ASSESSMENT OF OCCUPATIONAL HEALTH HAZARDS AMONG SOLID WASTE SCAVENGERS IN OWERRI NORTH LOCAL GOVERNMENT AREA, IMO STATE.

BY

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CERTIFICATION

This is to certify that this study on **"Occupational Health Hazards among solid Waste Scavengers in Owerri North Local Government Area in Imo State Nigeria"** was carried out by **Okpara, Barbara Oluebube** (Reg. No: **20194175908**) in partial fulfillment for the award of Masters in Public Health Technology.

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DEDICATION

This work is dedicated to my beloved husband Mr. Uche Oparanozie who is the source of inspiration and knowledge and to my wonderful father Mr. Okpara Silas, may God bless you all.

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ABSTRACT

This study determined the Assessment of Occupational Health Hazards among Solid Waste Scavengers in Owerri North Local Government Area, Imo State. Five specific objectives with corresponding research questions and five hypotheses guided the study. Cross-sectional descriptive study design was used for this study. A multi-staged sampling technique, simple random sampling technique and a purposive sampling technique were used to draw samples of 49 scavengers that responded. A structured questionnaire was used for data collection after being validated and its reliability tested. The data collected was analysed using frequencies, percentage, the hypotheses were tested using chi-square statistics at ≤0.05 level of significance. Results showed that (32.7) are within the age group of 38-47 years old. (89.8%), are male (36.7%) attain primary and secondary education (49.0%) are married, (49.0%) are less than 5 years into the scavenging business while (40.8%) earn less than N30,000 monthly from the scavenging business. On the exposure to physical health hazards, 55.1% have a high exposure while 44.9% have a low exposure to physical health hazards. On the exposure of chemical health hazards, 38.8% have a low exposure while 61.2% have a high exposure to chemical health hazards. On the exposure to biological health hazards 36.7% have a high exposure while 63.3% have a low exposure to biological hazard. On the exposure to ergonomic health hazards 71.4% have a high exposure while 28.6% have a low exposure to ergonomic health hazards. overall preventive practices taken by respondents against hazards resulting from Scavenging. 75.5% have poor preventive practices while 24.5% have good preventive practices. No significant association was established between exposure to physical health hazards during Scavenging activities and Respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.296, 0.816, 0.794, 0.920, 0,373, 0.442 respectively). No significant association was established between exposure to chemical hazard during scavenging activities and respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.317, 0.363, 0.743, 0.802, 0.113, 0.161 respectively). No significant association was established between exposure to biological hazard during scavenging activities and respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.617, 0.873, 0.222, 0.918, 0.914, 0.977 respectively). No significant association was established between exposure to ergonomic health hazard during scavenging activities and respondents age, sex, educational attainment, marital status, years in business and monthly income (pvalue = 0.216, 0.136, 1.764, 0.166, 0.679, 0.503 respectively).No significant association was established between preventive practices taken by respondents against health hazards resulting from Scavenging and respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.438, 0.805, 0.202, 0.623, 0.190, 0.357 respectively). Solid wastes scavengers are more exposed to physical, chemical and ergonomic health hazards than biological due to lack of PPE required for scavenging and ignorance of the health hazards, So the state government and regulating bodies should provide and ensure the usage of PPE and operational guidelines for solid waste scavenging.

Keywords: Hazards, Solid Waste, Occupational Health, Scavengers

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Occupational health hazards refers to possible adverse health impacts one undergoes in their working environment or Occupational health hazards is defined as risk or dangers as a consequence of the nature of the working conditions of a particular work. It can also refer to a work, material, substances, process, or situation that predisposes, or causes accidents or diseases at a workplace (Smith & Kdjaruna, 2014). While Occupational hazard (OH) is a hazard experienced in the workplace (Centers for Disease Control and Prevention 2016) Hazard is the potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources (IPCC, 2021). Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 1984). Occupational health hazards are divided into five groups according to their nature example, Physical hazard, which is relate to exposure to noise, ionizing radiation, and temperature. Chemical hazard, which relate to exposure to gases, vapors, fumes, and chemicals. Biological hazard, which relate to exposure to viruses, bacteria, blood and blood products, Ergonomic hazard which relate to the requirement of improper posture, monotony, repetitiveness, work shifts, and situations causing stress, Psychosocial hazard, which is constantly present at work or, responsible for a large number of occupational health diseases, such as hypertension, stress, and cancer etc, (Collins, 2017; HAS, 2017). Occupational health hazards also include injuries from sharp objects such as broken glasses, tin cans, knives, needles etc. These needles might be carrying other people's blood possibly contaminated with a number of viruses (Kuijer and Frings-Dresen, 2004). Hazards can arise

at any point during the process, including during transportation, at the locations where solid waste is collected from households, and during recycling or disposal.

Solid waste scavenging is a global event as refuse generation cannot be separated from man. Scavenging materials range from bags made of either plastics, metals, copper, Alumillum, paper, bins, drums, two wheeled or four wheeled containers. The job of solid waste scavengers involves frequent lifting, carrying, pushing or pulling of heavy objects (Kuijer, Frings-Dresen, De Looze *et al.,* 2000). Solid waste scavengers are expose to variety of occupational health hazards factors such as dust, bioaerosols, volatile organic matter and mechanical stress, which make them susceptible to certain occupational health diseases (Dutkiewicz, 1997; Krajewska *et al.,* 2002). Several studies reported that Solid waste scavengers are at high risk for developing disease resulting from exposure to various occupational health hazards (Schibye *et al.,* 2001; Wouters *et al.,* 2002 and Kuijer *et al.,* 2010).

Solid waste Scavengers are also exposed to numerous hazards: such as infectious waste from hospitals, smoke and fumes from burning waste, feces, contaminated needles, toxic paper, heavy metals from batteries, bottles, chemical waste containers and harsh weather conditions, solid waste scavengers spend most of the time working in a bent position as such scavengers may suffer from chronic backache (Al Khatib**,** Al-Sari & Kontogianni 2020). Scavengers of solid are also vulnerable to major health hazards such as accidents, and infections that can cause chronic diseases. Accidents could lead to injury or death and this could be caused by heavy equipment, fire outbreaks, falling from heights etc. Infections is caused by direct contact with infectious waste, bites from dogs (with threat of rabies), and enteric infections transmitted by insects feeding on waste. Chronic diseases such as respiratory diseases are caused from exposure to dust and toxic compounds. Cardiovascular disorders, and heat stress due to exposure to excessive temperature, and hearing function loss result from exposure to excessive

noise. Solid waste Scavenging also exposes them to human immune deficiency virus (HIV) and hepatitis infection. (Gutberlet & Baeder, 2008)

According to a research done on health hazards reduction behaviors model in Thailand, scavengers are exposed to occupational health hazards and most solid waste scavengers had low level of knowledge and alertness on occupational health hazards (Phiman, 2011). Despite the severity of occupational health hazards encounter by solid waste scavengers their provision and usage of PPE is low. Solid waste scavengers also exposed to increasing risk of respiratory and gastrointestinal tract diseases. These are attributed to the microbial agents they are exposed to in the course of discharging their duties. Violence from members of the public is another form of hazard. This might be as a reaction to the refuse trucks blocking the roads. The violence could be demonstrated in various ways from verbal abuse to spitting and even physical violence in most cases. They are also subjected to occupational health hazard of musculoskeletal disorders which has to do with back, shoulder and arm injuries. Incorrect manual handling, size of the bin and the distance they have to move the bins predispose to the injuries (Wouters, Hihorst & Kleppe, 2002),

The nature of duties involved in solid waste scavenging requires the use of protective equipment. They work in busy roads and carry heavy loads. The protective equipment they require range from “toetector” footwear, nose masks, high visibility clothing capable of being seen by car drivers from a reasonable distance, gloves, the right wear suitable for rain, heat or cold and reinforced trousers to minimized hazards. Scavengers may suffer from serious occupational health hazard as a result of scavenging which is a public health concern including work-related injuries, fatigue, morbidity effects, and disease accidents (Lasota & Hankiewicz, 2020).

In Imo state Poverty caused by unemployment results to solid waste scavenging, Solid waste Scavengers in Imo state may also contract skin and blood infection, eye and respiratory

infection as a result of expose to polluted dust, wound and insect bite, Inability to use proper equipment and lack of training on safe solid waste scavenging are the main reasons why solid waste scavengers in Imo may suffer from different kinds of occupational health disease. Occupational health hazards assessments should be carried out to identify the hazards that are involved and also look towards eliminating or reducing the hazard to a level as low as possible, This calls for the involvement of the operatives and safety representatives (Kuijer & FringsDresen, 2004),

Also health education should be given to solid waste scavengers to educate them on safety equipments necessary for scavenging to avoid occupational health hazards and injuries during scavenging. This study aim at occupational health hazards among solid waste scavengers in Owerri North local Government Area Imo State.

1.2 Statement of the Problem

In Imo state, as scavengers search for valuables among discarded solid wastes, they are exposed to certain occupational health hazards, which they are not aware of, that affect their health and well-being. Scavengers in Owerri North Local Government Area of Imo State faced occupational health hazards during solid waste scavenging which are threat to achieving some of the sustainable development goal, they also burn some of the solid wastes in order to extract one ‘valuable’ or the other. These activities of the scavengers expose them to some dangerous occupational health hazards such as physical, chemicals, biological, Ergonomic, psychosocial or hospital, which may cause occupational health diseases such as respiratory diseases, musculoskeletal disorder, and infectious diseases leading to death. Health status of scavengers in Owerri North Local Government Area of Imo State is therefore a public health concern because solid waste scavenging as an occupation but could be possible pathways for the spread of several communicable diseases, infectious diseases, like HIV, hepatitis to the scavengers.

This situation is most apparent in Owerri North, because of that the researcher have designed this study on assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State.

1.3 Aim and Objective of the Study

1.3.1 General Objective

This study was designed to determine the assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State.

The aim of this study is to determine the assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State.

1.3.2 Specific Objectives

The specific objectives of this study are to:

1. Determine the extent to which solid waste scavengers are exposed to physical health hazards in Owerri North Local Government Area, Imo State.
2. Determine the extent to which solid waste scavengers are exposed to chemical health hazards in Owerri North Local Government Area, Imo State.
3. Determine the extent to which solid waste scavengers are exposed to biological health hazards in Owerri North Local Government Area, Imo State.
4. Determine the extent to which solid waste scavengers are exposed to ergonomic health hazards in Owerri North Local Government Area, Imo State.
5. Identify the preventive measures adopted to reduce occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State.

1.4 Research Questions

The following research questions guided the study;

1. To what extent are solid waste scavengers exposed to physical health hazards in

Owerri North Local Government Area Imo State?

2. To What extent are solid waste scavengers exposed to chemical health hazards in Owerri North Local Government Area Imo State?
3. To What extent are solid waste scavengers exposed to biological health hazards in Owerri North Local Government Area Imo State?
4. To What extent are solid waste scavengers exposed to ergonomic health hazards in Owerri North Local Government Area Imo State?
5. What preventive measures are adopted to reduce occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State?

1.5 Research Hypotheses

The following null and alternative hypotheses were formulated by the researcher for the purpose of this study;

Hypothesis One

H_{01} (Null Hypothesis): There is no significant association between exposure to physical health hazards and the occurrence of work-related health problems among solid waste scavengers in Owerri North Local Government Area, Imo State.

H_{11} (Alternative Hypothesis): There is a significant association between exposure to physical health hazards and the occurrence of work-related health problems among solid waste scavengers in Owerri North Local Government Area, Imo State.

Hypothesis Two

H_{02} (Null Hypothesis): Exposure to chemical health hazards is not significantly associated with work-related health problems among solid waste scavengers in Owerri North Local Government Area, Imo State.

H_{12} (Alternative Hypothesis): Exposure to chemical health hazards is significantly associated with work-related health problems among solid waste scavengers in Owerri North Local Government Area, Imo State.

Hypothesis Three

H_{03} (Null Hypothesis): There is no significant association between exposure to biological health hazards and work-related health problems among solid waste scavengers in Owerri North Local Government Area, Imo State.

H_{13} (Alternative Hypothesis): There is a significant association between exposure to biological health hazards and work-related health problems among solid waste scavengers in Owerri North Local Government Area, Imo State.

Hypothesis Four

H_{04} (Null Hypothesis): Exposure to ergonomic health hazards does not significantly influence the occurrence of work-related musculoskeletal problems among solid waste scavengers in Owerri North Local Government Area, Imo State.

H_{14} (Alternative Hypothesis): Exposure to ergonomic health hazards significantly influences the occurrence of work-related musculoskeletal problems among solid waste scavengers in Owerri North Local Government Area, Imo State.

Hypothesis Five

H_{05} (Null Hypothesis): Preventive measures adopted by solid waste scavengers do not significantly reduce occupational health hazards in Owerri North Local Government Area, Imo State.

H_{15} (Alternative Hypothesis): Preventive measures adopted by solid waste scavengers significantly reduce occupational health hazards in Owerri North Local Government Area, Imo State.

1.6 Significance of the Study

Several occupational health hazards exist as a result of solid waste scavenging activities, however, lack of knowledge of occupational health hazards is a problem. Hence this research will be of great benefit in creating awareness among solid waste scavengers and general public on the existence of occupational health hazards associated with solid waste scavenging and as well as high hazard factors which predispose them to occupational health diseases such as respiratory diseases, muscoskeletal disorder, infectious diseases, cardiovascular diseases, gastrointestinal disease etc. This study will also serve as a good reference material to researchers, epidemiologist, health promotion expert, health environmentalist and base line for further research. This study will give insight and possibly proffer recommendations, input results in planning programs to health program developers. This study will also be beneficial to government, non-governmental organizations in making public health policies. It will go a long way in creating awareness on preventive measures taken to prevent occupational health hazards among scavengers. Above all this study will also be of great significant to the people of Owerri North and Imo State at large.

1.7 Scope of the Study

This study focused on the assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State and delimited to scavengers. The independent variables of the study are the occupational health hazards, defined in terms of physical health hazards, Chemical health hazards, Ergonomic health hazard, and biological health hazard etc.

CHAPTER TWO

LITERATURES REVIEW

This chapter deals with review of literatures on the assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State, this chapter has three main sections conceptual framework, theoretical framework and Empirical studies.

2.1 Conceptual Framework

2.1.2 Occupational Health Hazard

Occupational health hazards are any workplace condition that causes a risk to employee health. Also occupational health hazards are defined as risk or dangers as a consequence of the nature of the working conditions of a particular work. It can also refer to a work, material, substances, process, or situation that predisposes, or causes accidents or diseases at a workplace (Smith & Kdjaruna, 2014).

Occupational health hazard explains the risks of illnesses or accidents in the workplace. An occupational health hazard is something unpleasant that a person experiences or suffers as a result of doing their job. Occupational health hazard as a term signifies both long-term and short-term health hazards. Short term risks may include physical injury, while long-term risks may be increased risk of developing cancer or heart disease. Occupational hazard are divided into five groups according to their nature example, Physical hazard, related to exposure to noise, ionizing radiation, and temperature. Chemical hazard, related to exposure to gases, vapors, fumes, and chemicals. Biological hazard, this includes exposure to viruses, bacteria, blood and blood products, Ergonomic hazard which relate to the requirement of improper posture, monotony, repetitiveness, work shifts, and situations causing stress. Psychosocial

hazard, which relate to hazards constantly present at work or, responsible for a large number of occupational diseases, such as hypertension, stress, and cancer etc.

2.1.2 Types of occupational health hazards among solid waste scavengers

There are many types of occupational health hazards that affect the solid waste scavengers which is as follows.

Physical Hazards: Physical hazards are a subtype of occupational health hazards that involve environmental hazards that can cause harm with or without contact (Susan Harwood, 2015). Also physical hazards are hazards in the environment that can harm your body without you actually touching it, examples are radiation, prolonged exposure to sunlight, extreme high or low temperatures, loud noise, stress, fire, spills on floors and unguarded machines etc. It is one of the occupational health hazard that can cause harm to the solid waste scavengers and also substances or conditions that threaten the physical safety of solid waste scavengers. They can cause harm with or without contact. Solid Waste scavengers are exposed to extremes of temperatures (cold during rainy season and heat during the dry season), noise and vibration generated from the garbage trucks and radiation from radioactive wastes as a result of scavenging.

