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WASTE MANAGEMENT AND PUBLIC HEALTH: EXAMINING THE HEALTH RISKS OF POOR DISPOSAL PRACTICES IN NIGERIA

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Article Info

Abstract

The objective of this paper was to make a brief review on improper waste management and its public health effect in Nigeria. Thus, this paper examines the health risks associated with poor waste disposal practices in Nigeria. The authors review the current state of waste management in Nigeria, highlighting the challenges faced by the country in managing its waste. They note that improper waste disposal leads to environmental pollution, which in turn affects public health. The paper identifies various categories of waste that are harmful to human health, including agricultural waste, industrial waste, radioactive waste, and biomedical waste. The authors also discuss the different methods of waste disposal in Nigeria, including open dumping, landfilling, and open burning, and highlight the public health risks associated with each method. These risks include the spread of diseases, pollution of water and air, and the attraction of disease-carrying vectors such as mosquitoes and rats. The paper concludes by emphasizing the need for proper waste management practices in Nigeria to prevent the adverse health effects associated with poor waste disposal. The authors recommend strategies such as education and awareness creation, legislation and enforcement, and the adoption of integrated waste management practices to address the challenges of waste management in Nigeria.

Keywords:
Waste, Nigeria, public health, land pollution, water pollution, open dumps, open burning, infection, vectors

Introduction

Due to an increase in industrial activities and development, population rate increase, and change in human lifestyles, there are several types of wastes that are produced daily, almost in e very sort of human activities or interactions. However, most of the countries from the developing regions are facing a lot of challenges regards to their ability to properly deal and manage waste being produced by their citizens and industries. Resultant consequences of poor waste disposal or challenges led to unhealthy effects such as air pollution, water pollution, public health crises, and other sorts of environmental consequences (Singh et al., 2018). The objective of this paper was to make a brief review on improper waste management and its public health effect in Nigeria.

Waste and its Generation

Almost, the entire human activities produce waste; therefore, the task lies in the preparedness and commitment of producers, governments, and other stakeholders in order to abate public health waste effects that could be spurred by improper waste management (Raj, 20217). Waste is defined as all kinds of unavoidable materials emanating from human activities and these materials are disposed-off because their values have been reduced. Wastes are bye-products of human activities. Waste can be classified based on its source, such as in the case of agricultural waste, household waste, industrial waste, sewage sludge, energy production waste, extraction or mining waste, etc (Karshima, 2016; Ibrahim et al., 2021). Municipal waste is a general term referring to all waste made from households and similar places such as offices, shops, and related commercial waste. Sometimes, waste may be classified according to the constituents envisaged therein. This kind of classification include compostable waste, recyclable waste, organic waste, hazardous waste, and inert debris. Compostable waste include, leaves, miscellaneous and vegetables, food remnants, and the items that can be turned into compost. Recyclable waste envisages glass, plastics, metals, and ceramics, which can be turned into other new products by the industries (Libroin, 2015; Verma et al., 2016; Singh, 2022).

Organic waste includes the materials that are of plant or animal origin which can be turned to manure or compost (Santra, 2016). Hazardous waste envisages materials from industrial origin or hospital that are potentially harmful to humans or animals or the environment. This kind of waste easily cause harm or injury to man (Karshima, 2016; Magami et al., 2017). When subjected to certain treatment or handling, some wastes are readily harmful to humans, animals, and environments (Soumiya et al., 2018).

Forms of Waste

Waste is ideally a form of matter, therefore it has weight and occupy space. Waste may be an element, meaning it is a chemical substance that cannot be divided into more simple units by a n ordinary chemical process, such as in the case of heavy metals, (Pb, Cr, Zn, Cu, e.t.c.) and non-heavy metals (Santra, 2016; Obebe & Adamu, Lovo & Rawlings, 2021). Metals in waste conducts heat and electricity, are malleable, possessed high melting and boiling points, and are relatively of high density. Non-metals are poor conducts of heat or electricity, have low densities, are soft, brittle, and non-ductile. Non-metals act as oxidizing agent form acidic oxides, and form covalent compounds. Nevertheless, some wastes are produced as compounds because they are substances containing two or more elements chemically assembled together, such as in the cases of CO_2, H_2S, $CaCO_2$, NaOH, HCI, HNO_3, H_2S0_4, e.t.c. Other form of waste includes the mixtures of substances or materials, therewith, two or more constituents that can be separated by physical method are involved. Examples of mixtures include crude oil, brass, sea-waste, air, etc (WHO African Regional Office, 2014; Sarkingobir et al., 2021).

