EVALUATION OF THE RISK FACTORS ASSOCIATED WITH MUNICIPAL SOLID WASTE SCAVENGING: A CASE STUDY OF TWO WASTE DUMPSITES IN BENIN METROPOLIS

BY

Confidence Aigbedion EBOSELUMEN (Miss)
LSC1806470

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT AND TOXICOLOGY
FACULTY OF LIFE SCIENCES
UNIVERSITY OF BENIN
BENIN CITY

APRIL, 2024

EVALUATION OF THE RISK FACTORS ASSOCIATED WITH MUNICIPAL SOLID WASTE SCAVENGING: A CASE STUDY OF TWO WASTE DUMPSITES IN BENIN METROPOLIS

BY

Confidence Aigbedion EBOSELUMEN (Miss)
LSC1806470

AN UNDERGRADUATE DISSERTATION SUBMITTED TO THE DEPARTMENT OF ENVIRONMENTAL MANAGEMENT AND TOXICOLOGY, FACULTY OF LIFE SCIENCES, UNIVERSITY OF BENIN, BENIN CITY, EDO STATE, NIGERIA; IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR AWARD OF BACHELOR OF SCIENCE (B.Sc.) DEGREE IN ENVIRONMENTAL MANAGEMENT AND TOXICOLOGY

APRIL, 2024

CERTIFICATION

This is to certify that this research titled "EVALUATION OF THE RISK FACTORS ASSOCIATED WITH MUNICIPAL SOLID WASTE SCAVENGING: A CASE STUDY OF TWO WASTE DUMPSITES IN BENIN METROPOLIS" was carried out by "CONFIDENCE EBOSELUMEN AIGBEDION" and presented to the Department of Environmental Management and Toxicology, Faculty of Life Sciences, University of Benin, Benin City; in partial fulfillment of the requirements for the award of Bachelor of Science (B.Sc.) in Environmental Management and Toxicology. It was conducted under suitable conditions, was carefully supervised and subsequently approved as having met the requirements for the award of Bachelor of Science degree in Environmental Management and Toxicology.

……. ……

PROF. ISOKEN TITO AIGHEWI **Date**

Project Supervisor

…… ……

PROF. A. ENUNEKU **Date**

Head of Department

DECLARATION

I CONFIDENCE EBOSELUMEN AIGBEDION declare that "EVALUATION OF THE RISK FACTORS ASSOCIATED WITH MUNICIPAL SOLID WASTE SCAVENGING: A CASE STUDY OF TWO WASTE DUMPSITES IN BENIN METROPOLIS"" is my own work and that all sources that I have used or quoted have been acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other University.

……
CONFIDENCE EBOSELUMEN AIGBEDION
Student

DEDICATION

This work is dedicated to Almighty God the fountain of knowledge and understanding whose wisdom is beyond human comprehension, for his love and indisputable mercy over my life.

ACKNOWLEDGEMENT

My sincere gratitude goes to God Almighty who has been kind and generous and His unending grace and mercies towards me, I am forever grateful.

I wish to laud the effort of my project supervisor PROF. ISOKEN TITO AIGHEWI, for his thorough guidance, support, insight, direction and assistance which helped in making this research work a reality. To the Head of Department of Environmental Management and Toxicology PROF. ALEX and all lecturers and non- lecturers of the Department of Environmental Management and Toxicology for all their efforts. Also to my Course Advisor DR. OSAYOMWANBO OSARENOTOR thank you for your advice and support. Also to MR KENNETH WOSGHIREN Director of Climate, Ministry of Environment and Sustainability, Edo State.

My profound gratitude goes to my parents Mr. and Mrs. AIGBEDION, for their support, encouragement, financially, morally and spiritually guidance which enabled me to successfully complete this programme. To my siblings Mr. and Mrs. Omos Nevill, Mrs. Juilet Light, Mr. Jeremiah and Mr. Festus.

Also to my special person OSMEA OSUAGWU CJ for your love, moral support, encouragement, prayers and financial support. To my friends Jemima, Nathalie, Excellent, Sandra and Chidima for their encouragement and support throughout this journey.

Also to Mr. Bartholomew who assisted in ensuring the success of this work.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

ABSTRACT

This study evaluated the operational and health risk factors associated with municipal solid waste scavenging in two privately-operated municipal Solid waste dumpsites in Benin City, Edo State. A well-structured questionnaire was administered to 100 randomly selected scavengers; the questionnaire covered demographics, personal details, and information on the types and frequencies of health hazards encountered by waste scavengers, providing insights into the challenges they face. The findings revealed significant health risks including injuries, respiratory problems, and gastrointestinal illnesses, highlighting the need for interventions to improve the safety and well-being of the scavenging operations. Furthermore, they also face several operational risks due largely to the lack of use of personal protection equipment, resulting in cuts, respiratory issues, and gastrointestinal illnesses, with a notable proportion experiencing frequent headaches and a high prevalence of malaria. We recommend that the operators of the dumpsites should be regulated by the Edo State Waste Management Board, with strict guidelines and punitive measures put in place for lack of compliance. On the part of the dumpsite operators, they should provide all necessary personal protection equipment and enforce their use as a standard operating procedure. Furthermore, first aid equipment for staff, drinking water and bathrooms with soap and water for their sanitation should be provided.

CHAPTER ONE

INTRODUCTION

Many nations worldwide experience various challenges in the management of solid waste. Such challenges vary from reducing waste generation, separation, collection, change of habits, reuse, transport, disposal and treatment of the same waste. According to the United Nations Environment Programme (UNEP, 2005), the challenges are mainly diverse for dissimilar levels of industrial growth in the country. In a trial to quicken the speed of its industrial development, a nation that is trying to develop its economy might pay insufficient attention to the solid waste management issue affecting the country. Ngoc and Schnitzer (2009) claim that a growing population, different changing patterns of consumption, economic development, varying income, industrialization and urbanization lead to increased waste generation. The known fact remains that solid waste generation will continue to rise yearly if not efficiently managed, and thus it interferes with the service delivery of a county or country (Karanja & Okoth, 2003).

Globally, municipal waste assortment and removal are especially risky in non-industrial urban communities, yet numerous Western urban communities have additionally wrestled with this issue before (and some likely still do). Girling (2015) saw that before the twentieth century, numerous urban communities in Europe suffocated in an ocean of trash with the vast majority of their city solid waste being unloaded into waterways and open sewers. Civil waste administrations were then poor and streams like the Rhine and Thames were just open sewers as they were vigorously contaminated with squander and were significant wellsprings of irresistible illnesses (Girling, 2015). These days, Western nations depend on ashore landfilling to beat the issue of waste gathering (Pacione, 2015). The landfill appears to have a unique fascination for civil waste chiefs since it offers a modest and advantageous choice for garbage removal

contrasted with different systems, for example, reuse, and energy recuperation (Ezeah *et al.,* 2010).