Chemical hazards: Chemical hazards are a subtype of occupational hazards that involve a wide variety of chemicals. Exposure to chemicals hazards during Scavenging can cause acute or long-term detrimental health effects to the Scavengers. There are many classifications of hazardous chemicals, which include neurotoxins, immune agents, dermatologic agents, carcinogens, reproductive toxins, systemic toxins, asthmagens, pneumoconiotic agents and sensitizers which can cause harm to the solid waste scavengers health when exposed (CDC, 2015) Chemical hazards also exposed the solid waste scavengers to respiratory diseases, cardiovascular diseases, dermatological diseases etc solid waste scavengers can suffer acute

or long-term negative health effects when exposed to chemicals hazard. There are hundreds of hazardous chemicals, including immune agents, dermatologic agents, carcinogens, neurotoxins, and reproductive toxins. Asthmagens, sensitizers, and systemic toxins are also hazardous chemicals that can affect solid waste Scavengers, these exposure limits include evidence that a certain amount of a chemical exposure is linked to one or more adverse health effects. For instance, heart disease is more prevalent in workers who are exposed to the chemicals found in engine exhausts (Occupational health and safety 2017). Exposure to carbon tetrachloride has shown to cause liver and kidney damage. Exposure to benzene has been linked to leukemia.

Biological Hazard: According to Occupational safety and health administration (2022) Biological agents, that create biological hazards, include bacteria, viruses, fungi, microorganisms and toxins. These biological agents can cause adverse health effects in solid waste Scavengers, Influenza is an example of a biological hazard which affects a broad population of solid waste scavengers (CDC, 2015). Exposure to toxins generated by insects, spiders, snakes, scorpions, etc., require physical contact be made between the Solid waste scavengers and the living organism. Skin exposure to biological agents can cause contact dermatitis (caused by exposure to urushiol from poisonous *Toxicodendron* plants Lyme disease, West Nile virus, and coccidioidomycosis (caused by exposure to fungi) (CDC, 2015). Also Some of the biological hazards that solid waste scavengers in landfills encounter include diseases brought on by consuming contaminated food (Almoslim & Ibrahim, 2020; Phan *et al*., 2020) and water, contacting the animal flesh, feces, blood, or other body fluids, and dead or alive diseased animals like rats (Schenck *et al*., 2019). Vectors like flies and mosquitoes breed inside the landfill during the summer and spread to other areas (Chandramohan *et al*., 2010). Also solid waste Scavengers are at risk to exposure to blood-borne illnesses (such as HIV, hepatitis B, and hepatitis C) etc.

Ergonomic hazards: A physical component in the environment that damages the musculoskeletal system is known as an ergonomic hazard. Repetitive movement, manual handling, work place job task design, unpleasant workstation height, and improper body alignment are all examples of ergonomic hazards Ergonomics is the study of how to design a workplace, its equipment, and the work environment for maximum comfort, efficiency, safety, and productivity. These hazards put strain on your body over a period of time. You may just feel sore or cramped in the short term, but repeatedly sitting or standing in awkward positions or completing the same movements over and over, across a long period of time, can lead to long-term injury and illness. Solid waste Scavengers may be exposed to Ergonomic hazards due to lifting, pulling and pushing of the Solid waste material for a long period of time.

Figure 2.1: Ergonomic hazards

Source: Shutterstock.com

Solid waste:

Solid Wastes are also defined as all wastes arising from human and animal activities that normally solid and are discarded as useless or unwanted (Tchobanoglous *et al*, 1993), is also defined as any discarded material that is abandoned by being disposed of, burned or

incinerated, recycled or considered "waste-like, Solid waste is the term used to describe nonliquid waste materials arising from domestic, trade, commercial, agricultural, industrial activities and from public services (Aibor and Olorunda, 2006).Solid waste includes garbage, construction debris, commercial refuse, sludge from water supply or waste treatment plants, or air pollution control facilities, and other discarded materials. Solid waste can come from industrial, commercial, mining, or agricultural operations, and from household and community activities. The improper way of handling solid wastes by solid waste scavengers along streets, market places, and residential axis, constitutes nuisance which causes serious occupational health hazard, as dumping leads to percolation to pollute ground water supplies, breeding ground for such annoying and disease bearing organisms, such as rats, cockroaches, mosquitoes, flies, etc. which are major disease

Solid waste Scavenging.

Is defined inclusively as behavior of searching through solid waste for items that could be used for different purposes Okoye (2010). According to the international labor organization (ILO) defined scavenging as physical selected of recyclable matter from muddled waste discarded at landfills, dumpsite, and places where waste is collected.

Figure 2.2: Showing Solid waste scavenging at the dumpsite.

Source: Shutterstock.com

Solid waste Scavengers

Okoye (2010) defined scavenger as a person who picks up recyclable/re-usable materials from mixed solid wastes stream wherever it may be temporally accessible or disposed of or further use and/or processing. Waste scavenger are people who salvages re-usable or recyclable materials to sell or for personal consumption (Ebenezer, 2014). According to Wikipedia, a solid wastes scavenger is a person who salvages solid reusable or recyclable materials thrown away by others to sell or for personal consumption. The solid waste scavengers are also popularly known as Solid Waste Pickers. The term" Solid waste picker" was adopted at the First World Conference of Waste Pickers in Bogota, Colombia in 2008 to facilitate global networking. Example, in South Africa, "reclaimers" and "bagerezi" are used. Other languages have their own preferred terms: *catadores* in Portuguese, *recicladores* in Spanish, in Igbo they are also referred to "Onyeburu".

The term "Scavenger" is commonly used, but many solid waste pickers find it demeaning due to the implied comparison with animals. Human scavenging entails the use of one's hands to pick valuable items that can fetch money in the re-cycling companies. Ebenezer (2014), adds that scavengers do not care when looking for valuable materials. The occupational hazards are very high due to numerous items that are so toxic and life threatening and the people who rely on scavenging are low income earners.

2.1.3 Categories of Solid Waste Scavengers

Route/trucks solid waste scavengers

Route/ truck solid waste scavengers refers to formal collection crews who segregate recyclables from household solid waste as a supplement to their salaries. The term can also

designate informal pickers who have permission to collect materials alongside collection crews.

Dump/landfill solid waste Scavengers

Reclaim and sell recyclables and gather organic matter--usually for feeding livestock at disposal sites, may live on the disposal site in shacks or nearby

Doorstep solid waste scavengers

Door step solid waste scavengers collect recyclables as part of municipal segregation source, run in partnership with membership-based organizations of solid waste pickers. Cooperatives with formal or informal agreements with commercial/office buildings may have members engaged in the collection of large quantities of materials by trucks or other vehicles.

Itinerant Solid waste buyers

Itinerant buyers are those that purchase scrap directly from households, offices and shops. Most of the itinerant buyers are male and they typically require a certain amount of capital to purchase scrap or Collect recyclables from households/businesses in exchange for payment or barter. They generally work on fixed routes and use pushcarts or other collection vehicles.

Street Solid waste scavengers

Reclaim recyclables from mixed solid waste disposed in garbage bags and bins on streets or in dumpsters; some have arrangements with household residencies, commercial and/or office buildings and may have access to previously segregated material, this category of solid waste Scavengers retrieve valuables from either individuals who sell to them at a meagre price, dustbin in residential places, waste collection trucks, receptacles and dumpsites (Asibor & Edjere, 2017)

Mobile and residents solid Waste scavengers

The mobile scavengers store their wares in a locally fabricated cart and move from one site to the other while resident scavengers store their wares within the dumpsite area where they are resident (Elenwo, 2015).

Types of solid waste Materials Scavenged

Solid waste scavengers look for anything that can bring money. The materials sourced by scavengers includes bags, cartons, containers, jars, glass bottles, wire, plastic bottles, metals, tins, ceramics, old utensils, furniture, bottle covers, leather, etc. which can be sold to scrap dealers or direct men who then process the wastes and sell it on, either to be recycled or to be used directly.

2.1.4 Sources of Solid Wastes

Municipal Solid Waste

Municipal solid waste includes commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated biomedical wastes (Ministry of Environmental and Forests, India, 2000). Municipal waste is produced as a result of economical productivity and consumption. It includes non-hazardous wastes from households, commercial establishments, institutions, markets, and industries. Since 1970's, when it became apparent that even controlled landfills were causing significant water pollution, sanitary landfill technology was developed to provide barriers to pollutant migration, as well as to provide leachate and gas management system (Cointreau, 2004).

Domestic solid waste: It consists of household waste, kitchen, house cleaning, old papers, packing bottles, crockery wares, furniture materials, and garden trimmings, etc. (Palnitkar, 2000).

Commercial Solid waste: Waste generated at business premises, shops, offices, markets, departmental stores, organic, inorganic, and chemically reactive and hazardous waste (Palnitkar, 2000).

Institutional solid waste: Schools, colleges, large hotels, vegetable market, fruits, meat, etc. community halls, religious places, etc. (Palnitkar, 2000).

Street solid waste: It includes uncontrolled throwing, litter by pedestrian and vehicular traffic, stray animals, roadside tree leaves, rubbish from drain cleaning, debris, etc. (Palnitkar, 2000).

Biomedical solid Waste: It is generated at hospitals, clinics, medical labs, pharmacies, and medical institutions.

2.1.5 Daily Solid Waste Scavenging Practices

The scavengers obtain solid waste by scrambling indiscriminately once a waste truck arrives the dumpsite. Normally, they form a quasi-group where only "registered member" are given first priority. Outsiders can only come in after the registered members have had their pick.

The registered members also pay a little amount to the "site engineers" who oversees the dump. The scavengers comb through mixtures of waste dumps and collect items they consider valuable enough for their merchandise. At times solid waste scavengers also purchase the reusable or recyclable waste materials from residents at negotiated sums of money. The mobile solid waste scavengers store their wares in a locally fabricated cart and move from one site to the other while resident solid waste scavengers store their wares within the dumpsite area where they are resident. The metal cart is manually pushed by the scavenger from street to

street visiting waste collection or receptacle points or dumps and collecting valuable materials desired. The final destination of the Solid waste scavengers terminates at the scrap market where the merchandise is segregated, weighed using the salter scale and sold to the junk merchant. The resident solid waste scavengers on the other hand recovered items and wait for buyers to come. Most items are scavenged based on customers request. There is no form of sorting or treatment before the solid wastes are disposed to the dumpsites. Solid waste, sorting is carried out by the scavengers in a very crude manner without the use of personal protective equipment (PPE).

Due to their ignorance of the occupational health hazards associated with this occupation, solid waste scavengers are exposed to sharp objects leading to cuts, which lead to loss of blood and infection; encounter with dangerous animals such as scorpions, reptiles, rats, mosquito, cockroaches and flies. They are also faced with air pollution in form of objectionable odor, obnoxious gas inhalation from decomposing materials, eyesores, radiation from sun, fatigue, and risk of infectious diseases like cholera, typhoid, and malaria (Asibor & Edjere, 2017).

2.1.6 Benefits of Solid Waste Scavenging

The Solid scavengers access streets and house where the disposal trucks cannot access for waste collection. Public health and sanitation improves when solid waste scavengers remove solid wastes from urban areas not served by municipal garbage collection. According to the UN publication, Solid Waste Management in the World's Cities, waste pickers perform 50100 per cent of ongoing waste collection in most cities in developing countries (Van de Klundert & Anschutz, 2010).

Solid waste scavengers offer a range of economic benefits such as job opportunities; they provide crucial income for people and households. For 65 per cent of the IEMS sample,

earnings from waste picking were the main source of household income. Only about one quarter had any other income. Waste pickers collect household or commercial/industrial solid waste. They may collect from private waste bins or dumpsites, along streets and waterways or on dumps and landfills. Some rummage in search of necessities; others collect and sell recyclables to middlemen or business men (Ebenezar, 2014). Scavenging from the waste stream is an important economic activity that provides income for over 15 million people worldwide, most of whom are in cities in developing countries (Asibor & Edjere, 2017). According to him, scavenging is an example of sustainable development, emphasizing that scavenging activity enhances environmental protection by increasing the amount of waste collected, re-used and recycled, resulting in high indicators for energy saving, pollution prevention and pollution reduction, as well as extending the useful life of landfills. He further said that scavenging is relevant to economic growth, as it reduces the cost of raw materials for local enterprises. Medina (2012), also pointed that recycling by waste pickers saves municipalities money by reducing the volume of waste that needs to be collected, transported, and disposed of.

In Jakarta, it has been estimated that waste pickers reduce the volume of waste by 30 percent, saving the municipality fuel, equipment, and labour costs and extending the life span of dumps and sanitary landfills. Recycling has obvious environmental benefits, and the involvement of waste pickers in recycling programmers can enhance it. The recovery and recycling of inorganic materials by waste pickers saves energy. Waste pickers' composting activities also divert organic waste away from dumps and landfills, reducing the generation of methane. However, in the view of Ebenezar (2014), unsupervised and uncontrolled scavenging is detrimental to the health and safety of the scavenger as well as other people around. Scavenging is a common occurrence in the third world countries, because of high unemployment, and widespread poverty (Asibor & Edjere, 2017).

Therefore, the work gets some off the streets and labour market. Many solid waste scavengers sell to buyers, who then sell the material for a profit. Waste pickers also pay private carriers and transport drivers. Solid waste Scavengers provide reusable materials to other enterprises

2.1.7 Factors Influencing Solid Waste Scavenging.

Low income, unemployment and poverty: solid waste Scavenging is common occurrence because of high unemployment, widespread poverty and lack of a safety net for the poor (Medina, 2012).

Economic boost/ready market for industrialists: People continue to scavenge because industrialists offer readymade market for their merchandise with the possibility of satisfying their needs (Furedy, 2014).

Waste generation and composition: If a solid waste bag dump or dump comprises of possible usable valuables such as shoes, cartons, tin and bottles, etc and not segregated (or when waste is not segregated) at the source of generation, it leads to solid waste scavengers making a field day with the waste bin. So, it is important to avoid mixing up of waste or to promote waste segregation at the source by educating people.

Delay in waste disposal and waste processing by waste management agency: Wastes and few recycling industry's inefficient and outdated model is not equipped to deal with the ever growing demands of waste management solutions. As the waste managers waste time in evacuating the collected waste, it gives room for scavengers to carry out their activities the more.

Ignorance and Attitude of Residents: Most of the residents do see the scavengers as they tear and scatter waste bags but they do not speak nor caution them but show

sympathy/empathy on them since it is their source of livelihood, not realizing the health hazard or after effect of such activities both on the Scavengers and the people.

Ways solid waste scavengers are exposed to occupational health hazard

Solid waste scavenging is the extraction of useful items from solid wastes, is a popular activity among the urban poor, Despite being an income-generating activity, scavenging is a hazardous activity and the ways solid waste scavengers are exposed to occupational health hazard are as follows.

1. Breathing in the chemical
2. Exposure to excrement, toxic substances, chemicals, and chemical coming in contact with the skin, especially if your skin is chapped, irritated, or if you have an open wound.
3. Hand-to-mouth.
4. Bending, heavy lifting, pulling, pushing, and carrying.
5. Come in contact with sharp objects, and medical waste, leave adverse effects on both the physical and mental health.
6. Radiation
7. Noise pollution.

2.1.8 Public Health Implications of Occupational Health Hazard on Solid Waste Scavengers.

Musculoskeletal disorders

Musculoskeletal are injuries caused by improper body motions. Damage can occur during solid waste scavenging as the effect of strenuous physical labor, such as hauling the waste and pushing carts and heavy bags of recyclables (Scheneck *et al*., 2019). Solid waste in general, have a weak sense of balance, a solid waste scavenger may lose balance and fall if they are unable to balance themselves after slipping, which can result in several injuries. In research looking at injuries from street cleaning occupations in Korea from 2009 to 2011, these correlations were identified (Jeong, 2017). In affluent nations, automated trucks are utilized to pick up and dump trash cans utilizing hydraulic lifts (Snel, 1999). In musculoskeletal disorders, Low back pain (22%) and shoulders (15%) were the most commonly affected body parts among solid waste scavengers, followed by the neck (7%) and knee (6.7%), and then the thighs and elbows (5.8%) each (Abou *et al*., 2012), lastly Solid waste scavenging is a physically demanding job, which is the reason for high prevalence rate of musculoskeletal disorders (Ewis *et al*., 2013).