States of Some Waste Materials

Waste basically exist in three states, namely, solid, liquid, and gas. A solid waste is a waste with definite volume and as well definite shape such as Cu, Zn, detergent, plastics, soot, e.t.c. Liquid waste has definite volume but takes the shape of its prevailing container, for instance, HCL, HNO_3, H_2S0_4 gaseous state of waste involved particles that are possessing more kinetic energy compared to liquid, they lack fixed shape, and fixed volume, least dense, and compressible (Massalha, 2015; Faris et al., 2022). States of waste can change as a result of one or varied environmental pressures. Solid waste can melt by obtaining more kinetic energy and on reaching certain temperature (melting point) the structure collapses allowing the particles to move freely (Santra, 2016; Reza & Yousuf, 2016). Some kinds of solid waste materials may transgress from solid to gases in a process known as sublimation. Liquid particles become energetic and break away to the space, in a process known as vaporization. Upon the lowering of temperature to a certain level vapors may return to liquid, and liquid subjected to a much lower temperature may become solid in a process known as freezing or condensation. Diffusion is the process whereby solute particles move from region of higher concentration to the region of lower concentration in a medium in order to be distributed throughout the medium. Diffusion occurs in gases, liquids, and solid as well. Osmosis is the special diffusion type that involves movement through a semi permeable membrane (Dhar, 2010; Massalha, 2015; Fikri et al., 2017; Avio et al., 2016).

Some other forms or processes that waste matter exist are the "solutions". A solution refers to dissolution of solid crystals in a liquid medium. A solution involves a solute being dissolved in a solvent. Aqueous solutions utilize water as a solvent medium, colloids are forms of false solutions whereby, there are solute particles larger than those in two solutions comparatively. Colloids with liquid as solvent are denoted as sols or gels; aerosols require liquid particles to be dispersed in a gas; while emulsions are states requiring a liquid to be dispersed in another liquid. Suspensions, are states whereby dispersed particles are large enough to be seen by naked eyes (Santra, 2016; Asante-Duah, 2017).

Some Empirical Findings About Waste Management in Nigeria

Several studies were carried out to examine waste management in Nigeria with the view of assessing the situation and promulgating a proper advice to prevent escalations. However, these studies mostly indicate a public health concern. (Jibatswan et al., 2012) examined household waste management by the managers (government). Ahmed (2011) recounts the prevalence of insect vectors in different refuse dumps collected in Kaduna city, and in turn there was high potential of causing public health problem characterized with transmission of diseases. Abah & Ohimain (2011) in healthcare waste study in southern Nigeria, disclosed that very few of the hospital staff had received training on waste management, there was also unsustainable practices, highlighting pitfalls of waste management in the country. Sa'idu (2011) examined water quality of wells near refuse dumps in Minna, Northern Nigeria, and reiterated that most of the water examined were contaminated when bacteriological quality was considered, and physiochemical parameters were not in conformity with WHO standard values. Ndidi et al. (2009) in waste management study in Jos among major hospitals, disclosed that the hospitals were practicing waste management below the standard. Gani & Okojie (2013) assessed status of waste management in Niger Delta, and commented that, there was lack of antipollution strategies, poor sanitation at sites, shortage of manpower to handle waste, poor awareness about waste handling, among other inconveniences. Butu & Mshelia (2014) in Kano city recorded that waste heaps caused by anthropogenic activities cause air, water, soil, pollutions in the city in streets and open spaces.

Waste Categories That Are Easily Harmful

Albeit, most of the waste we produced are harmful when handled or treated in a certain manner. Some of the readily harmful waste include:

