32–6. PubMed Google Scholar
7. Brinkel J, Khan M. H and Kraemer A. (2009). A systematic review of arsenic exposure and its social and mental health effects with special reference to Bangladesh. Int J Environ Res Public Health. 2009;6(5):1609–19. View ArticlePubMedPubMedCentralGoogle Scholar.
8. Chup, C.D. (2000), Landforms of the Federal Capital Territory, University of Abuja (unpublished Manual).
9. Dawam, P.D. (2000) The Geography of the Federal Capital Territory, Abuja. Published by Geography Department, UNIAbuja.
10. Giusti L. (2009). A review of waste management practices and their impact on human health. Waste Management. 2009;29 (8):2227–39. View Article Pub Med Google Scholar.
11. Gumodoka B. (1997) Occupational exposure to the risk of HIV infection among health careworkers in Mwanza Region, United Republic of Tanzania. Bull World Health Organ. 1997;75(2):133–40. Pub Med Pub Med Central Google Scholar.
12. Gwagwalada leaflet, (2014) information manual, information division, Gwagwalada areacouncil, FCT.
13. Hoornweg D and Bhada-Tata P. (2012).What a Waste: A Global Review of Solid Waste Management. In: Urban development series, knowledge papers. Washington: World Bank; 2012. Google Scholar.
14. Hu S. W and Shy C. M. (2001). Health effects of waste incineration: a review of epidemiologic studies. J Air Waste Manag Assoc. 2001;51(7):1100–9. View ArticlePubMedGoogleScholar.
15. IAEA. (1988). The radiological accident in Goiânia. Viena: International Atomic Energy Agency; 1988. Google Scholar.
16. Jayakrishnan T, Cherumanalil M. J and Bhaskar R. (2013). Occupational health problems of municipal solid waste management workers in India. Int J Env Health Eng. 2013;2:42.View Article Google Scholar.
17. Lamond J, Bhattacharya N and Bloch R. (2012).The role of solid waste management as a response to urban flood risk in developing countries, a case study analysis. In: Proverbs D, et al. editor. Flood Recovery Innovation and Response. Bristol: WIT Press; 2012. p. 193–205. Google Scholar.
18. Mabogunje.A. (2002) Nigeria and the Good Urban Governance Campaign. The Launching of the Global Campaign for Good Urban Governance in Nigeria Federal Ministry of Works and Housing, Abuja, Nigeria.
19. National Population Commission 2006- Wikipedia. 2006.Needhidasan S, Samuel M and Chidambaram R. (2014). Electronic waste - an emerging threat to the environment of urban India. J Environ Health Sci Eng. 2014;12(1):36. View ArticlePubMedPubMed Central Google Scholar.
20. NPC. (2012). National Population Commission Nigeria. Retrieved fromwww.population.gov.ng.Accessed 16th April 2018.
21. Nweke O. C and Sanders W. H. (2009). Modern environmental health hazards: a public health issue of increasing significance in Africa. Environ Health Perspect. 2009;117(6):863–70. View Article Pub MedPub Med Central Google Scholar.
22. Pukkala E. (2009). Occupation and cancer - follow-up of 15 million people in five Nordic countries.

ActaOncol. 2009;48(5):646–790. View ArticlePubMedGoogle Scholar.
23. Ramin B. (2009). Slums, climate change and human health in sub-Saharan Africa. Bull World Health Organ. 2009;87(12):886. View ArticlePubMedPubMedCentralGoogle Scholar.
24. Rushton L and Elliott P. (2003). Evaluating evidence on environmental health risks. Br Med Bull. 2003; 68:113–28. View ArticlePubMedGoogle Scholar.
25. Ryu J. Y. (2015). Chronic Obstructive Pulmonary Disease (COPD) and Vapors, Gases, Dusts, or Fumes (VGDF): A Meta-analysis. COPD. 2015;12(4):374–80. View rticlePubMedGoogle Scholar.
26. Salkin I. F. (2004). Review of Health Impacts from Microbiological Hazards in Health-Care Wastes. Geneva: WHO; 2004. Google Scholar.
27. Tadesse M. L andKumie A. (2014). Healthcare waste generation and management practice in government health centers of Addis Ababa, Ethiopia. BMC Public Health. 2014; 14:1221. View Article PubMed Central Google Scholar.
28. UNEP (2007). Developing Integrated Solid Waste Management Plan Training Manual: ISWM Plan.UNEP. Guidelines for National Waste Management Strategies: Moving from challenges to opportunities. Nairobi: United Nations Environment Programme; 2013. Google Scholar
29. UN-Habitat State of the World's Cities 2011 - Cities for All: Bridging the Urban Divide in State of the World's Cities. Nairobi: UN-Habitat; 2010. Google Scholar.
30. Vrijheid M. (2000). Health effects of residence near hazardous waste landfill sites: a review of epidemiologic literature. Environ Health Perspect. 2000; 108 Suppl 1:101–12. View Article PubMed Central Google Scholar.