Respiratory disorders

It is any of the diseases and disorders of the airways and the lungs that affect respiration. Respiratory disease are any of the diseases and disorders of the airways and the lungs that affect human respiration, Any part of the respiratory system may become infected or diseased and the effects may have a wide variety of complications. There may be a connection between working at open dumps and an increase in respiratory illnesses. Exposure to biologically active substances, gases, bioaerosols, and dust with high concentrations of organic content such as bacteria and fungi is linked to an increased risk of respiratory disease (Jayakrishnan *et al*., 2013).

Solid waste scavengers may be exposed to a variety of diseases related to respiration, including diarrhea, allergic broncho-pulmonary mycosis, hypersensitivity pneumonitis, rhinitis, and irritation of the mucous membranes. Gases such as hydrogen sulfide, methane, ammonia, and carbon monoxide are frequently exposed by scavengers using information from a crosssectional survey of 273 solid waste scavengers in India, additional analysis was done. The authors observed chronic respiratory morbidity while accounting for several risk factors, including age, sex, socioeconomic position, length of employment, smoking habit, type of home, location, cooking fuel, and pets (Sabde & Zodpey, 2008). According to a study by Singh and Ladusingh in 2017 the municipal workers were more prone to chronic bronchitis (Singh & Ladusingh, 2017). These findings show that these scavengers may have had lower lung capacities due to exposure to pathogens from municipal waste, road dust, pulling heavy vehicles packed with solid trash, and lifting solid waste container bins. These findings demonstrate that these scavengers' lung capacity had decreased, and they also have asthma, bronchitis, and other lung conditions (Patil & Kamble, 2017), Therefore respiratory disorders is one of the health implication of occupational health hazard associate with solid waste scavenging.

Byssinosis or brown lung disease:

This is caused by breathing in dust from hemp, flax, and cotton processing. It may affects solid waste scavengers as a result of their activities, it is one of the health implications of occupational health hazard of solid waste scavengers.

Hypersensitivity pneumonitis:

This is an allergic lung disease. It is caused by a lung inflammation that happens from breathing in many different substances. These include fungus spores, or plant protein, or certain chemicals. They can come from moldy hay, bird droppings, and other organic dusts.

The disease causes inflamed air sacs in the lungs. It leads to fibrous scar tissue in the lungs and can affect solid waste scavengers as a result of their occupation.

Silicosis:

This condition is caused by breathing in airborne crystalline silica. This is a dust found in the air of mines, foundries, and blasting operations. It is also found in the air of stone, clay, and glass manufacturing facilities. It causes lung scarring. It can also increase the risk for other lung diseases, it can affect the scavengers as well.

Asbestosis:

This is caused when a person breathes in tiny asbestos fibers. Over time, this leads to lung scarring and stiffening of the lungs. It is one of the health implications of solid waste scavenging.

Work-related asthma:

This is caused by breathing in dusts, gases, fumes, and vapors. It causes asthma symptoms such as a chronic cough and wheezing. This condition can be reversed if found early. The solid waste scavengers are at higher risk of getting this illness if they work in certain environments.

Dermatological disorders

Dermatological disorders are an umbrella term to describe conditions affecting the skin. They may range from common skin rashes to severe skin infections which may occur as a result of: infections, allergens, systemic disorders or medications, dermatological disorder is one of the occupational health disease or illness that affect solid waste scavengers as a result of scavenging activities of them and without personal protective equipment necessary, Based on

research conducted by Srisantyorini and Chayaningsih (2019), there are 42 out of 75 respondents that suffered from skin disease**,** most respondents stating that they suffer from itchiness. These respondents were solid waste scavengers who work at the Sumur Batu landfill in Bekasi. Furthermore, the cases of skin disease have a significant correlation with several variables such as age, working hours (the longer they work, the more exposed they are), years of working, skin cleanliness, hair hygiene, oral hygiene, nail hygiene, clothes hygiene, and the availability of a clean water supply**,** based on

2017 data from the public health center of Bantar Gebang district, skin disease itself is noted as one of the top five out of 10 diseases that were recorded at the public health center, with 2.537 new cases in February 2018 that affect solid waste scavengers.

Figure 2.3: Solid Waste Scavengers sorting waste

Gastrointestinal problems

Gastrointestinal diseases refer to diseases involving the gastrointestinal tract, namely the esophagus, stomach, small intestine, large intestine and rectum, and the accessory organs of digestion, the liver, gallbladder, and pancreas. Gastrointestinal problem is one of the health implications of occupational health problem of solid waste scavengers as a result of scavengering and as well not practicing good hygiene during scavenging. In 2017, many

crosssectional investigations by Poole & Basu revealed that these solid waste scavengers had more gastrointestinal complaints (Poole & Basu, 2017). Gastroenteritis can result from scavengers not practicing good hygiene while Scavenging. The scavengers may display the warning signs and symptoms including nausea, vomiting, and diarrhea with water (Pintakham & Siriwong, 2015). In a study on gastrointestinal problems, indigestion, flatulence, worm infestation, and diarrhea were the most prevalent symptoms (Mahajan *et al*., 2017). The exposed group had significantly more gastrointestinal problems. There were frequent reports of stomach cramps, diarrhea, vomiting, or dysentery (Abd El-Wahab *et al*., 2014).

Cadmium

Cadmium is an element. Its most abundant naturally-occurring isotope is non-radioactive. It is found in nature in mineral forms and is obtained for commercial uses principally from cadmium ore, called greenockite, which is commonly found in association with zinc ore.

Commercial production of cadmium ore depends on the mining of zinc (ATSDR, 1999). Cadmium is commercially available as an oxide, chloride, or sulfide. Cadmium metal (Cd^{2+}) refined from the ore is a silver-white, blue-tinged lustrous heavy metal solid at room temperature (National Toxicology Program 2004).

Cadmium, which has toxicological qualities from its similarities to zinc, is present in the Solid wastes produced by the industries, including and batteries, PVC, and detergent boxes. In the human body, cadmium builds up and affects several organs, including the liver, lungs, placenta, brain, kidneys, and bones. Hepatic, hematological, and immunological impacts as well as reproductive and developmental toxicity are other forms of harm that have been noted (Jerie, 2016). Solid wastes scavengers can be expose to cadmium as a result of their activities

Other health problem

Gasess, pressurized gases, toxic chemicals, and air pollution are considered chemical dangers since they can cause neurological disorders, skin problems, respiratory issues, and kidney and liver ailments (Jerie, 2016). Researchers note that burning waste can produce gases and smoke, either as a method of management of it or to recover the metals embedded in electronic cables (Mathema *et al*., 2017).

Infection

According to the study, solid waste scavengers had a high frequency of nail infections,47% of scavengers had infections in their nails on their fingers or toes, with the majority of these infections being fungal and lesions having subsequent bacterial infections that were made worse by frequent soaking brought on by direct contact with solid waste (Jayakrishnan *et al*., 2013). The dengue carrying mosquito Aedesaegypti prefers breeding in containers, tires, and tin cans found in trash heaps that contain small, clean water pools. The physicochemical properties of coconut shells, as opposed to plastics and pots, enhance mosquito development; these shells were abundant in the solid waste of these areas (Jayakrishnan *et al.*, 2013). The reproduction rate of disease vectors like the Diptera and cockroaches has been aided by open space dumping in business backyards and makeshift pit dumping (Tchobanoglous *et al*., 1993).

Malaria:

Malaria is a serious and sometimes fatal disease caused by a parasite that commonly infects a certain type of mosquito which feeds on humans. Also malaria is a disease spread by mosquitoes is caused by the protozoa Plasmodium. This is a very common disease in places where mosquitoes breed very quickly. The sewers in these places aren't taken care of properly, so the water there runs in the streets. Mosquitoes breed in still water, so because of all this

water, many mosquitoes breed and there is a large amount of them. And, unfortunately, they all carry the malaria disease, Solid waste scavengers may be infected as a result of Scavenging at the dumpsite and been beating by the mosquitos.

Hepatitis:

Hepatitis refers to an inflammatory condition of the liver. It is commonly the result of a viral infection, but there are other possible causes of hepatitis, it can also be defined as an inflammation of the liver that is caused by a variety of Infectious viruses and non-infectious agents leading to the range of health problems (WHO, 2020), Solid waste Scavengers may be suffer from hepatitis as a result of viral infection contacted at the dumpsite.

Typhoid:

Typhoid fever is a life-threatening infection caused by the bacterium *Salmonella typhi*. It is usually spread through contaminated food or water. Once *Salmonella typhi* bacteria are ingested, they multiply and spread into the bloodstream, scavengers can be expose to such bacteria because some does not practice hand washing at the time of eating while Scavenging.

Cholera:

Cholera is an acute diarrhoeal infection caused by ingestion of food or water contaminated with the bacterium *Vibrio cholerae*. Cholera remains a global threat to public health and an indicator of inequity and lack of social development, and solid waste scavengers can be expose to such infection due to poor hygiene practice during scavenging.

HIV/AIDS:

AIDS is a chronic immune system disease caused by the human immunodeficiency virus (HIV), HIV damages the immune system and interferes with the body's ability to fight infection and disease. HIV can be spread through contact with infected blood, semen, or vaginal fluids. There's no cure for HIV/AIDS, but medications can control the infection and prevent disease progression, solid waste scavengers may contact HIV through Scavenging at the dumpsite and been injured by contaminated needle of HIV person disposed at the dumpsite.

Accident

Accident on the road while transporting the materials and exposure of physical hazards. examples are rod, iron, nails, broken bottles, used needles and syringes, hospital wastes, etc. Exposure of chemical hazards such as carbide powder, mercury, burning of tyres to extract some certain valuables, Destruction of aesthetics causing eye sour and foul smell stench around the environment are one of the occupational health hazard of solid waste scavengers.

2.1.9 Preventive Measures of Occupational Health Hazards

The main steps of occupational health hazards preventions are as follows.

1. **Identification of those occupational health hazards:** identification of those occupational health hazard that have the potential to cause harm (hazard identification) to the solid waste scavengers and take precautions towards preventing those hazards
2. **Analysis and evaluation:** Analysing and evaluating the factors in association with that hazard (factors analysis, and factors evaluation).
3. **Dose-Response Assessment**: relationship between exposure and effects
4. **Exposure Assessment**: frequency, timing, and levels of contact with the potential occupational health hazards

5. **Determining appropriate ways to eliminate hazard** Determining appropriate ways to eliminate hazards, or control the risk when the hazard cannot be eliminated (risk control).

2.1.10 Control Measures of Occupational Health Hazards among solid waste scavengers.

These includes actions that can be taken to reduce the exposure to the potential hazard. Alternatively, the control could be implemented to remove the hazard or to reduce the likelihood of the risk by reducing the exposure to that hazard (HAS, 2017). Actions are listed hierarchically from the most preferred to least (1–6):

1. **Elimination**: Eliminations of the hazards (e.g., removal of dangerous substance while Scavenging),
2. **Substitution:** Substitution of the hazards with those of lower risk (e.g., usage of less toxic substitutes),
3. **Isolation**: isolation of the hazard (e.g., noise-isolated, noisy equipment),
4. **Engineering approaches:** Engineering approach to the hazards (e.g., redesigning a process to place a barrier between the person and the hazard),
5. **Administration approaches:** to the hazards (e.g., adopting safe work practices, training to reduce the potential for harm and/or adverse health effects to people),
6. **Usage of personal protective equipment**: To prevent the exposure to occupational health hazards.
7. **Health Education**: Health providers can play a crucial role in reducing the incidence of OHH through educating the solid wastes scavengers on the preventing measure necessary to apply while Scavenging.
8. **Use of personal protective equipments (PPE):** To protect against hazards during solid waste Scavenging.

2.2 Theoretical Framework

2.2.1 Social Cognitive Theory (SCT)

This theory goes well beyond individual factors in health behaviour change to include environmental and social factors. Infact this theory may be the most comprehensive model of human behaviour yet propose (Bandura, 1986). Banduras social cognitive theory also referred to as social learning theory is a behavioural prediction theory that represent a clinical approach to health behavioural change (Fishbein *et al.,* in press and Fishbein *et al.,*1991).

This theory has been widely applied to health behaviour with respect to prevention, health promotion and modification of unhealthy lifestyles for many different risk behaviour. Chassin and Shenman (1987); Kulbok, Earls & Montgomery (1988); and Elliot (1993) reported that there was less clear evidence supporting the ideals of health enhancing lifestyle why Donovan, Jessor and Coasta (1993) said that it is clear however, that all health enhancing behaviors tend to correlate negatively with health corresponding behavior's adults and adolescent. SCT emphasizes what people think and its effect on their behavior (Perry, Baranowski & Parcel, 1990; Baranowski, Perry & Parcel, 1997). They further reported that this concept state that there is a continuous dynamic interaction between the individual, environment, and behaviour. Thus a change in one of this factors impacts on the other two. That is whichever one that occurs first will be predictive of others. Jessorand Jessor (1977); Donodan and Jessor (1985); Elliot, Huizinga, and Ageton (1985); Osgood, Johnson and Mally (1988) and Elloit and Morse (1986) are off the idea that difference adolescents problem behaviours clustered and had the same underline causes and had been evident for many years and was evident in several theories. This study will torch preventive and health promotional measures (prevention of occupational hazard (that will affect the health of the solid waste scavengers and modify

unhealthy lifestyles that contributes to hazards with affect the scavengers lately eg. Scavenging solid waste without any form of PPE (Personal Protective Equipment etc). The occupational health hazards among the scavengers are usually the interaction between the individual, environment and behavours. The environmental factors like scavenging solid waste disposal at the dumpsite as their occupation could affect the health of the scavengers negatively.

2.2.2 Health Belief Model

This study is situated within the framework of the Health Belief Model (HBM) developed by Rosenstock (1966) to help understand and explain why people did or did not use preventive services offered by public health departments in the 1950's, and has evolved to address newer concerns in prevention and detection as well as lifestyle behaviors such as sexual risk behaviors and disease prevention. The HBM has been most often applied for health concern that are prevention related and asymptomatic, such as early cancer detection and hypertension screening where beliefs are as important as or more than symptoms.

Formal Education or Educational attainment is one of the socio-economic factors modifying individual beliefs about occupational health hazard among solid waste scavengers. Those who have formal education are likely to be adequately informed about the occupational hazard disease and infections associated with solid waste scavenging, expectedly to moderate their individual beliefs on its consequences, and the threat it poses to the health and wellness of the scavengers. This is expected to have positive consequences on their individual risk behavior relating to their health. The Health Belief Model is an individual level behavioral model to classify the knowledge necessary to promote behavior change (Champion & Skinner, 2010). The basic tenant of HBM is that if a person has a particular health risk with a known behavior that will reduce the risk, the likelihood that the behavior will be adopted depends on a number

of knowledge and attitude around the health risk as well as the behavior (Usuwa *et al.,* 2020). HBM has multiple factors that contribute to the outcome as the behavior including perceived susceptibility of being afflicted by the disease, barriers such as cost and access to executing the behavior, perceived severity of the disease, perceived benefit and efficacy of the behavior, believe that one can perform the behavior (self-efficacy), and social cues to action. While HBM can help to characterize individual-level factors needed to initiate behavior change, additional social determinants contribute directly and indirectly across the HBM framework (Champion & Skinner, 2008).

The Health Belief Model (HBM) postulates that when an individual perceives that he/she is at risk of contracting a serious disease (threat), he/she will initiate a certain health behavior to prevent it. However, this health behavior will not be adopted unless the benefits of the behavior outweigh its barriers and con-sequences. Those beliefs are potentiated by triggers (cues to action), which could be internal or external (Sheeran *et al.,* 2004). In addition, the model proposes that certain variables such as demographic factors, and knowledge of disease, can affect an individual's beliefs. This could indirectly influence an individual's behavior as well as cues to action. Self-efficacy is another important facet influencing health behavior as people are more likely to adopt a behaviour if they have high self-confidence and belief in their ability to take on that behaviour. Though discovered fifty years ago, a lot is yet to be understood about occupational health hazard among solid waste scavengers including the factors influencing human behaviours towards prevention and control of the disease. Understanding the consequences of occupational health hazard among solid waste scavengers in communities, and state is a prerequisite for successful development and implementation of its prevention and control strategies.