In Nigeria, the landscape of occupational safety and health (OSH) presents both progress and challenges. The country has established legal frameworks such as the Factories Act and the National Policy on Occupational Safety and Health, along with dedicated institutions like the Federal Ministry of Labour and Employment and the Nigeria Social Insurance Trust Fund (NSITF), aiming to protect workers' rights and enforce regulations. Recent years have seen increased awareness of OSH among stakeholders, driven by media coverage and advocacy campaigns (Elugoke *et al.,* 2019). However, challenges persist. Fragmented legislation and weak enforcement mechanisms hinder the effectiveness of OSH laws. Resource constraints and manpower limitations undermine enforcement efforts, particularly in the informal sector where many workers operate beyond regulatory reach. Additionally, a deeply ingrained culture prioritizing productivity over safety, fueled by economic pressures and lack of awareness, exacerbates risks (Ngoc, 2009). To advance OSH in Nigeria, several strategies are imperative. Strengthening enforcement mechanisms through increased resources, training, and improved data collection is essential. Promoting a safety culture requires sustained awareness campaigns and training programs. Harmonizing legislation into a unified OSH law would enhance effectiveness, while meaningful engagement among government, employers, workers, and civil society is crucial for driving change.

Waste scavengers,' are men, women and children that make their living by selling or using valuables from materials that households and commerce discard. Sarka (2003) described them as those who make a living by collecting and selling recyclable materials out of municipal solid waste. Scavenging is a widespread and regular activity in nearly all cities in developing countries.

"Some waste scavengers work at a single site that holds an abundance of waste like dump sites, or transfer stations. Others move from place to place, collecting materials from factories, offices, stores, schools, hospitals and residential areas. Others work at dump sites, canals, and rivers where people dump their refuse" (Aboagye-Larbi *et al.,* 2014). In the process, they make a significant contribution to environmental management in different cities and render services to the local economy (Elugoke *et al.,* 2019). Waste-scavengers play vital roles in solid waste management. In spite of this, they unfortunately have little or no social status. The roles of waste-scavengers include: waste collection, separation and reuse, thereby aiding recycling and reducing pressure on the environment.

Wastes scavengers at dump sites and on the streets are generally socially marginalized, they live and work without basic economic and social security, under conditions which are extremely hazardous to health and detrimental to family, social and educational development. Waste-scavengers are exposed to many health hazards; for instance, they often rummage through decaying organic waste, including toxic medical waste (Elugoke *et al.,* 2019). Most of them sort with bare hands and feet and thus are very vulnerable to infections due to direct contact. Waste-scavengers also frequently suffer injuries in the form of bruises and cuts from glass, metals, broken bottles and other sharp objects. Often children and the elderly are involved in this work, in Benin, one of Nigeria's main cities, many school age children walk around the city streets and dumpsites sorting a wide range of items. The composition of solid waste influences the roles of waste-scavengers, solid waste composition in Nigeria include: paper, metal, glass, textiles, food waste, garden trimmings and plastic/cellophane.

Solid wastes that are not composed of articles such as plastic, metal, glasses and other recyclables and reusable are of no interest to waste-scavengers. The kind of items or articles

discarded can tell us a great deal about the nature of the society that produces them and the availability or otherwise of waste-scavengers in that society.

Waste scavengers suffer many more illness and injuries than the general population. Particularly prevalent are gastrointestinal, respiratory and skin diseases, lead poisoning, and cuts from needles and broken glass (Ezeah *et al.,* 2010). Working in hazardous conditions has serious consequences for waste keepers. Life expectancy of Mexican waste keepers is 11 years lower than that overall Mexican population (53 versus 64) (World Bank 1994). Infant mortality among the Zabbelin waste collectors in Cairo is much higher than that of other residents of the city with about one in four infants dying before reaching their first birth day (Medina 1997), Waste-scavengers are part of society and waste picking poses substantial health and safety risks to them. The risks will continue to increase as the urban population increases and as their economic status improves. Those who will bear the brunt of this urban population increase and social-economic status improvement are the solid waste collectors and the recyclers/scavengers who will have to handle increasing quantities of municipal solid waste, industrial waste and hazardous waste. The solid waste collectors and informal recyclers are vulnerable informal settlement dwellers typified by poverty, homelessness and underemployment and are a population group at risk for exposure to physical injuries and waste hazards (Rotich, 2015). Even though the human risks of injuries and diseases and the associated monetary costs to vulnerable households are high, information available to public health practitioners is hardly enough for use in drawing stakeholder attention to reduce such risks.

However, solid waste handling is often unsafe due to among others non-segregation of waste at source, application of rudimentary and uncontrolled collection, recovery and processing methods and non-compliance with occupational safety and health regulations. This often results in not

only contaminated environments but also exposes the vulnerable collectors and recyclers who include women and children to harmful chemicals and injuries. While many of the occupational tragedies are preventable through the implementation of sound prevention, reporting and inspection practices, statistics on occupational diseases and injuries among waste collectors and informal waste recyclers are scarce and the occupational hazards facing them has not yet received the attention it deserves in research, public health agendas and at national and county government levels. Therefore, the purpose of this study is to evaluate the extent of occupational health among solid waste collectors' scavengers at dumpsites in Benin metropolis, Edo State, Nigeria

Benin City, the capital of Edo State in Nigeria, is a significant urban center with a rich population and sociopolitical landscape. Its population dynamics are influenced by historical significance, economic activities, and cultural heritage, with the Edo people constituting the indigenous population. The city's strategic location has contributed to its growth as a regional hub. Socio-politically, Benin City's history as the capital of the Edo Kingdom shapes its landscape, though interrupted by British colonization in 1897. Today, it remains a cultural and economic hub within Edo State, with governance structures overseen by the Edo State Government and traditional institutions. Benin City's sociopolitical geography reflects broader Nigerian political dynamics, with challenges including infrastructure development and managing population growth typical of urban areas.

The efficient management of solid waste is crucial for sustainable development, yet Benin metropolis in Edo State, Nigeria, faces challenges in waste collection and disposal due to rapid urbanization. Despite efforts by local authorities, inadequate waste collection systems lead to visible issues such as trash accumulation and blocked drains, impacting public health and the

environment, particularly affecting the poor. Solid waste scavengers face occupational hazards including exposure to physical, chemical, and biological risks due to manual tasks and inadequate protective measures. Despite extensive studies on waste management, specific health risks in Benin metropolis remain poorly understood. This research aims to address this gap by identifying occupational health risks among solid waste scavengers, aiming to inform practical solutions for solid waste management in the area.

1.1 OBJECTIVES

The objectives of this study are to:

1. Evaluate the major health risks factors associated with municipal solid waste scavenging in two waste dumpsite in Benin City metropolis, Edo state
2. Evaluate the operational risk factors associated with municipal waste processing at the waste dumpsites
3. Recommend mitigation factors

CHAPTER TWO

LITERATURE REVIEW

2.1 CONCEPT OF SOLID WASTE

Municipal solid waste commonly known as garbage or refuse is a waste type consisting of everyday items that are discarded by the public with variation from country to country. Municipal solid waste changes significantly with time and may include durable goods, non-durable goods, containers and packaging, food wastes and yard trimmings, and miscellaneous inorganic wastes (Jerrie, 2016). They are classified based on their composition as biodegradable (food and kitchen waste, green waste), recyclable (glass, bottles, plastics, metals), electrical (electrical appliances, televisions, computers), hazardous (paints, chemicals, light bulbs), and toxic (pesticides, herbicides) wastes. Four hierarchy ranking strategies have been developed by the United States of America for municipal solid waste management based on environmental friendliness from the most to the least preferred methods. These include; source reduction and reuse, recycling or composting, energy recovery as well as treatment and disposal (Ezeah, Clive, Paul, Mbeng and Nzeadibe, 2014).