- Agricultural waste- Agricultural waste is made from farm-based activities, and they include, sewage, sludge, spray residues, pesticides, insecticides, oils, greases, solvents, containers, etc. Most of the itemized materials in agricultural waste category are chemically-based therefore persistent and are of great potential to cause environmental degradation or pollution, and are harmful to humans.
- Industrial waste- Industrial wastes are remains from industrial activities. They include, organic wastes, alkalis, acids, metals, packaging materials, etc. Most of the industrial waste readily cause harm to human biological system upon exposure. Industrial waste materials are sometimes categorized or classified under the aegis of hazardous waste.
- Radioactive waste-Radioactive waste is produced by radioactivity programs being executed such as though power generation, hospital applications, medicine, engineering, agriculture, sterilization, etc. Indeed, radioactive materials are utilized in medicines, agriculture, energy production, etc, but that has to do with production of bye-products wastes that can elicit cancer, anemia, genetic mutation, leukemia, and death, depending on the doze taken by the biological system and duration of exposure.
- Biomedical waste- Biomedical waste is mostly collected from hospitals and related health centers, research institutes, academic facilities, and. waste, quasi. They include, the human anatomical waste, laboratory waste, infected animal waste, sharps, and quasi. This category of waste may be objects that can be cause an injury such as sharps, and facilitate disease transmission or ill-health; and can be biological materials that can equally spur infection (Nkwachukwu et al., 2010; Santra, 2016; Malami et al., 2022; Sabo et al., 2022; Sidi & Yahaya, 2022).

Waste Management Strategies

Waste management refers to chain of processes taken in order to control waste though the waste generation, storage, collection, transport, processing or disposal in-line with practices that are best economically, scientifically, environmentally, and in the interest of public health (Mbue et al., 2015; Santra, 2016; Nasir & Ibrahim, 2022). The proper waste management aim to ensure, protecting the public health, environmental quality, efficiency, economy, productivity, job-creation, and employment (Singh et al., 2018). Waste generation involves making the waste may be through the households, industries, markets, farms, and other human endeavors. Waste collection and producer (generator) and storage involves the tips taken to collect or gather waste from every home or producer using pits, dumps, containers, etc. At this juncture, mostly the producer does not segregate their waste into various components, but it is an opportunity to create job for many people. After this collection, the waste is momentarily stored before the huge collection is done (Alam & Ahmade, 2013; Kaoje et al., 2017; Kaoje et al., 2018; Singh et al., 2018). Transportation of waste involves shuttling the already collected wastes from households or other producers to the ultimate point of disposal (Raj, 2017). Waste disposal involves a step taken after transportation of waste from major collection sites. Waste disposal is an approach taken to get rid or dispose-off waste including landfilling, open dumping, open burning, and processing, therewith all these methods have merits and demerits to the public heath.

Suggestions for Proper Waste Handling

Wastes are varied, many of the waste generated are readily and directly hazardous, therefore, shall be properly handled as described here in the following contexts.

Bioconversion of Waste

Bioconversion is an important aspect of altering waste to for, useful products through following biological processes. Bioconversion include, composting, biogasification, etc. Composting is the process of turning organic waste inti manure or fertilizer to offsets the waste generated. Biogasification is the biological method of converting organic waste into gas that may be utilized as fuel (Santra, 2016; Abubakar et al., 2018).

Integrated Waste Management (IWM) is a mixture of techniques and methods combined to manage waste stream by following a hierarchy of waste management. The major goal of IWM is to ensure sustainability in waste management; therewith, the hierarchy in IWM is shown in Figure 1.

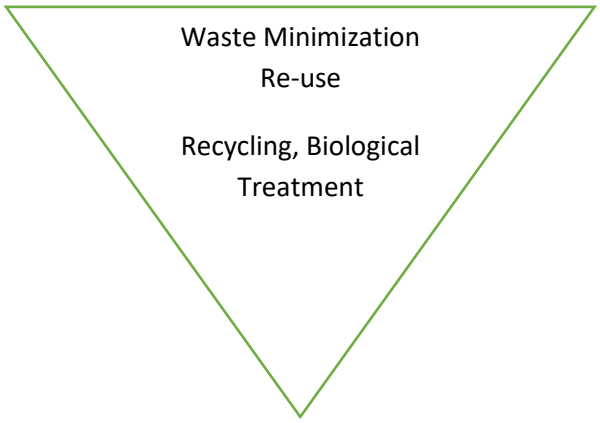

Figure 1: A highlight of IWM

According to IWM hierarchy, the initial or lower step of waste management is the landfilling which involved burying of waste in soils. Thermal treatment involves use of heat to burn waste being generated, while recycling involves scientifically-devised methods (mostly) at industrial level to treat waste. Biological treatment uses biological systems like microbes to degrade or convert waste materials. Re-use is a behavior change activity that require individuals or groups to keep on using a product or material after its first use-up. For instance, re-using a plastic bottle or beverage bottle for carrying home-made foods or products. Waste minimization includes al steps taken to ensure that quantity of waste such as single-use plastics is reduced or lowered. This may include avoiding or refusing commodities that easily cause waste such as single-use plastics and championing the use of alternatives such as organic materials or products. For instance, a lad refusing plastic-based container, while using containers made from plant leaves; and another person refusing plastic mats while championing the use of mats made from Northern Gamba Grass popularly utilized in Northern Nigeria (Santra, 2016).