2.2.3 Behavioural Change Model

The Behavioural change model is a preventive approach and focuses on lifestyle behaviours that impact on health. The model as elaborated by Ewles and Simnett (2003), seeks to persuade individuals to adopt healthy lifestyle behaviours, to use preventive health services, and to take responsibility for their own health. Ewles and Simnett (2003), distinguish five approaches to health promotion, each necessitating the use of different kinds of activities. These approaches are: medical; behavioural change; educational; client-centred, and societal change. There are several theories and models that support the practice of health promotion and disease prevention. Theories and models are used in program planning to understand and explain health behavior and to guide the identification, development, and implementation of interventions (Gerford & Volk, 1990).

2.3 Empirical Studies

2.3.1 A study on occupational health hazard, among solid waste scavengers

In a descriptive survey research design conducted by Olowoye and Oludare (2021) in Onderstepoort waste dumpsite in pretoria south Africa with the aim of investigating the perception of scavengers on scavenging and related occupational health hazards, Primary data were obtained through observation and implementation of a questionnaire to a total number of 53 scavengers (27 females and 26 males). The questionnaire was structured to extract information that included perceptions of scavengers about their activities, health implications of scavenging, monthly income, and behavioural norms. Educated scavengers had high school education. The period of scavenging ranged from 10 to 15 years. The majority of scavengers did not use protective clothing. However, few used gloves and boots picked from the dumpsite. Common health issues reported included back pain, headache, diarrhoea, and shortness of breath. Some sustained injuries from sharp objects. Scavengers stored food among the waste;

food could be either brought from home or bought from the vendors who cook at the dumpsite. Some drank bottled water picked from the waste. Eighty-five percent of females cleaned themselves immediately after work in temporary shacks at the dumpsite, while all males bathed at home. The average monthly income from scavenging was approximately R1372 (approximately $91 (US)). Women scavengers liked their job despite associated health hazards. Scavengers would benefit if government and nongovernmental organizations educate them on the significance of protective clothing and good hygiene. Policymakers should assist the scavengers by providing necessary workshops on-site that will assist them to change their behaviour.

A cross sectional study conducted by Afon (2021) in Olusosun one of the government designated open waste in Lagos state on social, economic, health and occupational health implications of solid waste scavenging activity, using incidental or convenience sampling methods of questionnaire administration, 112 scavengers were sampled. It was established that scavenging on the site was only possible through registration with an associate on site. Recovering items from hills of waste involved physical energy and the use of manuallyoperated rudimentary equipment. Thus, 87% of the scavengers were males in their early twenties (minimum age = 19 years; maximum age = 35 years; mean = 26.7 years; SD = 4.2). The daily mean income from the exercise was Naira 480.80 (Naira 160 = $1.00). The most important method of arriving at the selling prices of the scavenged products was the use of scale measurement. Although the scavengers were aware that scavenging exposed them to both environmental and occupational health hazards, they continued scavenging for economic and social reasons. The study concluded that because of the level of employment provided and the large number of people directly involved (1243 on this site alone), outright banning, even when the open dump is closed down, without rehabilitating the scavengers will constitute a

social, economic and security threat to the community. Scavenging should, therefore, be integrated fully into the waste-management system and regulated.

A cross-sectional descriptive survey design done by Kipchumba Peninah, Festus Berukelonye and Glennonsomu Araka (2022) in Eldoret central business district Kenya, investigated the Occupational health hazards faced by solid waste collectors in Eldoret Central Business District. Cross-sectional descriptive research design was used and target population was 114 solid waste collectors and three (3) Public Health officers. A sample size 89 waste handlers and 3 supervisors was used and were selected through simple random and purposive sampling. Questionnaires and interview guides were used to collect both quantitative and qualitative data. Validity was attained through expert judgement while reliability was attained through piloting and use of Cronbach Alpha coefficient. Quantitative data was analyzed using frequencies, mean and standard deviation and presented in tables and figures. Qualitative data were thematically classified and arranged before they were reported in narrations and quotations. The study found out that 97.6% of the waste handlers had been affected by wastes collected. In addition, 97.6%, had been pricked by sharped objects, 98.8% had cuts from sharp objects, 84.5% had been pierced by sharp objects, 83.1% had suffered dermal injuries and 74.7% had suffered strain. The paper concluded that the major hazards that were associated with solid waste handling included; cuts from metals and broken bottles, piercing, strain, corrosions and musculoskeletal injuries. It was recommended that there is need for segregation of wastes at the source to reduce mixing of solid wastes which increases the likelihood of an occurrence of hazards among waste handle.

A descriptive cross sectional study conducted by Stanley Nyemahame, Emmanuel Clement, Emmanuel Tamunobelema and Uchechukwu Ifeanyichukwu (2023) in port Harcourt metropolis on occupational risk exposure of waste managers, data were collected from solid waste collectors or managers who have worked for over a year in the Rivers state, using a

researcher administered semi-structured questionnaire. The data was analysed using SPPS version 23. A total of 317 were recruited, with the majority as males (68.5%), aged between 30 – 39 years (56.5%), married (55.5%), permanent staff (54.3%), educated to the tertiary level (31.2%), have over 5 years of experience (52.1%) and earn between 30,000 – 39,000 Naira monthly (44.8%). Also, 87.1% of the respondents had good practice of occupational health and safety, while 61.5% and 32% of the waste managers have been exposed to workrelated accidents and diseases respectively in course of carrying out their job within the last 12 months. Cuts (30.0%), puncture wounds (20.5%), and road accidents (20.2%) as the most experienced hazards by the workers, while allergies (23.2%) and rash/other skin diseases (22.1%) were the most experienced type of illness. The high prevalence of occupational hazards can be attributed to poor working conditions and lack of adequate safety gear. Hence, there is a need for increased governmental budgetary allocation for the provision safety gear and training.

A cross sectional descriptive study design done by Abeer Abd El-Aziz Mohamed Madian (2018) in Middle and El-Gomrok Zones in Alexandria governorate, aimed at assessing adverse health effects among solid waste collectors. Randomly selected of 4 zones out of 8 zones namely; El-Montaza, East, the target population of this study was solid waste collectors in previous mentioned zones (n = 100). One tool was used, it consists of four parts; sociodemographic characteristics of solid waste collectors, work related characteristics and different health problems among waste workers. Study findings revealed that vast majority (94%) of the collectors suffering from health problems and 76% of them experienced workrelated accidents. It can be noted that, there was high propagation of occupational health morbidities among waste collectors as gastrointestinal complaints, eye problems, skin problems, work related injury, respiratory and musculoskeletal pain. Risk factors of the adverse health effects among solid waste collectors namely age, level of education, duration

of employment, type of work, use of personal protective equipment, awareness about adverse health effects, job stress, and job satisfaction; this shed the light on the urgent need for application of awareness programs to increase their knowledge about occupational health hazards also routine medical examination of waste collectors must be carried out by health officers.

Study on occupational health hazards prevention on solid waste scavengers

A cross-sectional survey design done by Fikrom Gebremedhin & Aberakumie (2015) was aimed to assess the knowledge, attitude and practices of solid waste collectors towards prevention of occupational health hazards in Lideta sub-city in Ethiopia. A cross-sectional survey was conducted among four hundred six solid waste collectors for this work. The data was collected by using semi-structured questionnaire and observational checklist, which was completed from December 2014 to February 2015. The data was entered into epi info version 3.5.1 and exported to SPSS 20 version for analysis. Multiple logistic regression analysis had been performed. Adjusted odds ratio with confidence interval had been computed to see the presence of association between the dependent and selected independent variables. The results on this finding were reported using different descriptive statistics. The response rate of this study was 94.8%. Female respondents accounted 69.7%. The mean age of the study subjects was 35 years, which varied from 17 to 65 years. About 60.8% of the study participants had satisfactory knowledge on preventing occupational health risks associated with solid waste handling. Most (75.9%) of the solid waste collectors had favorable attitude while only 37.2% of them had safe practice on preventing occupational health hazards. As compared to workers who were satisfied on their job, odds of having safe occupational health practice were 2.8 higher (AOR = 2.8, 95% CI: 1.84 - 4.26). The knowledge and attitudes of workers about prevention of occupational health hazards were moderate but the magnitude of having safe

occupational health practice was very low. So, implementation of basic occupational health services with provision of personal protective equipment's and supervising waste handlers on appropriate utilization is advisable.

A cross-sectional descriptive study was conducted by Mary Onoja-Alexzander, Usman Zakari, A Amme Usman, in Ahmadu Bello University Zaria with the aim of determine occupational health hazards among hospital waste handlers in Ahmadu Bello University Teaching Hospital, Zaria,79 medical waste handlers in were selected using a multistage sampling technique. Data were collected using structured self-administered and interviewer administered questionnaire and analyzed using SPSS version 20 software with significance set at $P < .05$. Results**:** More than half of the respondents (56.4%) were men, and most (70.3%) had <5 years work experience. Most of the respondents (60.8%) had had an injury in the previous 6 months. The most common injuries were falling on a slippery floor (48.1%), contact/irritant dermatitis (40.5%), and 34.2% from stress. Only 45.6% received treatment following injury at the work place. Most respondents (75.9%) were aware of safety devices, and more than half (51.9%) received their information from special safety training. More than half of the respondents (51.1%) had poor knowledge of use of safety devices, and 60% had special training in occupational safety. Most respondents (89.9%) used heavy-duty rubber hand gloves, but only 5.1% used aprons. Also, 82.3% of respondents used these devices regularly at work, and more than half of respondents (62%) had been immunized against hepatitis. Also, 65.8% practiced universal precautions. Occupational injury was higher among those aged 15–19 years

(occupational injury rate, 75%) compared to those aged 34–39 years (occupational injury rate, 16%). A positive association was detected between gender and injury in the last 6 months; injury was more common among men (43%) than among women (15%). Among respondents, there was a high level of injury and poor knowledge of the use of protective devices. Regular use of protective measures was not commensurate with the reported level of awareness.

Concerted efforts are needed to ensure the safety of the medical waste handlers in his work place.

A descriptive survey research design conducted by Asim, Batool and Nawaz (2020) in Southern Lahore examined the scavengers and their role in the recycling of solid waste. Data was gathered from 325 different scavengers, junkshops and middlemen. Waste generation rate in Allama Iqbal town is 0.80 kg per capita per day. In researched area and other cities of Pakistan there is no formal sorting of waste and this activity is mainly in the hands of informal sector of which scavengers are major stakeholders. *Korreywalas*, *Pheriwalas*, waste pickers, street pickers and dumpsite pickers are different types of scavengers. Scavengers have different socio-economic and socio-demographic characteristics. Males and females of all ages, poor refugees, migrants and minorities are involved in the recovery of waste recyclables, *Pheriwalas* purchase recyclable items form the household and shops and all other scavengers recover the recyclable items directly from waste. All scavengers sell recyclables to junkshop dealers or contractors, which resell these to middlemen or recycling industries. Most of the recyclable materials consists of variety of paper, cardboard, metal scrap, plastics, pet bottles, dry breads, heals of shoes, bones, etc. The price of an item depends on its quality or agreement among scavengers and contractors. The earnings of scavengers depend on the recovered amounts of recyclables from the waste or purchasing from the households and the quality of recyclable items. The estimated total amount of recyclable material recovered by all the scavengers working in the area is about 525 tons per month, which generate an income of US$ 30,875 per month. They are poor, suffer harassment from officials and face health and safety problems during the work. Despite of their low economic and social status, scavengers are making important environmental and economic contributions, Scavengers not only reduce the waste but also supply secondary materials to recycling industry, save the expenditures of SWMD in sweeping, transportation and disposing of waste. The overall impact of activities of

scavengers was positive economically and environmentally. Of the various categories of scavengers' household waste collection system run by *Korreywalas* is the best. This can be improved further if government or organized private sector helps them by organizing them, providing them medical and health facilities, PPEs and financial incentives. Phiman and Borjan (2019) evaluated the effect of comprehensive health risk protection behaviors, knowledge, attitudes, and practices among scavengers in open dump sites. A control group of 44 scavengers and an intervention group of 44 scavengers participated in this study. Interventions included the use of personal protective equipment, health protection training, and other measures. The analysis showed significant differences before and after the intervention program and also between the control and intervention groups. These observations suggest that further action should be taken to reduce adverse exposure during Solid waste collection. To reduce health hazards to workers, dump site scavenging should be incorporated into the formal sector program. Solid waste and the management of municipal solid waste has become a human and environmental health issue and future research should look at constructing a sustainable model to help protect the health of scavengers and drive authorities to adopt safer management techniques.

A descriptive survey research design conducted by Asibor and Edjere, (2017) in Warri metropolis on the assessment of the activities of scavengers and their economic impacts in waste recovery in Warri metropolis, Delta State using descriptive statistics and percentages. They noted that scavengers are involved in both on-site and off-site solid waste recovery. They recover reusable and recyclables materials like plastics, aluminum, glass, scraps metal, tins, cans, cables, like a horn, bones etc. Some go from door-to- door to recover solid waste, while majority limit their operation to the waste brought to the disposal sites. Some of the recovered wastes are processed before they are sold to the end-users, resource merchants or recycling industries.

The processes include washing, burning, etc. to add more value to sales. The majority of the scavengers often times spend part of their life in makeshift houses built on and around the disposal sites like. It is a common sight around the dumpsites to see heaps and mountains of recovered materials waiting to be purchased or transported to the resource merchants or recycling companies. The most scavenged wastes are scrap metals, tins, cans, glass bottles, polyethylene products, plastics bottles, aluminum, ceramics, wood, textiles, batteries, computer accessories and foams. The most scavenged waste material by weight is scrap metals (29.1%) followed by tins and cans (12.2%), polythene products (8.0%), glass bottles (7.1%) and plastic bottles (4.1%). This is similar to the work of Bichi and Amatobi, (2013), and Mshelia, (2015) carried out in Kano and Mubi metropolis of Nigeria, Medina, (2017) concluded that Municipalities often consider solid waste pickers a problem. Indeed, unorganized waste picking can have an adverse impact on neighborhood's and cities. Waste pickers often scatter the contents of garbage bags or bins to salvage anything of value.

They do not always put the garbage back, increasing the municipality's costs for waste collection. Their carts may interfere with traffic. And if they use horses or donkeys to pull their carts, the manure may end up on the streets. Some municipal authorities therefore often ban waste pickers' activities. But bans only drive the activities underground. Waste pickers adapt by salvaging materials at odd hours or bribing some corrupt authorities.

2.4 Summary of Literature Review

Scavenging for wealth is not entirely a bad idea but the means and manner the solid wastes are sourced and detrimental to the health of the scavengers. The review considered three theories namely, social cognitive theory, the health belief model, and the behavioural change model, which were deemed fit for the study because they touched on the human attitude, behavior change and prevention which was a necessary requirement for having a positive attitude

towards the occupational and oneself curbing health hazards associated with scavenging and maintaining a healthy mode of operation which will in turn benefit the scavengers. The topic under study which is occupational health hazards among solid waste scavengers in Owerri North Local Government Area Imo state was reviewed under the conceptual framework and included definition of occupational health hazards, type of occupational health hazards (physical, chemical, biological, ergonomical, and psychological), definition of solid waste, source of solid waste, scavenging ,waste scavengers, categories of solid wastes Scavengers, daily solid waste scavenging practice, materials scavenged, benefit of solid waste scavengers, occupational health problems affecting solid waste scavengers, factors influencing scavenging activities, consequences of occupational health hazards, preventive measure taken and control measure of occupational health hazards, The opinions of several researchers were sought on occupational health hazards among scavengers. Some relevant empirical studies were also consulted which gave support to this study. The study intend to fill an important gap in occupational health hazard among solid waste scavengers which has not been looked into by other researchers, hence the study is on the assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government

Area, Imo State.

CHAPTER THREE

MATERIALS AND METHODS

This chapter describes the materials that were used in this study, the methods for data collection and analysis. It also indicated the type of study design, the area of study, study population, sample size and sampling methods and states how the instruments were validated and the reliability of such instruments and the ethical considerations.