2.1.1 SOLID WASTE MANAGEMENT

According to Adeniran *et al*. (2017), solid waste is any trash or junk that results from human or animal activity and is discarded because it is unwanted or useless. A region's primary sources of solid waste are residential, commercial, and industrial activity, which can be managed in a number of ways. Thus, landfills are characteristically categorized as municipal, sanitary, construction and industrial or demolition waste sites. Solid waste can be characterized centered on material, like plastic, glass, paper, organic and metal waste. Classification might similarly be centered on hazard potential, which include radioactive, flammable, toxic, non-toxic or infectious waste. Classifications may perhaps relate to the waste origin, like industrial, commercial, domestic, demolition and institutional or construction.

According to the Arab Reporters for Investigative Journalism (Austin, 2011), waste that is produced on the streets build unfriendly smells and is mainly form the breeding sites for insects and vermin that results to diseases; hazardous resources from aimlessly and erroneously discarded waste can leak into and

contaminate resources of water, which include groundwater or any main drinking water source. Thus polluted earth as well as water get into the body of human beings, through drinking water, animal products and vegetables, whereas burning the solid left-overs contaminates the air, leading to severe health issues, which include respiratory diseases, cancer, and other diseases. Irrespective of the starting point, hazard or content potential, every solid waste needs to be systematically controlled to guarantee ecological best practices. Since solid waste management is a life-threatening feature of environmental sanitation, it must be assimilated into the environmental planning agenda.

Since the hours of the modern unrest, business possibilities in metropolitan zones have consistently affected country metropolitan relocation, which has been the primary driver for metropolitan populace development. The yearly metropolitan territories populace development rate surpasses 4% in many nations (United Nations Human Settlements Programme [UN-HABITAT], 2010). With quickly progressively populaces in urban communities came a tremendous test in help conveyance like solid waste administration, a test that has kept on overpowering numerous legislatures and metropolitan specialists particularly in the creating scene.

Larger part of the neighborhood governments burns through 20% to 40% of their incomes on solid waste administration however, they cannot stay aware of the developing issue (UN-HABITAT, 2010). As per the World Health Organization, governments in non-industrial nations ought to focus on medical problems dependent on natural concerns (WHO, 2010). In general, in developing nations, under 30% of metropolitan zones have appropriate and normal trash assortment and removal frameworks (Onibokun, 2009).

Local governments frequently leave the capacity of waste administration to separate nearby specialists, which regularly come up short on the imperative ability to adapt to the assistance requests of quickly developing populaces. As such, metropolitan experts in most non-industrial nations just come up short on the specialized and infrastructural assets needed to go up against the waste administration issue (UNEP, 2007). The lack of limit in local specialists is typically caused by flimsy and ineffective waste management systems, in which little or no effort is diverted. Frameworks for managing solid waste are

designed to collect, store, manage, transport, process, and arrange solid wastes in a way that is environmentally sound (ensures biological systems), socially acceptable, and economically beneficial. In North America and Australia, acceptable solid waste management has been taken into account; it mostly consists of landfills and recycling techniques. (Reddy, 2011).

Municipal solid waste management creates one of the highest critical service delivery challenges that face the African cities and towns (Achankeng, 2003). Thus, various economic melt-down that Zimbabwe underwent throughout the 10 years, between 2000 and 2010 led to several challenges being influenced against all-encompassing urban operational Solid Waste Management. Such challenges comprised of the incapability of the municipalities to source for non-toxic water to the inhabitants, incapacity to dispose off sewage as well as the breakdown of service delivery and infrastructure in Solid Waste Management (SWM) activities from production of waste, storage, collection, and similarly safe disposal of the same waste. SWM is well-defined as the activity related to control of production of solid waste materials, collection, storage, transfer or transport, processing as well as disposal of the same waste in various means, which best address the issue of public health, economics, conservation, engineering, aesthetic and other environmentally friendly concerns.

2.2 CONCEPT OF WASTE SCAVENGING

International Labour Organisation (2004) defined scavenging as manual sorting and picking of recyclable/reusable materials from mixed wastes at legal and illegal landfills, dumpsites, street bins and piles, transfer points, as well as waste collection trucks. Okoye (2010) defined scavenger as a person who picks up recyclable/reusable materials from mixed solid wastes stream whenever it may be temporally accessible or disposed of or further use and/or processing. A waste scavenger is a person who salvages reusable or recyclable materials to sell or for personal consumption (Ebenezer, 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, and it has a financial impact of several billions of US dollars every year (Medina, 2010). According to him, scavenging is an example of

sustainable development, emphasizing that scavenging activity enhances environmental protection by increasing the amount of waste collected, reused 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.

In the view of Adewole (2009), scavengers are normally part of the socio-economic structure; their displacement from a disposal site can have many direct and indirect consequences. He also opined that unsupervised and uncontrolled scavenging is detrimental to the health and safety of the scavenger as well as personnel operating the facility. Scavenging is common occurrence in the third world countries, because of high unemployment, widespread poverty and lack of a safety net for the poor (Medina, 2001). According to Ackeman (2005), scavenging provides a spontaneous labour incentive solution, becoming an alternative means of achieving an integral solid waste management system.

The programme to reduce and segregate waste at source led to the conflict of interest between government and scavengers (Ejares, *et al*., 2014). They also opined that waste segregation offers an advantageous step for solid waste management programme but is detrimental to the informal sectors due to reduced volume of waste that reached the dumpsite. Waste recycling in many low-income countries is driven by the informal sector, often with minimal input from state institutions (Ezeah, *et al*., 2014). In general, informal recycling refers to the waste recycling activities of scavengers and other groups and recycling companies involved in the recovery, processing/transformation and trading on materials recovered from waste (Wilson, Araba, Chinwah and Cheesam, 2009).

Important role of scavenging is the fact that it represents an income-generating activity for the poorest in the developing world (Moreno-Sanchez, Maldonado, and Sheldon, 2003). They also stated that recovery of materials from solid wastes, if organized properly, can generate a livelihood for unskilled workers in a developing country environment. Although poverty is an important factor that causes people to become scavengers, it is not the only one. In times of war or severe economic crises, scavenging reappears with particular intensity (Medina, 2001).The problem of waste can be linked to the fact that the population is

on the increase and rates of consumption by various individuals increase by the day, which on the other hand has led to an increase in the amount of wastes generated (Elenwo, 2015). However, scavenging helps in reducing the quantum of wastes that goes to or remains at dumpsites/landfills. This paper is focused on a review of works on scavenging as a means of environmental management.

2.3 FACTORS PROMOTING SCAVENGING PRACTICE

Scavenging, the act of gleaning usable materials from discarded items, transcends a mere economic activity. It's a complex phenomenon deeply rooted in social, economic, and environmental realities, interwoven with global forces and localized nuances. To truly understand its drivers, we must venture beyond a cursory glance and embark on a comprehensive exploration.