Figure 2: A typical waste dump in Nigeria in some places; Source: Field work (2023)

Education

Education or awareness creation is the passing of information to people to achieve the objectives of behavior change. There are new tricks to convert wastes to useful products such as bricks, buildings, walls, furniture, teaching aids, manure, etc. These kinds of changes shall be emulated among societies through diffusion of innovation and education. Peoples hall be made to believe that, use of locally-made materials from bio-based items is more sustainable such the use of baskets to replace plastics bags, refusing plastic materials as ably as possible. The use of best public media and classroom platforms to disseminate and learn about the best methods of handling waste and the importance of stressing the hazardous nature of improper waste management or disposal are crucial to public health prevention (Adekomaya, 2020).

Legislation

Making laws that prevent or ban the use of certain plastics or chemicals, creation of empowered agencies to change and punish offenders is crucial. Laws should compel the industries to imbibe methods of reducing or neutralizing waste being made in the case of industrial processes (Adeyi et al., 2019).

Public Health Effects of Improper Waste Management

Improper waste management led to several effects affecting everyone and the whole environment consisting of biota. Certainly, an empower waste management led to air pollution, water pollution, and land pollution. Many hazardous chemicals are released through the waste and ultimately affecting public health badly by introducing undesirable substances or energies into segments of the environment. Discharge of waste materials directly through improper waste management tactics such as open dumping, burning, release constituents such as heavy metals (lead, zinc, chromium, copper, zinc, mercury, etc), radionuclides, benzene, xylene, hydrogen sulfide, ammonia, water vapor, carbon dioxide, amines, fog, haze, aerosol, smoke, ethylene, nitrites, nitrous oxides, particulates, hydrocarbons, etc (Alabi et al., 2019; Alemayehu, 2024). On humans, air pollutants brought by waste released by homes or industries are harmful and diverse in effects. However, general effects include, death, headache, dizziness, bronchial spasms, eye irritation, skin irritation, lung inflammation, reduced visibility, poor attention, poor productivity, poor consciousness, anemia, coughing, etc (Park et al., 2013; Santra, 2016; Hamid & Asghar, 2017).

Water is a vital and crucial part of the earth, but waste mismanagement affects water quality and in turn leading to public health problems through discharge of unwanted chemicals such as sodium, ammonia, iron, calcium, lead, chromium, arsenic, mercury, acids, bases, detergents, plastics, organic matter, nitrogen, magnesium, manganese, etc (GESAMP, 2015; Rasul et al., 2021). The effects include, making the water unfit for biological consumption, and affecting the availability of quality water to aquatic animal. Poor water quality to aquatic biological systems spur the intake of polluted water and injection of chemicals into the food chain, therewith, humans will be affected. Polluted water help in transmitting diseases that are tremendous to human health (Iwuoha et al., 2013; Wagner et al., 2014; Hayes, 2019; Michigan Department of Environment, Great Lakes, and Energy, 2020). Effects of indiscriminate waste disposal have been noticed as major detriments on land and affects public health effects as well. Land waste management spur land pollution, while affecting soil organic organism and ultimately food quality and quantity. Poor food quality and insufficiency are major global public health trends causing poor immunity, and mortality worldwide, and regionally-wise (Manisalidis et al., 2020; Nasir & Ibrahim, 2022; Ngeno et al., 2022).