3.1 Study Design

Descriptive design and cross sectional study design was employed in this study. Descriptive design is aimed to obtain information to systematically describe a phenomenon situation or

population. Cross sectional study design is aimed at determining presence or absence of disease or other health-related variables in a population at one particular time (Ali, 1996). It provides information about the naturally occurring health status, behavior, attitudes or other characteristics of a particular group (Schmidt and Kohlmann, 2008). Cross sectional study was employed in this study because it provided data on the underlying occupational health hazard among solid waste scavengers in Owerri north local government area of Imo State. This study design was used by Kipchumba Peninah, Festus Berukelonye and Glennonsomu Araka (2022) in Eldoret central business district Kenya, investigated the Occupational health hazards faced by solid waste collectors in Eldoret Central Business District.

3.2 Area of Study

The study was conducted in Owerri-North L.G.A, one of the local governments in Imo State. Owerri North L.G.A. was created during the Administration of General Sani Abacha in 1996. This was the outcome of the appeal made by late Eze (Dr.) Onu Egwunwoke for the creation of Uratta L.G.A with headquarters at Orie Uratta. However, since the appeal for the creation of another Local Government by Emekuku/Emii and Alaenyi blocs did not come to fulfillment, they were merged into the said proposed Uratta L.G.A. which ended into changing the name to Owerri North L.G.A. to accommodate the new conformation. Owerri North is an urban Local Government Area with houses leaving in close proximity to each other giving room to less hygiene practice. It encircles Owerri Municipal like a peninsular. Six main roads pass through Owerri North Local Government communities. Within the North, Orlu Road ends up in Amakohia and Awkwakuma communities. In the East, Okigwe Road gives direction to Orji community. MCC Road leads off Wetheral Road to Obibi Uratta and Ihiteoha communities. In the South, Mbaise Road heads to Egbu and Emekuku communities, while Aba Road leads to Naze, Agbala, and Ulakwo communities. Owerri-North LGA occupies a

total area of 198 square kilometres and has a median temperature of 27 degrees centigrade. The LGA have quite a number of rivers and streams with average wind speed in the area put at 11 km/h.

Imo state is one of the states in the South East region of Nigeria. It was created on the 3rd February 1976 with the split of the former East Central States into Anambra and old Imo State (Imo State Government, 2005). Therefore, in 1992 there was another split of the old Imo State into two, which resulted in the creation of another new state known as Abia State and the present Imo State. The State is otherwise known as Eastern Heartland with Owerri as the Capital with a population of 4.8 million (National Bureau of Statistics of Nigeria, 2007). Imo State has three geographical zones and 27 local Government Areas.

According to National Population Commission of Nigeria [NPCN] (2016) the current estimated population of Owerri North LGA is put at 242,800 inhabitants with the area mostly populated by members of the Igbo ethnic group. The Igbo language is usually spoken within the LGA whereas the religion of Christianity is widely practiced within the area. Trade is a key feature of the economy of Owerri North LGA with the area known for having numerous markets where a surplus of commodities are bought and sold. Farming is also an important feature of the area's economy with crops such as oil palm, cassava, yam, vegetables and maize grown in the area. Other essential economic activities involved in by people of Owerri north LGA consist of hunting, animal rearing and welding. A number of festivals are celebrated in Owerri-North LGA and these include the Onwaoru, Uguuzo, and Onwa Awaka festivals.

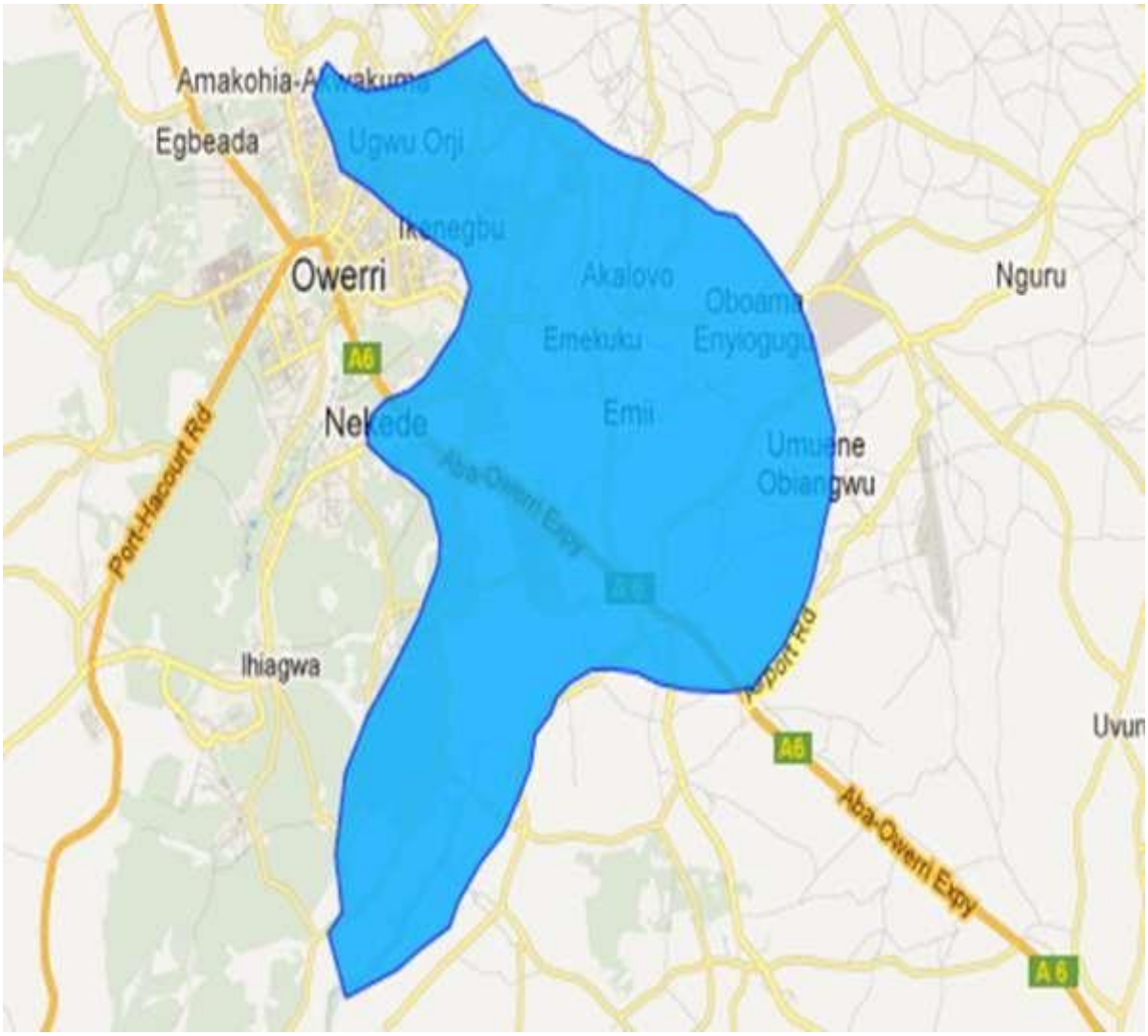

Fig. 3.1: Map of Owerri-North Local Government Area

Source: Nigeria – Mapcarta, 2018.

3.3 Study Population

The target population for this study consist of 55 scavengers in Owerri-North L.G.A. The number of the Scavengers was derived by the researcher from the current estimated population of scavengers in Owerri-North LGA. The scavengers for the study were selected randomly, 5 scavengers were selected each from 11 communities out of twenty-one communities that make up Owerri-North L.G.A. Some of these communities are rural communities such as Agbala,

Akwakuma, Amakohia, Emii, Ihitta-Ogada, Mbaoma, Emekuku, Egbu, Awaka, Orji, Urratta communities for the sample frame.

Inclusion Criteria

Participants eligible for inclusion in this study were:

- Solid waste scavengers currently engaged in scavenging activities in Owerri North Local Government Area, Imo State.
- Male and female scavengers aged 18 years and above.
- Scavengers who had been engaged in waste scavenging for at least six (6) months prior to the study.
- Scavengers who were available during the period of data collection.
- Scavengers who gave informed consent to participate in the study.

Exclusion Criteria

The following individuals were excluded from the study:

- Scavengers who declined to give informed consent.
- Scavengers who were ill or otherwise unable to participate at the time of data collection.

3.4 Sample Size and Sampling Methods

3.4.1 Sample Size

The sample size for this study consist of 49 scavengers Sample size was derived using Taro Yamane' formula for finite population.

Using Taro Yamane' formula for finite population

The Yamane sample size states that: $n = N/ (1+N$

$(e) 2)$

Where; n signifies sample size

N signifies the population size under study e signifies the

margin error (it could be 0.10, 0.05 or 0.01) n=52 / (1+

52 (0.05) 2) n= 52/ (1+52(0.0025) n=52/ (1+0.13) n=52/

(1.13) n = 46

Using non-Response Rate (NRR) at 4%; sample size =49 (See Appendix B)

3.4.2 Sampling Methods

Multi-stage sampling method was used for this study

Stage one: Selection of Wards

This stage involved the selection of the local government wards, out of twelve wards in Owerri north, six wards was selected which is Mbaoma, Emii, Emekuku 1 and 2, Awaka Ihitta Ogada ward using simple random samplings technique (balloting without replacement).

In stage two: Selection of the communities

Out of twenty-one communities in Owerri-North L.G.A which includes Agbala, Awaka, Akwakuma, Amakohia, Azara-Ubo, Emekuku, Emii, Ezimba, Egbu, Egbeluobube, Ihitoha, Ihitta Ogada, Mbaoma, Naze, Obibiezena, Obibiuratta, Obube, Orji, Owalla, Ulakwo, Umuakalikwu, six were selected which is Agbala, Awaka, Ulakwo, Ihitta Ogada, Emii, Emekuku. Using simple random sampling technique by (balloting without replacement).

In Stage three: Selection of Solid waste dumpsites

Dumpsites was selected from the six selected communities each in Owerri North local government area in Imo state. The proportional sample size for each of the selected communities were obtained, and the seven communities are Agbala, Awaka, Ulakwo, IhittaOgada, Emii, Emekuku. Using simple random sampling technique by (balloting without replacement).

In Stage four: Selection of respondent

Solid waste Scavengers were selected from the selected ea dumpsite through purposive sampling technique

3.5 Instruments for Data Collection

Self- structured survey questionnaire, observations and interview. was used for data collection, containing closed-ended questions with 6 sections. Section A is the demographic characteristics of the respondent which is age, sex, Education, marital status, occupation and monthly income. Section B contains 6 questions to determine the extent scavengers are exposed to physical health hazards in Owerri North local government area, Section C contains 4 questions to determine the extent scavengers are exposed to chemicals health hazards in Owerri north local government area, Section D contains 4 questions to determine the extent of scavengers are exposed to biological health hazards among solid wastes scavengers in Owerri north local government area, Section E contain 4 questions to determine the extent scavengers are exposed to ergonomical health hazards in Owerri north local government area, Section F contains 15questions to determine the preventive measure taken to prevent occupational health hazards among solid wastes scavengers in Owerri North local government area in Imo state after being validated and its reliability tested. The questionnaire had a total of 39 closed ended questions on a study of the assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State.

3.6 Validity of Instruments

The study questionnaire was validated for content relevance and appropriateness of language. It was reviewed by the researcher's supervisor and two other experts in the field of Public Health.

3.7 Reliability of Instrument

The questionnaire was administered to 49 respondents with similar characteristics to those in the target population. The reliability of the instrument was tested using Chronbach Alpha Coefficient of Reliability test, and a coefficient of (r = 0.70) was deemed reliable.

3.8 Methods of Data Collection

The researcher trained two research assistants who assisted in the data collection process. The introductory letter was given to the Head of Personnel Management of Owerri-North LGA, where the HOD health department documented the letter and handed the researcher to the head of environmental health unit Owerri North Council, who help to mobilised the CDDS of those selected community who took the researcher and her assistants to the sampled dumpsites. Some scavengers at those dumpsites were welcoming, few scavengers were surprised about our visit, after much explanations of our mission to get information, we were offered seats. The questionnaire was administered to the respondent by the researcher and research assistant after brief introduction of themselves and the significance of the research must have been explained to the respondent. After which a verbal consent was obtained from the respondent. The respondents that are literate were allowed to fill the questionnaire themselves but for those respondents that are non-literate in English language the questions were asked in local language and their responses were filled by the researcher (or research assistant).

3.9 Method of Data Analysis

Data analysis was conducted using IBM SPSS Statistics version 23. Descriptive analysis involved the generation of frequency distributions and summary statistics to describe respondents' socio-demographic characteristics, the extent of exposure to occupational health hazards, and the preventive measures adopted by solid waste scavengers.

Composite scores were generated to determine the overall extent of exposure to occupational health hazards and the level of preventive measures adopted. Each item was scored one (1) point, and the mean score was used to establish cut-off points for categorization. Scores below 3 were classified as very low extent, scores of 4–6 as low extent, and scores of 7–9 as high extent of exposure. The same scoring method was applied to assess preventive measures.

Inferential analysis was performed to examine the association between the extent of exposure to occupational health hazards and the preventive measures adopted. The chi-square (χ^2) test was used to test for statistical significance, while Fisher's exact test was applied for 2×2 contingency tables where the assumptions of the chi-square test were not met. All statistical tests were conducted at a 5% level of significance, and results with a p-value ≤ 0.05 were considered statistically significant.

3.10 Ethical consideration

An introductory letter was obtained from the Department of Public Health, Federal University of Technology, Owerri (FUTO), explaining the purpose of the study, the procedures involved, and the benefits of the research. This information, including assurances of confidentiality and voluntary participation, was clearly stated on the cover page of the questionnaire.

Approval to conduct the study was obtained from the Owerri North Local Government Area (LGA) authorities through the Director General, the Head of Personnel Management (HPM), the Head of the Primary Health Care Department, and the Head of the Environmental Health Unit of Owerri North LGA.

Prior to data collection, informed consent was obtained from all participants. Respondents were informed of their right to decline participation or withdraw from the study at any stage without any penalty. Confidentiality and anonymity were ensured by not including

participants' names or identifying information on the questionnaires. Data collected were used solely for academic purposes.

Throughout the study, ethical principles such as respect for persons, beneficence, and justice were upheld. Efforts were made to minimize bias, labeling, and any form of harm to participants before, during, and after the administration of the questionnaire.

CHAPTER FOUR

RESULTS

This chapter presents the detailed results of the analysis on the assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State. The data collected was meticulously analyzed and organized into detailed tables for clarity. Each table breaks down the variables studied, providing insights into the observed relationships and patterns. These results will underpin subsequent discussion and conclusions, shedding light on key trends and their implications.

4.1 Socio Demographic Characteristics

Table 4.1 shows the socio demographic characteristics of respondents. Majority of the respondents (32.7%) are within the age group of 38-47 while the least age group (6.1%) are within 48-57 and 58-67 respectively. Majority (89.8%), are male. 36.7% of the respondents attain primary and secondary education respectively. Majority (49.0%) are married while 6.1% are widowed. Majority (49.0%), are less than 5 years into the scavenging business while 4.1% have 15-19 years of experience. Majority (40.8%) earn less than N30,000 monthly from the scavenging business while 26.5% earn between N60,000-N89,000 monthly.

Table 4.1: Socio-Demographic Characteristics

Variables	Frequency (n)	Percent (%)
Age		
18-27	8	16.3
28-37	7	14.3
38-47	16	32.7
48-57	3	6.1
48–57	12	24.5
58-67	3	6.1
Sex		
Female	5	10.2
Male	44	89.8

Highest educational attainment		
No formal education	13	26.5
Primary education	18	36.7
Secondary education	18	36.7
Marital status		
Divorced	6	12.2
Married	24	49.0
Single	16	32.7
Widowed	3	6.1
Years in the Solid waste scavenging business		
10-14 year	12	24.4
15-19 years	2	4.1
5-9 years	13	26.5
Less than 5 years	22	44.9
Monthly income generated from solid wastes Sca enging		
Less than N30,000	20	40.8
N30,000-N59,000	16	32.7
N60,000-N89,000	13	26.5

4.1.2 Exposure of Respondents to Physical Health Hazards

Table 4.2 shows the respondents' exposure to physical health hazards. The majority (49.0%) reported they sometimes experience slips and falls while picking up solid waste, whereas 8.2% had never encountered slip or fall. 46.9% stated they sometimes pick waste during heavy rainfall, while 20.4% never so. 49.0% mentioned that they sometimes pick solid waste in excessively hot conditions. 55.1% of respondents reported never experiencing excessive noise in their work environment, while 44.9% sometimes encountered it. 69.4% of the respondents indicated that they collect solid waste in very hot weather, with 24.5% stating they never do

so. Majority (63.3%) reported always being exposed to sharps while 6.1% said they were not exposed to sharps.