1. **Driven by Desperation:** People turn to scavenging, often a risky and precarious occupation, when faced with limited job opportunities and the harsh realities of poverty, particularly in developing nations. It becomes a last resort, especially for those lacking education, skills, or facing discrimination in the formal job market. While the income may not always break the cycle of poverty, it offers a lifeline against extreme hardship (Nzeadibe and Iwuoba, 2008). Economic downturns exacerbate this trend, pushing more people towards scavenging as a means of survival. Rapid urbanization, further compounding poverty and unemployment, fuels the number of individuals resorting to this informal activity.
2. **Navigating the Informal Economy:** Beyond mere survival, waste picking serves as an entry point into the informal economy for marginalized individuals. It becomes a viable option for those with limited education or facing discrimination in the formal sector. The flexibility it offers allows individuals to manage their time and responsibilities effectively, balancing income generation with other commitments like childcare or education (Wilson, Velis and Cheesam, 2006). Furthermore, it provides a degree of autonomy and self-employment, unlike many low-skilled jobs. However, this informality comes at a cost, exposing workers to harsh working conditions, social stigma, and financial insecurity.

3. **Fueled by Demand, Complicated by Dynamics:** The global recycling industry's growing demand for recyclable materials provide incentive for scavenging activities. This demand, driven by factors like rising commodity prices and environmental concerns, creates a market for the materials collected by waste pickers (Adewule, 2009). These materials become integrated into complex supply chains, often involving intermediaries who buy from individual collectors. Specific materials like metals and plastics hold higher value, motivating individuals to scavenge, especially in areas with limited job opportunities. However, the power dynamics within these markets disadvantage waste pickers. Limited market information, monopolistic structures, and transportation costs often force them to sell at prices below market value. Additionally, increased demand for recyclables brings competition from established waste management entities, potentially marginalizing these informal workers (Medina, 2008).
4. **Filling the Gaps, Facing the Consequences:** In many regions, particularly developing countries, inadequate or absent waste management systems lead to vast amounts of waste being improperly disposed of, posing environmental and health threats. With the projected 70% increase in global waste by 2050 due to urbanization and consumerism, this problem is only expected to worsen (Elenwo, 2015). Scavenging steps in as a form of informal waste management, mitigating the issue by reducing waste in landfills and recovering valuable materials. These informal waste pickers contribute significantly to waste reduction, resource recovery, and recycling, even extending their services to street cleaning and waste collection, ultimately improving urban environments. Studies estimate that informal recycling saves landfill space and reduces environmental impact, including greenhouse gas emissions (UNEP, 2005). Despite their valuable contributions, these individuals face precarious working conditions and social marginalization. Policymakers need to recognize their role and create pathways for their integration into formal waste management systems, ensuring better working conditions, social protections, and acknowledging their contribution as environmental service providers.

5. **A Tangled Web of Urbanization and Waste:** Urbanization and the rise of consumerism significantly contribute to the ever-growing mountain of global waste. This trend presents both opportunities and challenges for waste pickers. Growing urban populations and changing consumption patterns, like the increased use of packaged goods, lead to more waste generation (Onibojun, 2009). The rise of single-use items and electronic waste adds further complexity to waste streams, posing challenges for both formal waste management and informal recycling practices. While the abundance of waste creates opportunities for waste pickers to collect recyclables, it also exposes them to health risks associated with hazardous materials like e-waste and medical waste (Allison and Von Blottnitz, 2010). Additionally, increased waste volumes and the involvement of official entities in waste collection can lead to competition and marginalization of these informal workers.

2.4 TYPES OF WASTE THAT ARE HAZARDOUS TO SOLID WASTE SCAVENGERS

In terms of waste management, the waste system, the job duties (assortment, transport, and reusing), and the type of hardware utilized all have an impact on the exposure to work-related dangers. The synthesis of waste, the idea of waste and its biodegradability, the methods for treating waste, the waste preparation processes that are utilized, and their removal, according to Cointreau (2006), govern the health risks inevitable to either the specialist or tenants surrounding waste offices. Although non-industrialized nations often experience low levels of economic activity, this does not mean that their solid waste is devoid of hazardous pollutants that pose serious health dangers to both the general public and solid waste personnel.

Workers who handle solid waste are at risk for health problems related to their jobs because of wastes such human feces, poisonous paper, pesticide deposits in trash cans, solvents, and small amounts of clinical waste like infusions, soiled cloths, and heavy metals in batteries. The Zimbabwean Environmental Management Act Chapter 20:27 defines dangerous waste as any substance that is poisonous, mutagenic, teratogenic, inflammable, responsive, touchy, destructive, and also irresistible. Waste isolation is not regularly done in non-industrialized nations, and as a result, filthy gauzes, wasted cotton fleece, and spent

infusions from medical facilities are frequently found mixed in with residential solid waste (Rushton, 2003).

Hazardous solvents, glues, plating materials, pesticides, asbestos-containing materials from construction and demolition projects, cleaning products, personal care items, automobile products, insecticides, herbicides, and a variety of batteries and sharps, like broken china, are among the waste stream's other components (Jerie, 2016). The collection of mixed garbage is permitted by the solid waste management systems in non-industrial nations like Zimbabwe, for instance, raising the health concerns caused by the numerous toxic synthetics. For instance, considerable levels of metals like mercury, cadmium, chromium, lead, and arsenic can be found in electronic waste (Jerie, 2016). Because these heavy metals are naturally neurotoxic and carcinogenic, they are associated with a number of health hazards (Van Eerd, 1997).

Inorganic arsenic is linked to illnesses like lung, kidney, bladder, and skin issues because of its capacity to cause sickness. Waste materials including polyvinyl chloride, cleaning product containers, and zinc batteries frequently contain cadmium. The body's internal systems, including the liver, kidneys, lungs, bones (which can cause osteoporosis), the brain, and the primary sensory system, are all negatively impacted by the huge quantity of metal that bio-accumulates there (Jerie, 2016). The same inventor claims that ingestion of harmful substances by accident through the skin, air, or bloodstream might hasten the development of cancer, cause birth defects, and cause casualties. The properties of combustible wastes can be determined using low-glimmer, readily landed focuses. Destructive waste are intended to eat and destroy biological and non-living tissues when they come into contact with them.

Mercury traces may be present in batteries, fungicides, and pharmaceutical disposal containers. The heavy element mercury has an especially bad effect on the nervous system. Some pesticides are resourceful by nature and have the potential to cause long-term harm, significant adverse effects, and ecological devastation. Biodegradable waste makes up a sizable component of solid waste. Food scraps and vegetable trash are examples of wastes with low lignin content that break down more quickly than wastes with high lignin concentration, such as paper and plastic (Jerie, 2016). the vast majority of biologically degradable substances in illnesses treated with natural remedies and waste (Tchobanoglous, 2003). Rats

and mice may live in biodegradable wastes, which also contain a lot of organic bacteria that cause sickness (Joseph *et al*., 2016).

2.5 OCCUPATIONAL CHALLENGES EXPERIENCED BY SOLID WASTE SCAVENGERS

SWM face various challenges when it comes to implementation. According to ARIJ (2009), these challenges comprise of critical funding shortages, and thus the international community has always given the provisions of major facilities and equipment. In the city of Nablus, every new infrastructure as well as major tools has been funded via either grant help or infrequent sponsoring from financial institutions such as the European Commission, and the donor nations. Although such financial support has made significant helps to the unit of waste management at Municipality of Nablus, still the unit is observed to lack various equipment and facilities, which include various types of containers having different functions, colors and sizes. According to UNEP (2005), the challenges are mainly diverse for dissimilar levels of industrial growth in the country. In a trial to quicken the speed of its industrial development, a nation that is trying to develop its economy might pay insufficient attention to the solid waste management issue affecting the country. Ngoc and Schnitzer (2009) claim that a growing population, different changing patterns of consumption, economic development, varying income, industrialization and urbanization lead to increased waste generation. The known fact remains that solid waste generation will continue to rise yearly if not efficiently managed, and thus it interferes with the service delivery of a county or country (Karanja & Okoth, 2003).