Some Public Health Risks Due to Improper Disposal

There are various methods of disposing waste being generated depending on the capacity of the waste managers (UNEP, 2018). Some of the methods of waste management and their public health risks are detailed below:

Open dumps

- Seriously, open dumping is a public health threat in many dimensions, more especially it's ability to invite water, air, and pollution. Dust and filthy dirt are Ben spread through the windstorm to adjacent areas
- Odour is being spread to nearby areas creating a foul smell that may affect the public health, reducing concentration, and may incite nausea or vomiting or cholera.
- Toxic gases are being released due to various reactions being taken place motivated by organism and environmental pressures such as heat, sun rays, light, rainfall, etc (Center for International Environmental Law (2019).
- Rats and other vermin utilized open dumps as habitat and in turn facilitate transmission of infectious diseases
- Leaching of waste due to environmental pressures is very crucial leading to soil and water pollution (Orvestedt, 2015). Leaching contaminates foods, water, because crops relied on soil for nutrients (Saidu, 2011). Ejaz (2010) Kingsley et al. (2016) Mosquitoes find open dumps as suitable sites, thereby facilitating the transmission of infections such as malaria, and microfilariases. Additionally, there is prevalence of arthropod species in waste dumps in Nigeria, which may facilitate vector borne diseases (Banjo et al. 2012). Indeed, Akindutire & Alebiosu (2014) decried that improper waste disposal spur houseflies, life, coach roaches, mosquitoes; therewith, there are illnesses such as malaria, cholera, conjunctivitis, malnutrition, scabies, relapsing fever, dysentery, amoebiasis, heavy metal toxicity, etc. waste disposal at open dumps cause blocking of waterways, and ultimately leading to flooding, and reduces tourism attraction or beauty of lands.

Landfilling

Landfilling is a practice of placing waste materials in a large pit or excavation site in the soil (ground) and later filled or carried with soil (sand) (European Commission, 2000). The public implications of landfilling include the following:

- It requires a large area, thereby, possibly resulting to land degradation instead of using the land for farming and related activities. The practice of landfilling lead to leachate that could seep into soils water bodies and in turn encouraging pollution (Giusti, 2009). Landfills and growth of microbes that may act upon the waste materials to Form new products therefore, landfills may make emissions that may affect the environment as well (European Commission., 2000, Kingsley., et 2016). (Kingsley., et 2016) Disclosed that landfills in Niger Delta region serve as breeding sites for rectors and contaminated the environment. Residua (2000) stressed that landfills are acted upon by soil microbes to transform organic constituents to carbohydrates or relations, thereby emitting mostly methane, carbon dioxide, oxygen, nitrogen and water. The emissions contribute to the environmental pools (Residua, 2000).

Incineration

Incineration is the process of disposing of waste through the application of fire the process is also denoted as burning (UNICEF, 2021). The public health implications of incineration include the following:

- May cause fire outbreak especially in bushes or farms or uncontrolled areas
- cause air pollution by cleansing chemicals to the environment space
- Cause skin diseases, eye irritation, and reduce visibility
- Cause respiratory problems in healthy people and people with underlying wealthy conditions (Karshima, 2016; Irianti & Prasetyoputra, 2019; Tait et al., 2020)
- Verily, incineration of waste materials is very harmful especially when undertaken at home or open medium because a lot of harmful bye- products are emitted as under listed in Table 1.

Table 1: Some harmful chemicals released through waste incineration

S/N	Chemical	Public heath effect
1	Dioxin	Persistent, entering food chain, disruption of hormones and immune system
2	Particulate	Reduces visibility, eye and skin irritation, respiratory problem
3	Polyclic aromatic hydrocarbons	Cancer causing
4	Lead	Affect all organs mostly
5	Arsenic	Anemia, kidney problem, liver problem, cancer causing
6	HCL	Bronchitis, choking, nausea, stomach pain, visual damage, skin damage, chills, death, diarrhea
7	Volatile organic compound (VOCs)	Breathing difficulties, sick building syndrome, poor concentration
8	CO	Anemia, lung disease
9	Plastics and derivatives	Several biological effects, food poisoning
10	Chromium	Cancers, respiratory problem

Conclusion

In conclusion, the paper has established that poor waste management practices in Nigeria pose significant health risks to the population. The indiscriminate disposal of waste leads to environmental pollution, which in turn increases the incidence of diseases. Therefore, there is a need for urgent

attention to be paid to waste management practices in Nigeria. This can be achieved through education and awareness creation, legislation and enforcement, and the adoption of integrated waste management practices. Additionally, the government should provide adequate funding for waste management initiatives and ensure the effective implementation of waste management policies. By taking these measures, Nigeria can reduce the health risks associated with poor waste management practices and promote a healthier environment for its citizens.

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