Table 4.2: Exposure of Respondents to Physical Health Hazards.

Variables	Frequency (n)	Percent (%)
Involved in slip and fall while picking Solid waste?		
Always	21	42.9
Never	4	8.2
Sometimes	24	49.0
Pick solid waste during heavy rainfall?		
Always	16	32.7
Never	10	20.4
Sometimes	23	46.9
Pick solid waste during excessive heat?		
Always	18	36.7
Never	7	14.3

Sometimes	24	49.0
Presence of excessive noise in the environment where you pick solid waste?		
Never	27	55.1
Sometimes	22	44.9
Pick solid Wastes when the weather is very hot?		
Always	3	6.1
Never	12	24.5
Sometimes	34	69.4
Exposed to Sharps like needles, broken bottles, knifes, Aluminum while picking solid wastes?		
Always	31	63.3
Never	3	6.1
Sometimes	15	30.6

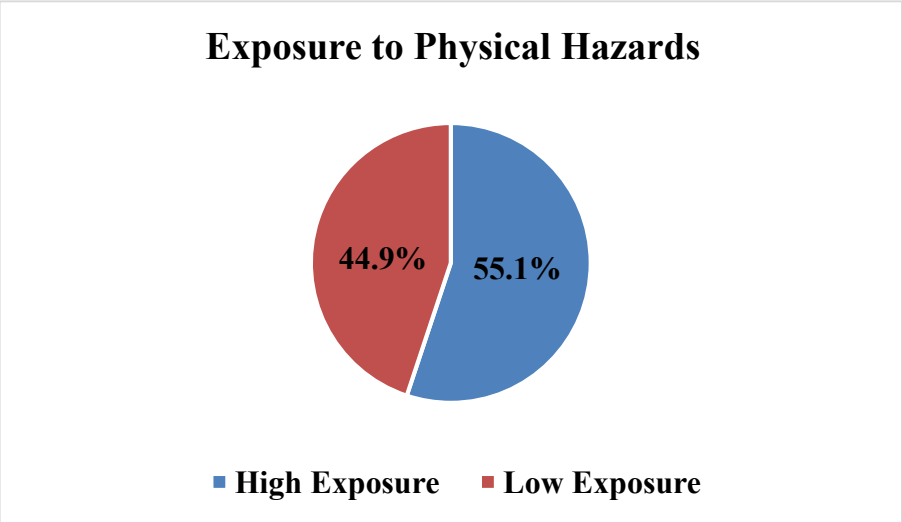

Figure 4.1: Overall Exposure of Respondents to Physical Health Hazards

Fig. 4.1 shows the Overall Exposure of Respondents to Physical Health Hazards. 55.1% have a high exposure while 44.9% have a low exposure to physical health hazard.

4.1.3 Exposure of Respondents to Chemical Health Hazards

Table 4.3 shows the exposure of respondents to chemical health hazards. 57.1% said they sometimes encounters burning at the dumpsite while 20.4% never encounter burning at the dumpsite. 51.0% said they are exposed to inhalation of Smoke from the burning dumpsites while 6.1% said they are never exposed to inhalation of Smoke from the burning dumpsites. Majority (59.2%), are exposed to inhalation of dust while picking solid waste while 8.2% are never exposed to inhalation of dust while picking solid waste. 75.5% of the respondents said they sometimes pick batteries while 16.3% said they never pick batteries.

Table 4.3: Exposure of Respondents to Chemical Health Hazards

Variables	Frequency (n)	Percent (%)
Encounters burning at the dumpsite?		
Always	11	22.4
Never	10	20.4
Sometimes	28	57.1
Exposed to inhalation of Smoke from the burning dumpsites?		
Always	21	42.9

Never	3	6.1
Sometimes	25	51.0
Exposed to inhalation of dust while picking solid waste		
Always	29	59.2
Never	4	8.2
Sometimes	16	32.7
Picks batteries as you pick solid wastes		
Always	4	8.2
Never	8	16.3
Sometimes	37	75.5

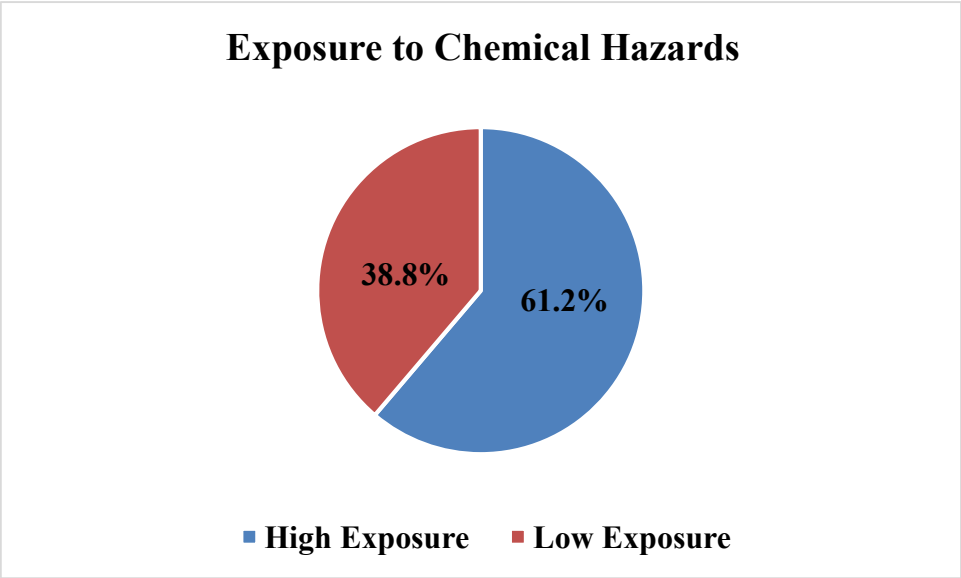

Figure 4.2: Overall Exposure of Respondents to Chemical Health Hazards

Fig. 4.2 shows the Overall Exposure of Respondents to chemical health hazards. 38.8% have a low exposure while 61.2% have a high exposure to chemical health hazard.

4.1.4 Exposure of Respondents to Biological Health Hazards

Table 4.4 shows the exposure of respondents to biological health hazards. 63.3% of the respondents said they sometimes experiences insects bite like mosquito while picking solid wastes at the dumpsites while 4.1% said they had never experienced insects bite like mosquito while picking solid wastes at the dumpsites. 85.7% of the respondents said they have never been bitten by a reptile. 100.0% said they have never been bitten by an animal like dog while picking solid wastes. All the respondents said they have never collected hospital waste during solid wastes picking.

Table 4.4: Exposure of Respondents to Biological Health Hazards

Variables	Frequency (n)	Percent (%)
Experiences insects bite like mosquito while picking solid wastes at the dumpsites		
Always	16	32.7
Never	2	4.1
Sometimes	31	63.3
Been bitten by a reptile		
Never	42	85.7
Sometimes	7	14.3
Bitten by an animal like dog while picking solid wastes?		
Never	49	100.0
Collects hospital waste during solid wastes picking		
Never	49	100.0

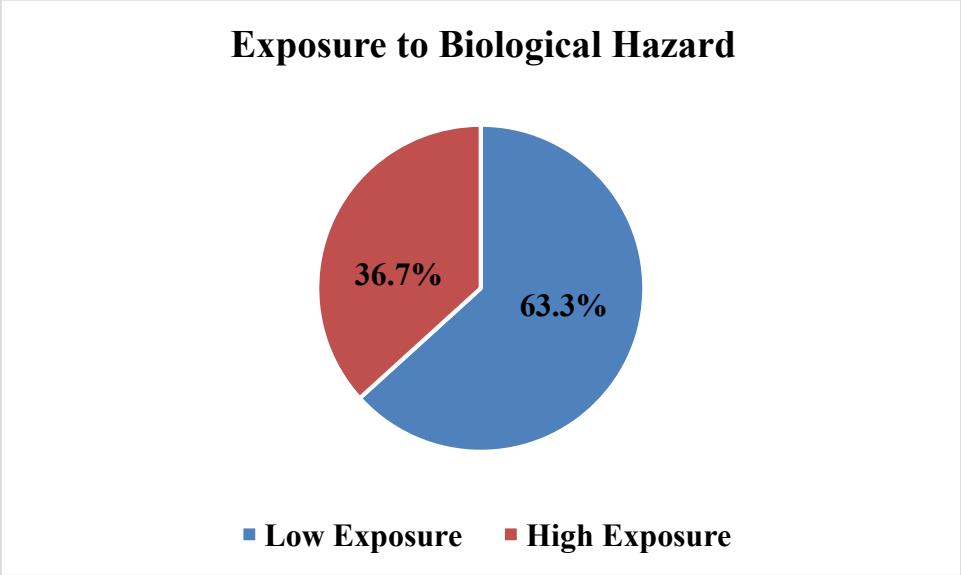

Figure 4.3: Overall Exposure of Respondents to Biological Health Hazards

Fig. 4.3 shows the Overall Exposure of Respondents to biological health hazards. 36.7% have a low exposure while 63.3% have a high exposure to biological health hazard.

4.1.5 Exposure of Respondent's to Ergonomical Health Hazards.

Table 4.5 shows the exposure of respondent's to ergonomical health hazards 53.1% of the respondents said they always lift solid waste materials picked by themselves while 8.2% said they do not. 65.3% of the respondents said the always push solid wastes materials picked while 4.1% said they do not. 51.0% of the respondents said they have been involved in pulling of solid waste while 2.0% said they do not. Majority (63.3%) of the respondents said they transport solid waste picked by carrying on their head while 36.7% said they uses truck**.**

Table 4.5: Exposure of Respondent's to Ergonomical Health Hazards

Variables	Frequency (n)	Percent (%)
Do you lift solid waste materials picked on your own		
Always	26	53.1
Never	4	8.2
Sometimes	19	38.8
Do you push solid wastes materials picked		
Always	32	65.3
Never	2	4.1
Sometimes	15	30.6
Have you been involved in pulling of solid waste?		
Always	23	46.9
Never	1	2.0
Sometimes	25	51.0
How do you transport solid wastes picked to your final destination?		
Carry on head	31	63.3
Truck	18	36.7

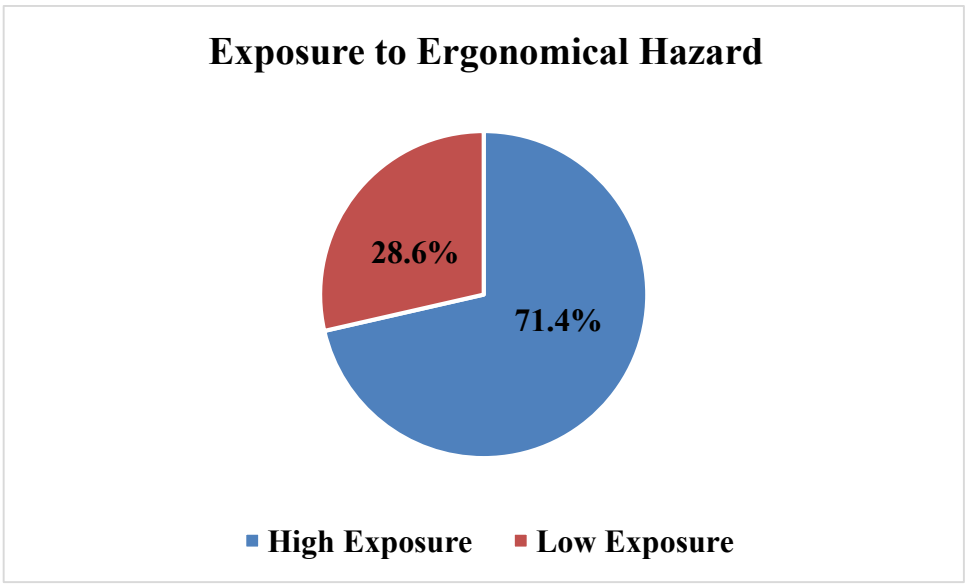

Figure 4.4: Overall Exposure of Respondents to Ergonomical Health Hazards

Figure 4.4 shows the Overall Exposure of Respondents to ergonomical health hazards. 71.4% have a high exposure while 28.6% have a low exposure to ergonomical health hazard.

4.1.6 Preventive practices taken by respondents against hazards resulting from scavenging

Table 4.6 shows the preventive practices taken by respondents against hazards resulting from scavenging. Majority (93.9%) of the respondents said they never wears rain coat while picking solid wastes under rain fall. 83.7% said they sometimes wear safety boot while picking solid waste while 10.2% never did. Majority (75.5% said they never wear nose mask while picking solid waste while 22.4% said the sometimes do. Majority (89.8%) said they never wears safety google while picking solid wastes during sunlight, 85.7% said they never wears hand gloves while picking solid waste. 95.9% said they never wears helmet to cover your head while picking solid waste during hot weather. 69.4% of the respondents said they sometimes wears overall while picking solid wastes. All the respondents said they never wears overall while picking solid wastes. 77.6% said they sometimes wears long sleeve shirts while picking solid wastes. 87.8% of the respondents said they always wears trouser while picking solid wastes. 93.9% of the respondents said they always washes their hands after picking solid wastes and takes bath after picking solid wastes respectively. All the respondents said they have not been vaccinated against tetanus and Hepatitis B respectively.

Table 4.6: Preventive practices taken by respondents against hazards resulting from scavenging.

Variables	Frequency (n)	Percent (%)
Wears rain coat while picking solid wastes under rain fall?		
Never	46	93.9
Sometimes	3	6.1
Wears safety boot while picking solid waste		
Always	3	6.1
Never	5	10.2
Sometimes	41	83.7
Wears nose mask while picking solid wastes		
Always	1	2.0
Never 37 75.5 Sometimes 11 22.4		
Wears safety google while picking solid wastes during sunlight?		
Never 44 89.8 Sometimes 5 10.2		
Wears hand gloves while picking Solid waste?		
Always	2	4.1
Never	42	85.7
Sometimes	5	10.2
Wears helmet to cover your head while picking Solid waste during hot whether?		
Never	47	95.9
Sometimes	2	4.1
Wears hat while picking solid wastes under hot whether?		
Always	7	14.3
Never	8	16.3
Sometimes	34	69.4
Wears overall while picking solid wastes		
Never	49	100.0
Wears long sleeve shirts while picking solid wastes		
Always	11	22.4
Sometimes	38	77.6
Wears trouser while picking solid wastes		
Always	43	87.8
Sometimes	6	12.2

Washes your hands after picking solid wastes		
Always	46	93.9
Sometimes	3	6.1
Takes bath after picking solid wastes		
Always	46	93.9
Sometimes	3	6.1
Been vaccinated against tetanus		
No	49	100.0
Been vaccinated against hepatitis B		
No	49	100.0

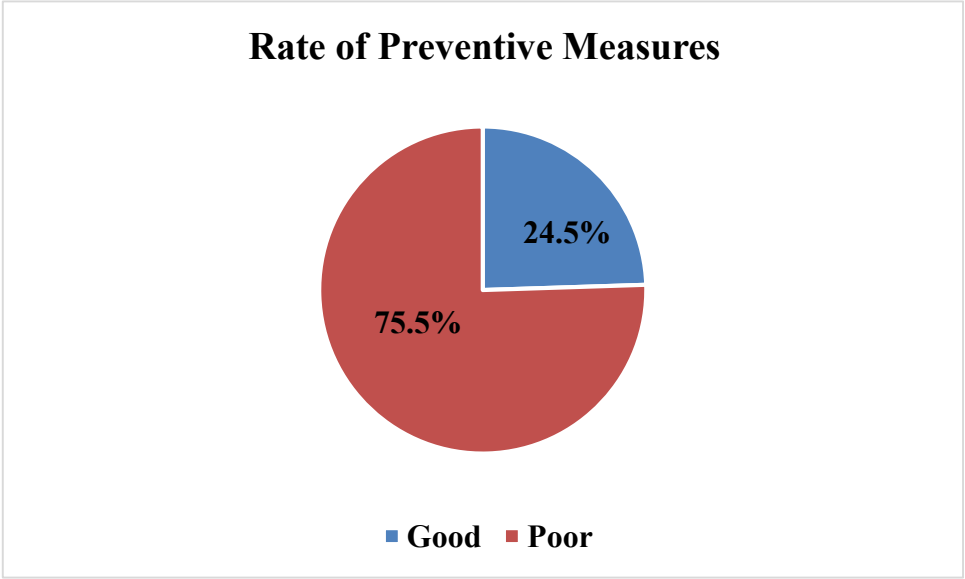

Figure 4.5: Overall Preventive Practices Taken by Respondents Against Hazards Resulting from Scavenging

Fig. 4.5 shows the overall preventive practices taken by respondents against hazards resulting from Scavenging. 75.5% have poor preventive practices while 24.5% have good preventive practices.