Because of this, many of the devices in use today are obsolete and ineffective. Lack of public awareness and participation may impede proper solid waste management. Lack of awareness and accompanying public ignorance, which are caused by unfavorable waste disposal and trash collection behaviors, continue to be the biggest problems for the entire Palestinian community when it comes to ecological concerns in general and SWM practices in particular. A lack of proper segregation practices exposes waste scavengers to serious health risks and increases the scope of those who are vulnerable to those risks, including doctors, nurses, patients, hospital management staff, the general public, and the environment, according to a study by Muniafu and Otiato (2010) that was based on a quantitative analysis of data.

Hospital trash is poorly disposed of as a result of incorrect waste segregation, disregard for local and system legislation, and disdain for WHO waste management guidelines. This, according to Muniafu and Otiato (2010), is a direct result of problems with ignorance, lax law enforcement, a lack of process ownership, and gaps in ongoing monitoring of waste management procedures. Muniafu and Otiato's (2010) work on the classification and management challenges of biomedical waste accurately illustrates practical issues to protect biomedical waste scavengers while having numerous gaps and methodological faults.

For agricultural country urban regions, the collection, transportation, and removal of solid waste comes at a massive cost: garbage executives typically account for 30 to 50 percent of metro operational budgets. Urban areas only collect between 50 and 80 percent of the decrease produced despite these high uses. For instance, as an agricultural country, India gathers almost 50% of the decrease that is made. Removal is given less thought, although 90% of the MSW collected in developing metropolitan areas ends up in an open landfill (Cointreau 2006). Additionally, residents in areas where low-pay networks are required to pick up refuse tend to either dump their trash in the next open area, spring, stream, or vacant lot, or to literally consume it on their terraces. When it rains, uncollected trash can accumulate on the streets and public spaces, potentially causing flooding. Additionally, run-off water can carry waste to lakes, oceans, and waterways, impacting those areas (Bullard, 2011). Another option is to end up as trash in an open landfill, which is the most common method of removal in non-industrial nations, regardless of whether it is legal or not.

Solid garbage that is unloaded in the open poses unique risks to the environment and human health. Methane gas, which can cause fire and explosions and contribute to changes in the climate and ecosystem worldwide, is produced when natural resources are decommissioned. An open landfill's natural and chemical cycles result in solid leachates, which contaminate groundwater and the surface (Medina, 2008). Additionally, fires do occasionally break out in open landfills, bringing smoke and increasing air pollution. For instance, in Coast, a fire at the nearby open landfill burned for more than six months. At

open dumps, flames occasionally break out suddenly, fuelled by the warmth and methane produced by natural decomposition.

Additionally, some metropolitan towns' dump managers willfully set fire to their facilities on occasion in an effort to reduce the weight of the rubbish there, allowing for the placement of additional waste there and extending the life of the dumps (Bryant, 2011). Additionally, human scavengers may start intentional fires because metals are easier to find and recover amid the cinders than they are among piles of mixed waste. To the unloading locations, food leftovers and kitchen waste attract rodents, insects, birds, and other types of animals. People who live nearby may contract diseases from animals being cared for at waste sites. The biodegradation of natural materials may have occurred decades ago, which may limit the use of the area where open dump locations are found in the future (Medina, 2008).

Inadequate training for waste scavengers, a lack of monitoring and control systems, a lack of personnel protective equipment during the segregation and transportation of biomedical waste, careless dumping of clinical waste within the non-infectious waste, and exposing workers to the risk of waste hazards (Egondi *et al*. 2015). From a management perspective, Allison and Von Blottnitz (2010) noted that waste segregation reduces risks to scavengers while simultaneously lowering the cost of disposal because some non-hazardous wastes can be recycled or reused, which lowers expenses.

In accordance with a regulatory requirement for waste management compliance, Ahmed *et al*. (2015) found that 90% of Nairobi County biomedical waste scavengers had subpar audit reports with records of work-related incidents. Ahmed *et al*. (2015) evaluated the record-keeping compliance of 30 firms out of 100 that produce biological waste and found that 73% did not preserve records to avoid accountability for workers who were at risk of accidents and other working risks. The study found that liquid wastes, plastics, incinerator ash, and injuries from sharp objects like needles and knives were the main sources of infection for diseases including hepatitis B and HIV. According to Parizeau (2015), there are a number of new challenges relating to workplace accidents and accidents at work, such as a lack of information about how to apply preventive measures to human health and contamination from untreated anatomical waste.

Absence of advanced technological capacity for separation of waste at the immediate source is considered as one of the main factors that help in hindering effective SWM. Waste recycling is costly. Even though current years have had a rise in various waste recycling amenities, the recycling economics is still unfavorable. In several cases, waste recycling is costly when compared to purchasing the product. Thus, the support of the government in terms of inexpensive land for landfills and grants are usually essential for profitable practicality. There is also underdeveloped market for the products developed through recycling process. Inadequate demand for the recycled goods in the local market is an additional reason that has hindered the development of the waste recycling business. Therefore, there exists some units taking part in recycling waste plastics, paper and paperboard (Ajani, 2008). The main technical issues that face many cities include, inaccessibility due to the urban and geographical structure, deficiency of appropriately planned collection time schedule and route system, malfunctioning and inadequate operation equipment. These combined with open garbage burning, poor final dump site condition and dropping litter at the corner around the waste containers are activities that promote illegal dumping (Siddharudha and Sowmyashree, 2015).

Ahmed *et al*., (2015) found that poorly maintained incinerators, which are frequently in poor operational condition, were the major issues encountered by biomedical institutions. Incinerators must be in good working order to minimize or eliminate risks associated with the workplace, particularly those posed by dangerous compounds such heavy metals and dioxin. Particularly when dealing with biological waste and in situations requiring the treatment of waste, Siddharudha and Sowmyashree (2015) urged that compliance with special equipment handling requirements, including emergency procedures in case of accidents, be necessary (Garg & Sarkar, 2013). The report suggested suggestions for groups to launch training and awareness-raising initiatives for institutions that produce medical waste and biological waste scavengers. The Department of Occupational Safety and Health, NEMA, and the Kenya National Biosafety Authority are appropriate entities to carry out such awareness-raising activities (DOSH). When handling trash, mishaps frequently involved bleeding into the nose, open skin, or mucocutaneous damage, which occurs when blood splashes into the mouth (Patan & Mathur, 2015). Additionally, they came to the

conclusion that improper handling of various biological waste kinds during collection and disposal greatly increased workplace mishaps.

2.6 RISKS ASSOCIATED WITH SOLID WASTE SCAVENGERS

Waste scavenging, while offering a means of livelihood for some, presents a multitude of health and occupational risks that demand attention. This section delves deeply into each of these risks, highlighting the potential consequences and emphasizing the need for preventive measures.

Injuries: The very nature of waste scavenging exposes individuals to a constant threat of physical harm. Sharp objects like broken glass, metal fragments, and contaminated needles, often present in waste piles, can inflict cuts, punctures, and lacerations (Nguyen *et al*., 2003). These injuries can be particularly severe if not adequately treated promptly, leading to potential infections and long-term complications. Additionally, the heavy lifting involved in carrying waste materials puts tremendous strain on the musculoskeletal system, often resulting in back pain, joint pain, and muscle strain. The uneven terrain and precarious conditions of poorly managed dumpsites further heighten the risk of falls and accidents, potentially causing serious injuries like fractures and head trauma (Wilson *et al*., 2006).

Infections: Waste serves as a breeding ground for various pathogens, posing a significant threat of infectious diseases to waste scavengers. Direct contact with contaminated waste exposes them to potentially life-threatening illnesses like typhoid, cholera, hepatitis B and C, and even HIV/AIDS (Cointreau, 2006). Bacterial and viral infections can spread rapidly through contaminated materials, causing severe health complications, particularly for individuals with weakened immune systems. Moreover, waste containing fecal matter harbors parasitic worms and protozoa, leading to intestinal illnesses like diarrhea, dysentery, and abdominal pain. Puncture wounds sustained from contaminated objects, if not properly immunized against, can lead to tetanus infection, further adding to the health risks faced by waste scavengers (Nzeadibe, 2009).

Respiratory Problems: Inhaling dust and smoke generated from burning waste poses a serious threat to the respiratory health of waste scavengers. Fine particles from dust can irritate the airways, leading to coughing, wheezing, and difficulty breathing. Chronic exposure to dust can worsen pre-existing

respiratory conditions like asthma and bronchitis, significantly impacting quality of life (Nzeadibe and Iwuoha, 2008). Additionally, exposure to harmful fumes from burning chemicals, plastics, and other hazardous materials can cause respiratory irritation, coughing, and even chemical burns in the lungs. These fumes can damage the delicate lung tissue, leading to long-term respiratory problems and potentially increasing the risk of lung infections and even cancer.

Chemical Exposure: Waste scavenging exposes individuals to a cocktail of harmful chemicals, posing a significant threat to their overall health. Leachate, the liquid that drains from landfills, can contain heavy metals like lead, mercury, and cadmium. These heavy metals can accumulate in the body over time, leading to various health problems including neurological damage, kidney and liver dysfunction, and birth defects in pregnant women who are exposed (Wang *et al*., 2012). Furthermore, discarded pesticides, herbicides, and other toxic chemicals often find their way into waste streams, posing a risk of poisoning, skin irritation, and other health complications. Chronic exposure to these toxins can cause long-term health problems, impacting various organ systems and potentially leading to cancer (Frazzoli *et al*., 2010; Kristen *et al*., 2013).

Mental Health: The harsh working conditions, poverty, and social stigma associated with waste scavenging can take a significant toll on the mental health of individuals engaged in this occupation. The constant exposure to hazardous materials, the physical toll of the work, and the lack of social acceptance can lead to significant psychological stress, anxiety, and depression (Nguyen *et al*., 2003). Additionally, witnessing the harsh realities of poverty and the struggle for survival can have a profound psychological impact, especially on children who are sometimes forced into waste scavenging. These mental health challenges, if left unaddressed, can have a debilitating effect on the overall well-being of waste scavengers and their families.

For countless individuals across the globe, scavenging discarded materials represents a desperate struggle for survival. Yet, this informal occupation casts a long shadow, weaving a web of health risks as intricate as the waste itself. From the physical assaults of contaminated debris to the insidious threats of chemical exposure, the path of a scavenger is fraught with perils.

Scavengers operate at the very interface of society's discards, confronting a potent cocktail of contaminants. Unsorted waste harbors a breeding ground of pathogens, with studies revealing an elevated risk of infectious diseases like hepatitis B and C due to exposure to residential and hospital waste (Austin & Schill, 2011). This constant barrage extends beyond mere infections, triggering a cascade of respiratory issues. Inhaling bio-mists laden with microorganisms and their toxic byproducts, scavengers face heightened risks of developing chronic bronchitis, asthma, and other debilitating lung conditions (Beasley, 2010).

Lurking beyond the immediate dangers of pathogens lie even more insidious threats. Improperly disposed household hazardous waste unleashes a silent assassin in the form of leaching chemicals. These toxins contaminate nearby groundwater, poisoning the very source of life for scavenger communities. Furthermore, inhalation exposes individuals to a multitude of harmful toxins directly impacting the respiratory system, skin, and eyes. Studies by Abhay (2010) highlight the prevalence of skin and eye irritation, fatigue, and headaches among waste pickers, serving as stark reminders of the constant chemical warfare waged within landfills and dumpsites.

The impact of waste scavenging transcends individual health, disproportionately affecting some of society's most vulnerable populations. Children, with their developing bodies and immature immune systems, are particularly susceptible. Research by Medina (2008) paints a grim picture, revealing the detrimental effects of electronic waste exposure on children's growth and development, potentially stunting their physical and cognitive potential. Pregnant women, exposed to these toxins, unknowingly pass them on to their unborn children, perpetuating a cycle of harm across generations.

The hazardous journey of a scavenger extends beyond the realm of physical ailments. Open burning of waste releases a plume of airborne pollutants, exacerbating respiratory problems not only for scavengers but also for surrounding communities (Bullard, 2011). This environmental injustice amplifies the health burden, creating a domino effect of suffering. Furthermore, the precarious nature of this work often relegates individuals to the margins of society, exposing them to social marginalization, economic insecurity, and psychological distress, compounding the overall burden they carry.

The perilous path of solid waste scavenging demands immediate and multifaceted intervention. Implementing safer waste management practices is paramount, including waste segregation at source**,** establishment of designated collection points, and investment in proper disposal facilities. Equipping scavengers with protective gear like masks, gloves, and boots can provide a crucial shield against immediate threats. However, addressing the root causes requires further action. Investing in research to quantify the health burden and its economic impact is vital to raise awareness and advocate for systemic change. Additionally, promoting formal waste recycling program**s** that offer fair compensation and safe working conditions can empower scavengers and transition them into dignified livelihoods (Beasley, 2010).

Mitigating the health crisis faced by solid waste scavengers necessitates a collective effort. By acknowledging the gravity of the situation, implementing targeted interventions, and fostering a culture of responsibility, we can pave the way for a future where waste scavenging no longer comes at the cost of human health and well-being.

CHAPTER THREE

METHODOLOGY

3.1 STUDY AREA

This research will be carried out in Benin City, Edo State, Nigeria. Positioned at Latitude: 6.633958864 and Longitude: 5.928960026, Benin City serves as the focal point for examining the risks associated with municipal solid waste scavenging. The investigation is centered on two specific waste dumpsites, namely Wemtap and Anthas, with their precise locations detailed in Figure 1. These dumpsites are situated in the Oredo Local Government Area of Edo State, specifically along Omo Imasuen Street and Vesa Road, off Enogie Road, Ihinmwinrin community, Benin City.