4.1.7 Association between Socio-demographic Characteristics of Respondents and Exposure to Physical Hazard during Scavenging activities

Table 4.7 shows the cross-tabulation between Socio-demographic Characteristics of Respondents and Exposure to Physical Hazard during Scavenging activities. No significant association was established between Exposure to Physical Hazard during Scavenging activities and Respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.296, 0.816, 0.794, 0.920, 0,373, 0.442 respectively).

4.7

Association between Socio-demographic Characteristics of Respondents and

demographic characteristics of

Exposure to Physical Hazard during Scavenging activities

Variable	Physical Hazards		Total	X^2	*p*-value
	High Exposure	Low Exposure			
Age 18-27	6(75.0)	2(25.0)	8	6.366	0.296
28-37	3(42.9)	4(57.1)	7		
38-47	10(62.5)	6(37.5)	16		
48-57	0(0.0)	3(100.0)	3		
48–57	7(58.3)	5(41.7)	12		
58-67	1(33.3)	2(66.7)	3		
Sex					
Female	3(60.0)	2(40.0)	5	0.054	0.816
Male	24(54.5)	20(45.5)	44		
Highest educational attai nment No formal education	7(53.8)	6(46.2)	13	0.46	0.794
Primary education	9(50.0)	9(50.0)	18		
Secondary education	11(61.1)	7(38.9)	18		
Marital status					
Divorced	3(50.0)	3(50.0)	6	0.495	0.920
Married	14(58.3)	10(41.7)	24		
Single	8(50.0)	8(50.0)	16		
Widowed	2(66.7)	1(33.3)	3		
Years in the Solid waste scavenging business					
10-14 year	6(50.0)	6(50.0)	12	3.124	0.373
15-19 years	1(50.0)	1(50.0)	2		
5-9 years	5(38.5)	8(61.5)	13		
Less than 5 years	15(68.2)	7(31.8)	22		
Estimated monthly inco ıe generated from solid wastes Scavenging					
Less than N30,000	13(65.0)	7(35.0)	20	1.634	0.442
N30,000-N59,000	7(43.8)	9(56.3)	16		
N60,000-N89,000	7(53.8)	6(46.2)	13		

Table : Association between Socio-demographic Characteristics of Respondents and

4.1.8

Exposure to Chemical Hazard during Scavenging activities Table 4.8 shows the cross-tabulation between Sociorespondents and Exposure to chemical hazard during scavenging activities. No significant association was established between exposure to chemical hazard during scavenging activities and respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.317, 0.363, 0.743, 0.802, 0.113, 0.161 respectively).

Association between Socio-demographic Characteristics of Respondents and

demographic characteristics of

4.8

Variables	Exposure to Chemical Hazard during Scavenging activities				
	High Exposure	Low Exposure	Total	X^2	*p*-value
Age					
18-27	4(50.0)	4(50.0)	8	6.075	0.317
28-37	6(85.7)	1(14.3)	7		
38-47	8(50.0)	8(50.0)	16		
48-57	3(100.0)	0(0.0)	3		
48–57	8(66.7)	4(33.3)	12		
58-67	1(33.3)	2(66.7)	3		
Sex					
Female	4(80.0)	1(20.0)	5	0.827	0.363
Male	26(59.1)	18(40.9)	44		
Highest educational attainment					
No formal education	9(69.2)	4(30.8)	13	0.595	0.743
Primary education	10(55.6)	8(44.4)	18		
Secondary education	11(61.1)	7(38.9)	18		
Marital status					
Divorced	4(66.7)	2(33.3)	6	0.998	0.802
Married	13(54.2)	11(45.8)	24		
Single	11(68.8)	5(31.3)	16		
Widowed	2(66.7)	1(33.3)	3		
Years in the Solid waste scave ging business					
10-14 year	10(83.3)	2(16.7)	12	5.969	0.113

Table : Association between Socio-demographic Characteristics of Respondents and

15-19 years	0(0.0)	2(100.0)	2		
5-9 years	7(53.8)	6(46.2)	13		
Less than 5 years	13(59.1)	9(40.9)	22		
Estimated monthly income generated from solid wastes Scaven ing					
Less than N30,000	15(75.0)	5(25.0)	20	3.657	0.161
N30,000-N59,000	7(43.8)	9(56.3)	16		
N60,000-N89,000	8(61.5)	5(38.5)	13		

4.1.9

Exposure to Biological Hazard during Scavenging activities Table 4.9 shows the cross-tabulation between Socio respondents and Exposure to biological hazard during scavenging activities. No significant association was established between exposure to biological hazard during scavenging activities and respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.617, 0.873, 0.222, 0.918, 0.914, 0.977 respectively).

Association between Socio-demographic Characteristics of Respondents and

demographic characteristics of

4.9

Variables	Exposure to Biological Hazard during Scavenging activities		Total	X^2	*p*-value
	High Exposure	Low Exposure			
Age					
18-27	6(75.0)	2(25.0)	8	3.615	0.617
28-37	4(57.1)	3(42.9)	7		
38-47	10(62.5)	637.5)	16		
48-57	1(33.3)	2(66.7)	3		
48–57	9(75.0)	3(25.0)	12		
58-67	1(33.3)	2(66.7)	3		
Sex					
Female	3(60.0)	2(40.0)	5	0.026	0.873
Male	28(63.6)	16(36.4)	44		
Highest educational attainment					
No formal education	8(61.5)	5(38.5)	13	3.011	0.222
Primary education	9(50.0)	9(50.0)	18		
Secondary education	14(77.8)	4(22.2)	18		

Table : Association between Socio-demographic Characteristics of Respondents and Marital status

Divorced	4(66.7)	2(33.3)	6	0.503	0.918
Married	14(58.3)	10(41.7)	24		
Single	11(68.8)	5(31.3)	16		
Widowed	2(66.7)	1(33.3)	3		
Years in the Solid waste scavenging business					
10-14 year	7(58.3)	5(41.7)	12	0.523	0.914
15-19 years	1(50.0)	1(50.0)	2		
5-9 years	8(61.5)	5(38.5)	13		
Less than 5 years	15(68.2)	7(31.8)	22		
Estimated monthly income generated from solid wastes Scavenging					
Less than N30,000	13(65.0)	7(35.0)	20	0.047	0.977
N30,000-N59,000	10(62.5)	6(37.5)	16		
N60,000-N89,000	8(61.5)	5(38.5)	13		

4.1.10

Exposure to Ergonomical Hazard during Scavenging activities Table 4.10 shows the cross-tabulation between Socio respondents and Exposure to ergonomic hazard during scavenging activities. No significant association was established between exposure to ergonomic hazard during scavenging activities and respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.216, 0.136, 1.764, 0.166, 0.679, 0.503 respectively).

Association between Socio-demographic Characteristics of Respondents and

demographic characteristics of

Table

4.10: Association between Socio-demographic Characteristics of Respondents and Exposure to Ergonomic Hazard during Scavenging activities

Variables	Ergonomical Hazard		Total	X^2	*p*-value
	High Exposure	Low Exposure			
Age 18-27					
	7(87.5)	1(12.5)	8	6.985	0.216
2a8-37	5(71.4)	2(28.6)	7		
38-47	9(56.3)	7(43.8)	16		
48-57	3(100.0)	0(0.0)	3		
48–57	10(83.3)	2(16.7)	12		
58-67	1(33.3)	2(66.7)	3		
Sex					
Female	5(100.0)	0(0.0)	5	2.227	0.136
Male	30(68.2)	14(31.8)	44		
Highest educational att inment					
No formal education	9(69.2)	4(30.8)	13	0.586	0.746
Primary education	14(77.8)	4(22.2)	18		
Secondary education	12(66.7)	6(33.3)	18		
Marital status					
Divorced	2(33.3)	4(66.7)	6	5.717	0.166
Married	18(75.0)	6(25.0)	24		
Single	12(75.0)	4(25.0)	16		
Widowed	3(100.0)	0(0.0)	3		
Years in the Solid waste scavenging business					
10-14 year	9(75.0)	3(25.0)	12	1.516	0.679
15-19 years	1(50.0)	1(50.0)	2		
5-9 years	8(61.5)	5(38.5)	13		
Less than 5 years	17(77.3)	5(22.7)	22		
Estimated monthly income generated from solid wastes cavenging				20	
Less than N30,000	16(80.0)	4(20.0)		1.376	0.503
N30,000-N59,000	10(62.5)	6(37.5)	16		
N60,000-N89,000	9(69.2)	4(30.8)	13		

4.1.11 Association between Socio-demographic Characteristics of Respondents the Preventive Practices Taken by Respondents Against Hazards Resulting from Scavenging

Table 4.11 shows the cross-tabulation between Socio-demographic characteristics of respondents and the preventive practices taken by respondents against hazards resulting from Scavenging. No significant association was preventive practices taken by respondents against hazards resulting from Scavenging and respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.438, 0.805, 0.202, 0.623, 0.190, 0.357 respectively).

Table

4.11: Association between Socio-demographic Characteristics of Respondents and Exposure to Ergonomic Hazard during Scavenging activities

Variables	Preventive Measures		Total	X^2	*p*-value
	Good	Poor			
Age					
18-27	2(25.0)	6(75.0)	8	4.322	0.438
28-37	2(28.6)	5(71.4)	7		
38-47	2(12.5)	14(87.5)	16		
48-57	1(33.3)	2(66.7)	3		
48–57	3(25.0)	9(75.0)	12		
58-67	2(66.7)	1(33.3)	3		
Sex					
Female	1(20.0)	4(80.0)	5	0.061	0.805
Male	11(25.0)	33(75.0)	44		
Highest educational attain ıent					
No formal education	2(15.4)	11(84.6)	13	3.197	0.202
Primary education	3(16.7)	15(83.3)	18		
Secondary education	7(38.9)	11(61.1)	18		
Marital status					
Divorced	1(16.7)	5(83.3)	6	2.472	0.623
Married	8(33.3)	16(66.7)	24		
Single	3(18.8)	13(81.3)	16		
Widowed	0(0.0)	3(100.0)	3		
Years in the Solid waste scavenging business					
10-14 year	2(16.7)	10(83.3)	12	4.762	0.190
15-19 years	1(50.0)	1(50.0)	2		
5-9 years	1(7.7)	12(92.3)	13		
Less than 5 years	8(36.4)	14(63.6)	22		
Estimated monthly income generated from solid wastes Scavenging					
Less than N30,000	7(35.0)	13(65.0)	20	2.063	0.357
N30,000-N59,000	3(18.8)	13(81.3)	16		
N60,000-N89,000	2(15.4)	11(84.6)	13		

4.2 Discussion

The study findings revealed that most solid waste scavengers were from the low economic background and most did not have formal education. Similar findings were reported, which showed that solid waste scavengers in developing countries were generally from poor backgrounds, uneducated and less skilled (Lissah *et al.,* 2020; Melaku & Tiruneh 2020). There were more male practicing solid waste in the current study likely because solid waste scavenging requires a lot of physical strength. Ziaei *et al.* (2018) also found that most of their participants drawn from African countries were males. Similarly, in Nigeria, Inyang (2007) had only male participants in his study. However, Njoku, Edkpayi and Odiya (2019) had more female solid waste scavengers in their study. The study finding's revealed also that most solid waste scavengers in Owerri North are exposed to Occupational health hazards, such as physical, chemical and Ergonomical health hazards, more few biological health hazard because of the lack of PPE. Therefore, solid waste Scavengers in Owerri North experienced injuries from sharps, road accident, cuts from broken bottles skin problems, respiratory problems, joint pain, musculoskeletal pain, respiratory problem, gastrointestinal problem because of the exposure to biological, physical, chemical and ergonomical health hazards which is as a result of lack of PPE during scavenging practice.

Similar findings have been reported by Inyang (2007) and Ncube, Ncube and Voyi (2017) who reported that solid waste scavengers experienced injuries, accidents and work-related diseases because of non-availability and non-use of PPE. The current study findings also concur with those by Melaku and Tiruneh (2020) who reported that solid waste Scavengers in most developing countries were exposed to occupational health problems because of lack of PPE. Personal protective equipment provides the first line of defence against hazards but aren't

effective in preventing injuries and accidents. Solid waste scavengers were only provided with face masks and hand gloves but were not given full body cover.

Solid waste scavengers also complained that they were exposed to excessive noise levels from busy streets, heavy garbage trucks and the passing traffic. Thus, some scavengers experienced hearing disorders because they are not supplied with earmuffs. Moreover, high noise levels expose solid waste scavengers to accidents because they cannot hear warning sounds from the cars. Some solid waste scavengers climb and sit on top of the truck full of garbage, thus exposing themselves to falling from the moving truck. Similar findings were reported among solid waste scavengers in Zimbabwe and the Netherlands and the United Kingdom where noise has been blamed for causing most accidents that occurred among solid waste (Ncube *et al.,* 2017; Pereira-de-Paiva *et al.,* 2017). Also, some noise from solid waste emanates from glass and metal tins during emptying of metal bins on the metal floor of waste collection vehicles (Suthar, Rayal & Ahada 2016). Mehlum and Aarhus (2020) also reported that occupational noise exposure in a workplace is a cause of noise-induced hearing loss and tinnitus as well as other health outcomes like hypertension, distress and occupational injuries.

Solid waste scavengers indicated exposure to extreme weather conditions such as excessive sun and cold weather conditions that expose them to health problems such as respiratory symptoms, itching eyes, skin rashes and flu-like symptoms. This is because solid waste are not provided with suitable PPE. They were sometimes compelled to use plastic bags to wrap their hands or use bare hands when collecting solid waste. Parallel results were also confirmed by several researchers who said solid waste scavenging is an outdoor activity that exposes workers to extreme hot and cold temperatures, thus exposing solid waste scavengers to health problems such as dizziness, skin rashes, asthma and skin cancer if protective equipment were not provided (Inyang 2007; Ncube *et al.,* 2017).

Solid waste scavengers mentioned that they suffer from body pains, and most of them complained about backaches because of lifting heavy containers and walking for long distances when collecting waste. Similar findings were reported from different studies done

on solid waste scavengers who complained about musculoskeletal symptoms such as backache, shoulder ache, wrist pain and joint problems (Bulduk 2019; Zakaria *et al.,* 2017).

Solid waste scavenging is a labour-intensive occupation that requires strength, which involves carrying, lifting, sorting and loading waste into collection truck or vehicles. There is a need to introduce a hydraulic system for removing waste that can be used in garbage trucks to load, lift and transport solid types of waste. A hydraulic system makes it easier for garbage trucks to load, lift and transport both solid types of waste (Pires *et al.,* 2019). There is a need to develop low-cost measures such as training solid waste Scavengers on correct posture (Ncube *et al.,* 2017). Several researchers from Nigeria, Thailand and South Africa also point out that waste handlers are injured and suffer from bacterial or viral diseases because they do not have proper PPE. Solid waste Scavengers suffer from health hazards such as dermatitis, cuts, burns, hepatitis, respiratory ailments and bites from snakes or mosquitoes (Made *et al.,* 2020; Ncube *et al.,* 2017).

Solid waste scavengers complained of community harassment and discrimination at work as some of the psychological stressors. Similarly, Pereira-de-Paiva *et al.* (2017) found that municipal waste handlers suffer from historical discrimination because of the low nature of their work. The study further revealed that solid waste Scavengers experience physical violence, verbal abuse and spitting from members of the public.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

This chapter presents the conclusion and recommendation on the assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State based on the data analyzed in the previous chapter.