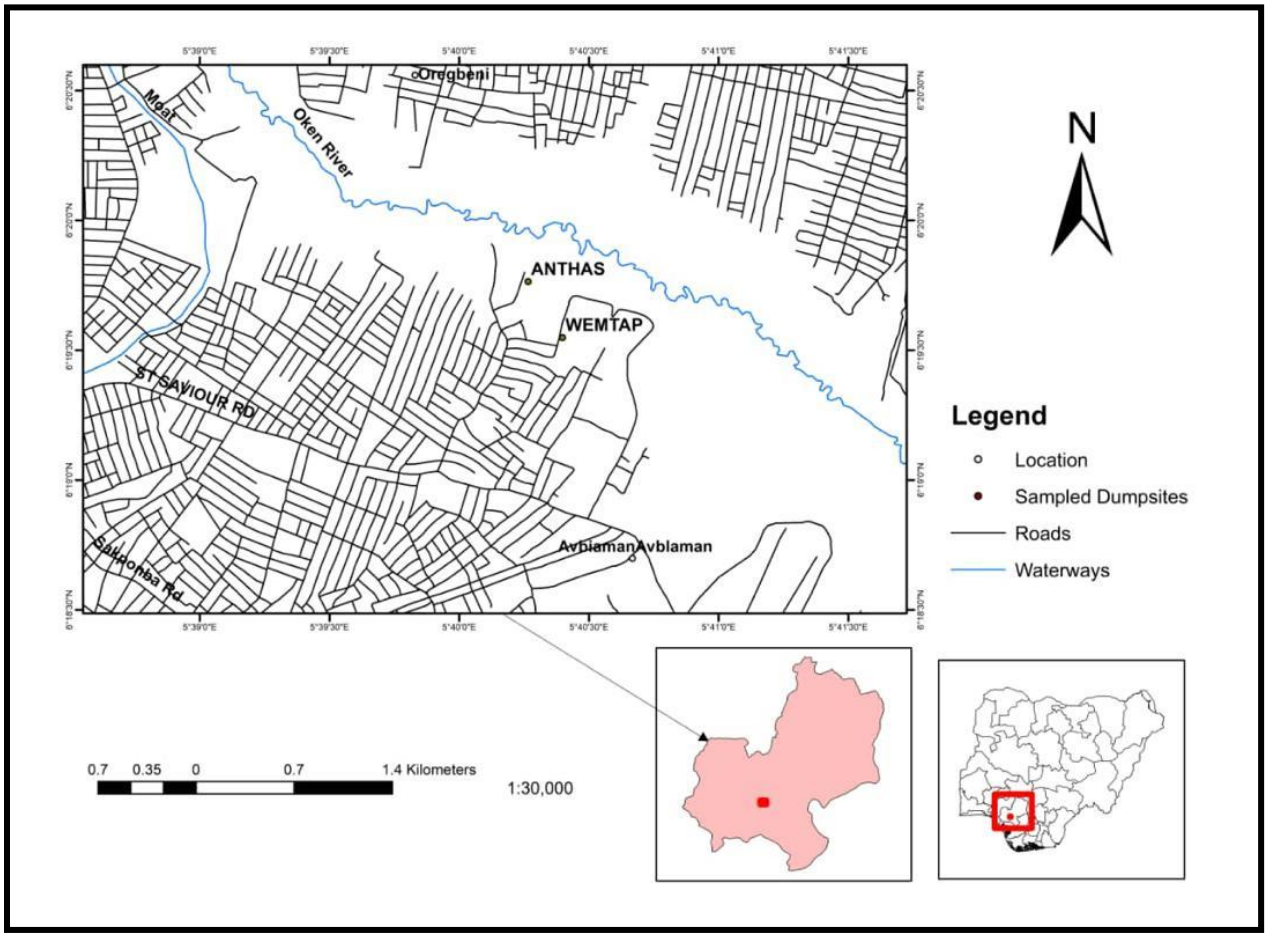

Fig 3.1: Map of Edo State, showing study Location

The study focuses on people involved in waste scavenging and recycling in Edo State, Nigeria. These individuals perform tasks like collecting, sorting, recycling, and selling waste materials. Despite their crucial role in waste management, they often lack formal occupational protection and face marginalization.

To overcome challenges in reaching the entire population, a simple sampling method was used. This involves selecting individuals who are easily accessible and willing to participate, offering a practical way to collect data (Etikan *et al*., 2016). Despite potential sampling bias, the pragmatic needs of field research in this context justify this method.

A well-structured questionnaire was given to 100 randomly chosen respondents from two waste dump sites. The questionnaire covered diverse information, including demographics, personal details, and information about the types and frequencies of health hazards faced by waste scavengers. It also explored the rate of occupational injuries and diseases among them. This thorough approach provided a solid understanding of the challenges faced by waste scavengers, informing potential interventions to improve their occupational safety and well-being.

Prior to analysis, a rigorous data cleaning process was implemented to identify and rectify any inconsistencies, missing values, or outliers, ensuring data reliability. Percentages was employed to quantify the prevalence and distribution of various factors, aiding in understanding the proportion of respondents with specific characteristics. Visual representations, such as bar charts and histograms, will be utilized to illustrate response distributions and identify patterns or trends.

Table 3.1: Measurement of questionnaire operationalization

S/N	Variable	Operationalized definition	Measurement scale	Question number
1.	Demography	Percentage of responses for the 6 items testing the demography of the respondents	Relative to question	Q. i– Q. vi
2.	Attitudes while working	Percentage of responses for the 8 items testing the attitudes of the respondents while working	Relative to question	Q.1 – Q8
3.	Perception of waste scavengers	Percentage of responses for the 3 items testing the perception of respondents	2-point scale	Q.9 – Q11
4.	Prone occupation risks of waste scavengers	Percentage of responses for the 8 items testing the respondents prone to health risks	2-point scale	Q.12a – Q.12h
5.	Prone occupation risks	Percentage of responses for the 11 items testing the respondents prone to occupation risks	2-point scale	Q.13 – Q.23
6.	Observed protective equipment on respondents	Percentage of respondents for the 8 items testing the observed protective equipment on respondents	2-point scale	Q.24 – Q.31

Source: Researcher construction, 2024

CHAPTER FOUR

RESULTS

4.1 DEMOGRAPHY OF STUDY SUBJECTS

All one hundred questionnaires administered in this survey were returned successfully. Of these, 63 were males (63%) while 37 or 37.0% were females. The data shows a clear gender disparity among waste dump scavengers. Specifically, men appear to be more prevalent in this occupation at the two locations investigated (see Figure 4.1). The age of the scavengers ranged from less than 18 to greater than 50 as shown in Figure 4.2, however, while 84% of the scavengers were within the age bracket of 19-50 years old; those within the age bracket of 31-50 constituted the majority.

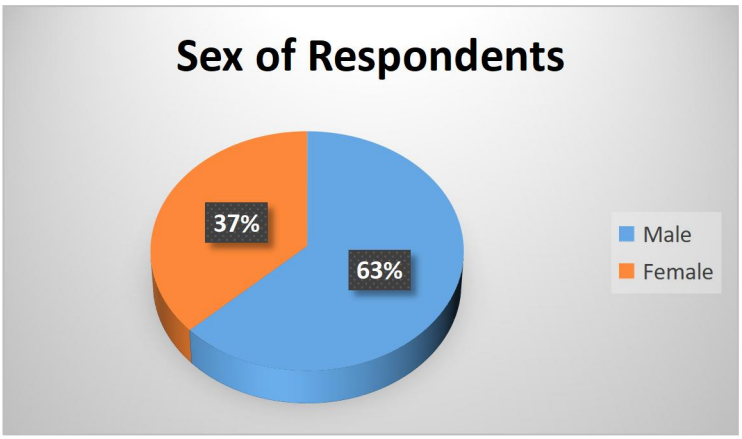

Fig. 4.1: Sex of Scavengers

The proportion of subjects less than 18 years and over 50 years are few and made up 16% of the scavengers surveyed.