5.1 Conclusion

The findings of this study showed relationship between the assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State. The findings above showed that collection of data on Occupational health hazards among solid wastes scavengers in Owerri-North L.G.A at the community level is feasible. It also showed the necessity for preventive measures of occupational health hazards among solid wastes scavengers focusing on hazard reduction, prevention and control. The result showed the possibility of avoiding the occurrence of occupational health hazards, reduced the burden of diseases by increasing prevention method, appropriate preventive training and modification of these occupational health hazards-factors such as Identification of those occupational health hazards, which is identification of those occupational health hazard that have the potential to cause harm (hazard identification) to the solid waste scavengers and take precautions towards preventing those hazards factors, analysis and evaluation which is analysing and evaluating the factors in association with that hazard (factors analysis, and factors evaluation), dose- Response assessment which is relationship between exposure and effects, exposure assessment which is frequency, timing, and levels of contact with the potential occupational health hazards, determining appropriate ways to eliminate hazard or control the risk when the hazard cannot be eliminated (risk control).

5.2 Recommendations

1. Solid waste scavengers should be educated on preventive measures of occupational health hazards which will be beneficial to solid wastes scavengers and will help improve behaviour of solid waste scavengers towards the waste handling and scavenging, thus there should be a call for educational intervention to improve the knowledge of occupational health hazards among solid waste scavengers, this is based on the expectation that good knowledge of hazards associated with the activities of the scavengers can reduce the rate and spread of the Infection.

2. Scavenging should be modified in such as a manner that scavengers will be organized under a recognized and approved body which will be subject to a regulatory agency to make sure that their activities are in conformity with Imo State health and environmental standards and do not jeopardize their health.

3. Solid waste organizations should enter into informal agreements or formal contracts with businesses, industry, and neighborhood associations to gain access to recyclable materials or to sell materials or manufactured items. One of the main benefits of formalization is the possibility of entering into agreements or contracts for recycling programs with separation at source. Recovering materials that have been separated at source raises the productivity and incomes of solid waste scavengers by freeing them from having to walk several miles a day in search of materials. By taking their work out of dumpsites, it also greatly reduces health implications from contact with waste.

4. It is recommended that further studies on occupational health hazards among solid waste scavengers can be conducted e.g the effect of health education program on knowledge of occupational health hazards among solid waste scavengers in Imo State.

5.3 Contribution to Knowledge

The study concerning the assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State, contributes significantly to knowledge by establishing the reality of these hazards, outlining a framework for prevention, and offering structural recommendations for improving scavenger health and livelihood.

The key contributions to knowledge include:

1. Establishment of Health Hazard Relationship and Data Feasibility

The study found a relationship between assessment of occupational health hazards among solid waste scavengers in Owerri North Local Government Area, Imo State. A practical contribution is the confirmation that collecting data on these occupational health hazards at the community level is feasible.

2. A Framework for Hazard Prevention and Control

The findings demonstrate the possibility of reducing the disease burden and avoiding the occurrence of occupational health hazards through increased prevention methods, appropriate preventive training, and the modification of specific hazard factors. The study identified several critical steps necessary for effective hazard prevention and control, including:

a. **Hazard identification:** Identifying those occupational health hazards that have the potential to cause harm to the scavengers.

b. **Analysis and evaluation:** Analyzing and evaluating the factors associated with that hazard (factors analysis, and factors evaluation).

c. **Dose-Response assessment:** Determining the relationship between exposure and effects.

d. **Exposure assessment:** Evaluating the frequency, timing, and levels of contact with potential occupational health hazards.

e. **Risk control:** Determining appropriate ways to eliminate the hazard or control the risk when elimination is not possible.

3. The Central Role of Education in Infection Reduction

The research highlights the expectation that good knowledge of hazards associated with scavenging activities can reduce the rate and spread of infection. This insight strongly supports the call for educational intervention to improve scavengers' knowledge of preventive measures, thereby improving their behavior towards waste handling and scavenging.

4. Policy Insights on Formalization and Modification

A significant contribution involves the recommendation to modify scavenging activities through formalization, which offers powerful benefits for health and income.

- **Regulatory Structure:** The study proposes that scavengers be organized under a recognized and approved body that is subject to a regulatory agency. This structure would ensure their activities conform to Imo State health and environmental standards and safeguard their health.

- **Economic and Health Benefits of Contracts:** It is suggested that solid waste organizations enter into formal contracts or informal agreements with businesses, industry, and neighborhood associations to gain access to recyclable materials or to sell materials. This formalization allows for recycling programs with separation at source. Recovering source-separated materials significantly raises the productivity and incomes of solid waste scavengers, and, crucially, removes their work from dumpsites, which greatly reduces health implications from waste contact.

In essence, the study provides a roadmap moving from identifying the relationship between solid waste scavenging and occupational health issues to establishing a detailed plan for prevention, training, and policy reform through formal organization and contractual source separation.

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APPENDIX A

FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI
SCHOOL OF HEALTH TECHNOLOGY
DEPARTMENT OF PUBLIC HEALTH

Dear respondent,

My name is OKPARA BARBARA OLUEBUBE and I am pursuing a Master of Public Health Degree in the department of Public Health, Federal University of Technology, Owerri.

I am carrying out a study on "OCCUPATIONAL HEALTH HAZARD AMONG SOLID WASTES SCAVENGERS IN OWERRI NORTH LGA IMO STATE NIGRIA", for my thesis.

I seek your voluntary participation and honest responses to the items in this questionnaire. All information collected will be treated with utmost confidentiality. Kindly sign the consent form below if you agree to participate in this study.

Thank you for your participation.

Okpara, Barbara O.
Phone: 08144590235

CONSENT FORM

This study titled **Occupational health hazard among solid waste scavengers in OwerriNorth LGA Imo State Nigeria** already explained to you is for academic purpose and your participation is voluntary. You are free to seek further clarification about the study and/or discontinue your participation at any point if you so desire. I request that you kindly sign below, as proof of your consent to this voluntary and willingly participation.

Sign: _____ Date: _____

QUESTIONNAIRE

OCCUPATIONAL HEALTH HAZARDS AMONG SOLID WASTE SCAVENGERS IN OWERRI NORTH LOCAL GOVERNMENT AREA IMO STATE NIGERIA.

SECTION A: **DEMOGRAPHIC CHARACTERATIES.**
Instruction: Pleases tick* [√] *at the option that best represent your answer.

1.What is your age as at last birthday(in years)?
(a) 18-27 [ ] (b) 28–37[ ] (c) 38-47 [ ] (d) 48–57 [ ] (e) 58-67 [ ] (f) 68-77 [ ]
(g) 78-87 [ ] (h) 88 & above [ ]

2. What is your Sex?
(a) Female [ ] (b) Male [ ]
3. What is your highest educational attainment?

(a) No formal education (b) Primary education [ ] (c) Secondary education [ ] (d) Tertiary education [ ]

4. What is your marital status?
(a) Single [ ] (b) Married [ ] (c) Separated [ ] (d) Widowed [ ] (e) Divorced [ ]
(f) Others (Specify) _____

5. Years in the business?
(a) 5- 10 years[ ] (b) 10-15 years [ ] (c) 15- 20 years [ ]
(d) 20-30 years [ ] 30-35 years [ ]
(f) 35 – 40 years (specify)_____

6. What is your estimated income generated
(a) Less than ₦30,000 [ ] (b) ₦30,000-₦59,000 [ ] (c) ₦60,000-₦89,000 [ ]
(d) ₦90,000-₦119,000 [ ] (e)₦120,000 - ₦149,000 [ ] (f) ₦150,000 & above [ ]

SECTION B: EXTENT OF PHYSICAL HEALTH HAZARDS.
Instruction: Pleases tick* [√] *at the option that best represent your answer.

7. To what extent have you been sick while working as a solid waste scavengers?
(a)Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

8. To what extent have you been exposed to noise and vibration? (a)Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

9. To what extent have you been exposed to hot whether while scavenging?
(a)Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

10. To what extent have you experienced injury cause by broken bottles and sharps while working as a solid waste scavengers.
(a)Very high extent [ ] (b) High extent [ ] (c) Low extent[ ](d) Very low extent [ ].

11. To what extent have you been exposed to cold whether while working?
(a)Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ]

12. To what extent have you experienced fall while working due to slippery or moving vehicles? (a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent
[ ].

13. To what extent do you work on the road while traffic flows?
(a)very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

SECTION C: EXTENT OF CHEMICAL HEALTH HAZARDS.

Instruction: Pleases tick* [√] *at the option that best represent your answer.

14. To what extent have you been exposed to unpleasant smell
(a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

15. To what extent have you been exposed to Smoke while working as a solid waste scavengers? (a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].
16. To what extent have you been practicing solid waste burning in the dumpsite to extract some valuables? (a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

17. To what extent have you experienced difficult in breathing while working as a solid waste scavengers. (a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

18. To what extent have you been exposed to dust while working as a solid waste scavengers. (a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

19. To what extent have you experienced cough while working as a solid waste scavengers. (a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

SECTION D: EXTENT OF BIOLOGICAL HEALTH HAZARDS.
Instruction: Pleases tick* [√] *at the option that best represent your answer.

20. To what extent have you been exposed to insect bite while working as a solid waste scavengers. (a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

21. To what extent have you been exposed to creeping reptiles while working as a solid waste scavengers. (a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

22. To what extent have you been practicing bathing after scavenging?
(a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

23. what extent have you been practicing hand washing during eating at the dumpsite or after scavenging. (a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

SECTION E: EXTENT OF ERGONOMICAL HEALTH HAZARDS.
Instruction: Pleases tick* [√] *at the option that best represent your answer.

24. To what extent have you been lifting heavy objects during scavenging.
(a) Very High extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

25. To what extent have you been exposed to twisting and bending of waist during scavenging at the dumpsite or after scavenging? (a)Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

26. To what extent have you been experiencing eye problem in the course of scavenging? (a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

SECTION F: PREVENTIVE MEASURE TAKEN.
Instruction: Pleases tick* [√] *at the option that best represent your answer.

27. To what extent do you wear protective cloth while Scavenging?
(a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

28. To what extent do you wear safety boot while scavenging?
(a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

29. To what extent do you wear nose mask while scavenging?
(a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

30. To what extent do you wear safety google while scavenging?
(a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

31. To what extent do you wear hand gloves while Scavenging?
(a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

32. To what extent do you where helmet while scavenging?
(a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent [ ].

33. To what extent do you vaccinate against tetanus, hepatitis B to prevent the occurrence of the disease while scavenging?
(a) Very high extent [ ] (b) High extent [ ] (c) Low extent [ ] (d) Very low extent

34. Where do you receive health care whenever you are sick or feel ill. (a) Health Centre [ ] (b) Hospital [ ] (c) I visit the traditional healer [ ] (d) Others (specify).....

Thanks for participating.

APPENDIX B

DEFINITION OF TERMS

Scavengers: Scavenger is defined as a person who picks up recyclable/re-usable materials from mixed solid wastes stream wherever it may be temporally accessible or disposed of or further use and/or processing.

Hazard: Hazards is defined as the potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

Health: Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO).

Solid Wastes: Solid waste is defined as all wastes arising from human and animal activities that normally solid and are discarded as useless or unwanted, it is also defined as any discarded material that is abandoned by being disposed of, burned or incinerated, recycled or considered "waste-like.

Occupational health hazards: Occupational health hazards is defined as risk or dangers as a consequence of the nature of the working conditions of a particular work. It can also refer to a work, material, substances, process, or situation that predisposes, or causes accidents or diseases at a workplace.

Occupational hazard: Occupational health hazard is defined as a hazard experienced in the workplace.

Physical Hazards: Physical hazards is defined as a subtype of occupational health hazards that involve environmental hazards that can cause harm with or without contact.

Chemical hazards: Chemical hazards is defined as a subtype of occupational hazards that involve a wide variety of chemicals.

Biological Hazard: Biological hazards can be defined as biological agents that can cause harm which include bacteria, viruses, fungi, microorganisms and toxins.

Ergonomic hazards: Ergonomic hazard is defined as physical component in the environment that damages the musculoskeletal system is known as an ergonomic hazard.

APPENDIX C

Sample Size and Sampling Methods Sample Size

The sample size for this study consist of 49 scavengers Sample size was derived using Taro Yamane' formula for finite population.

Using Taro Yamane' formula for finite population

The Yamane sample size states that: n = N/ (1 +

N (e) 2)

Where; n signifies sample size

N signifies the population size under study e signifies the

margin error (it could be 0.10, 0.05 or 0.01) n = 52 / (1 +

52 (0.05) 2) n = 52/ (1 + 52(0.0025) n = 52/ (1 + 0.13) n =

52/ (1.13) n = 46

APPENDIX D

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B.Sc, M.Sc, Ph.D
Head of Department: Dr. C. C. Iwuala
B.Sc, MPH, Ph.D.

Our Ref: FUT/SOHT/PUH/CS.006/VOL. 1
Your Ref:

August 12th, 2024.

Dear Sir/Ma,

LETTER OF INTRODUCTION

The bearer **OKPARA BARBARA OLUEBUBE** with Registration number **20194195908** is a bona-fide MPH Post graduate student of Federal University of Technology Owerri, of the Department of Public Health. As part of requirement for MPH Post graduate students, she is expected to carry out well-articulated research.

Accordingly **OKPARA BARBARA OLUEBUBE** is seeking to carry out his research on the topic: **OCCUPATIONAL HEALTH HAZARDS AMONG SOLID WASTE SCAVENGERS IN OWERRI NORTH LOCAL GOVERNMENT AREA IMO STATE.** We would appreciate your kind assistance towards the realization of this Compulsory requirement for her MPH post graduate program.
Please give her the necessary assistance she requires for a successful program.

Best regards.

HOD OF DEPARTMENT

Dr. C. C. Iwuala
HOD Public Health

APPENDIX E VALIDATION OF QUESTIONNAIRE

NAME: UKPARA BARBARA CHUEBUBE
08144590235

Face and Content Validity of This Study has been done by Dr ... Dept of Public ... IMSU, Owerri ... 28/06/24

QUESTIONNAIRE

OCCUPATIONAL HEALTH HAZARDS AMONG SOLID WASTE SCAVENGERS IN OWERRI NORTH LOCAL GOVERNMENT AREA IMO STATE NIGERIA.

SECTION A: SOCIO DEMOGRAPHIC CHARACTERISTICS.

ID NO: - - - -

Instruction: Pleases tick [√] at the option that best represent your answer.

1.What is your age as at last birthday(in years)?
(a) 18-27 [ ] (b) 28–37[ ] (c) 38-47 [ ] (d) 48–57 [ ] (e) 58-67 [ ] (f) 68-77[ ] (g) others (Specify)____________

2.What is your Sex?
(a) Female [ ] (b) Male [ ]

3.What is your highest educational attainment?
(a) No formal education (b) Primary education [ ] (c) Secondary education [ ] (d) Tertiary education [ ]

4. What is your marital status?
(a) Single [ ] (b) Married [ ] (c) Separated [ ] (d) Widowed [ ] (e) Divorced [ ] (f) Others(Specify)____________

5.Years in the Solid waste scavenging business?
(a) Less than 5 years [ ] (b) 5-9 years [ ] (c) 10- 14 years (d) 15-19 years [ ] (e) 20-24years [ ]
(f) 25– 29 years (f) Other (specify)____________

6.What is your estimated monthly income generated from solid wastes Scavenging?
(a) Less than ₦30,000 [ ] (b) ₦30,000-₦59,000 [ ] (c) ₦60,000-₦89,000 [ ] (d) ₦90,000-₦119,000 [ ] (e) ₦120,000 - ₦149,000 [ ] (f) ₦150,000 and 179 [ ](g) Others (Specify)____________

SECTION B EXPOSURE TO PHYSICAL HEALTH HAZARDS.

Instruction: Pleases tick [√] at the option that ~~best represent your~~ answer.

7.Have you been involved in slip and fall while picking Solid waste?
(a) Always (every time) [ ] (b) Sometimes (Once in a while [ ] (c) Never (not at all [ ]

8.Do you go out to pick solid waste during heavy rainfall?
(a)Always (every time) [ ](b) Sometimes (once in a while/occasionally) [ ] (c) Never (not at all) [ ]

9.Do you go out to pick solid during excessive heat?
(a)Always (every time) [ ] (b) Sometimes once in a while/occasionally [ ] (c) Never (not at all) [ ]

Have you ever experienced bites and stings from insects, Scorpions etc in the course of Scavenging => Bites can also qualify as physical Hazards