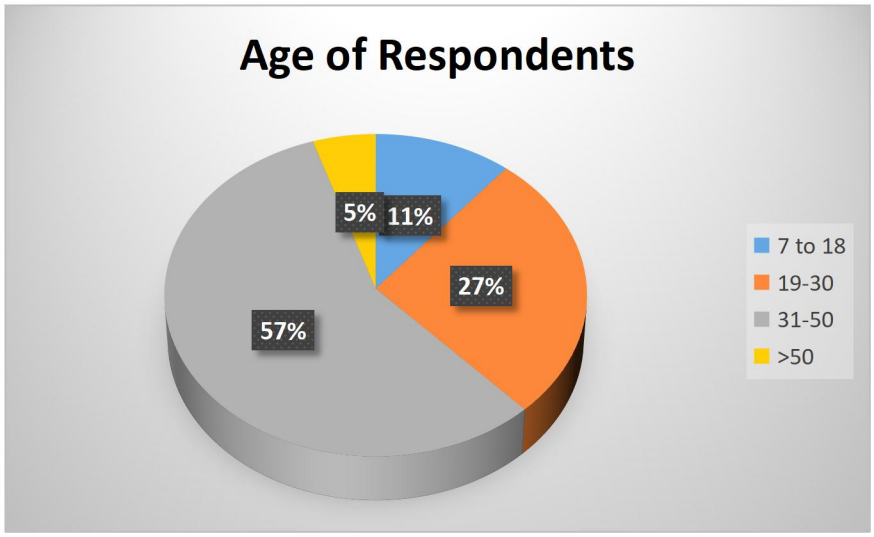

Fig. 4.2: Age of scavengers

With respect to marital status, 43% of the respondents are single while 47% are married, and 10% are divorced

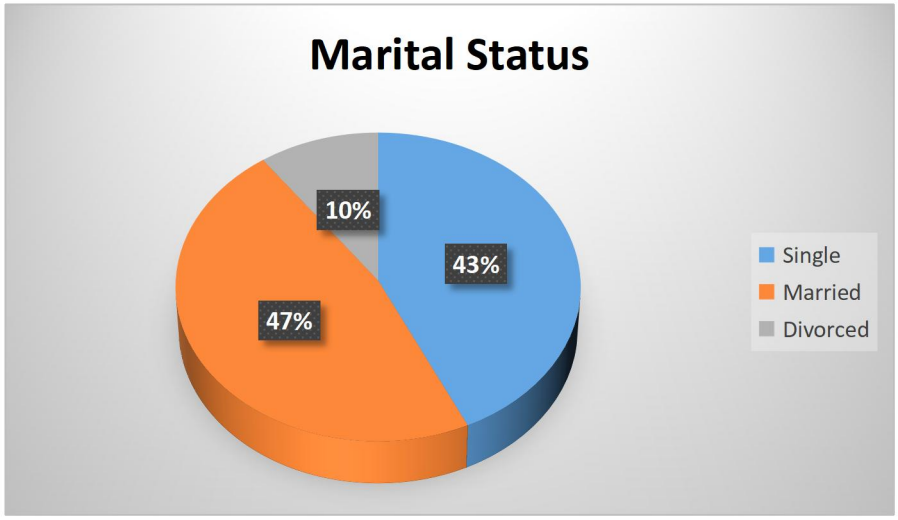

Fig. 4.3: Marital Status of Scavengers

Fig. 4.4 shows the educational qualifications of the scavengers surveyed. Those who completed Secondary education constituted a majority (54%) while 17% of them possess Tertiary educational qualifications. The latter is however noteworthy despite the relatively low proportion

because people with post-secondary school educational qualifications will naturally prefer other jobs than scavenging; perhaps this may reflect the state of unemployment in Benin City.

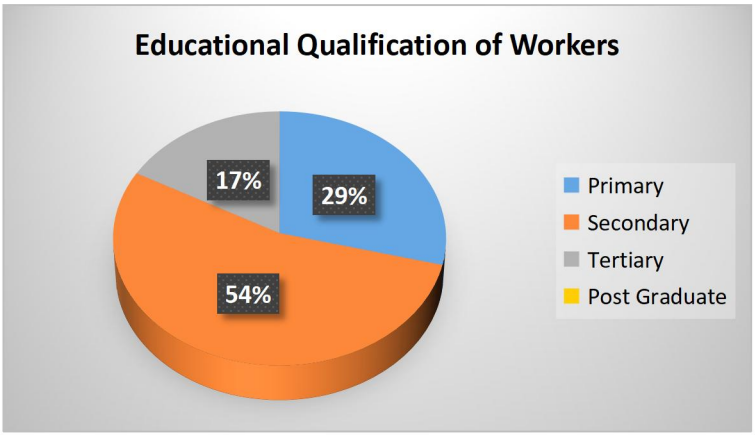

Fig. 4.4: Educational Qualification of Scavengers

4.2 OPERATIONAL ASPECTS OF WASTE DUMPSITE SCAVENGING

Occupational Experience of Scavengers

The study subjects were asked how long they have been engaged in Scavenging as an occupation. The result is shown in Fig. 4.5 Majority of the respondents have been engaged in this line of profession for 1-2 years (31.0%), followed by 28.0% who started scavenging less than one year ago. Others have been scavenging between 3-4 years (19.0%) and 5-6 years (15.0%) while only 7.0% of them have been scavenging for more than six years

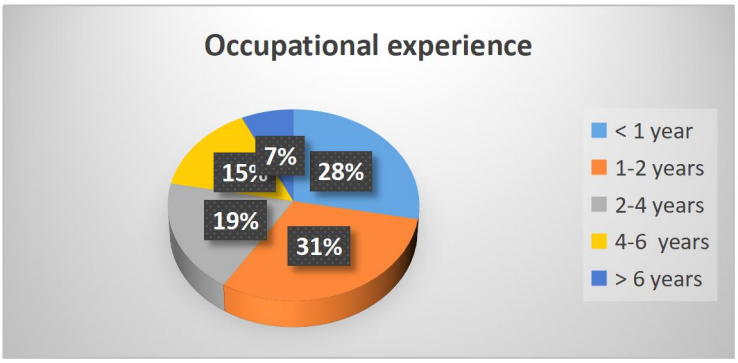

Fig. 4.5: Occupational experience

Scavengers Daily hours of work

With respect to duration of work per day (see Fig 4.6), a majority (42%) of the scavengers work for 0-8 hours (62.0%) while 38% of the respondents work for longer hours than 8 hours. This could be a concern from an occupational safety perspective for the respondents who work for longer hours, considering long work hours might be associated with increased fatigue and potentially higher risks of accidents or injuries. In addition, 8-hours per week and not more than 48hours week is the internationally accepted occupational standard worldwide (ILO, 2008)

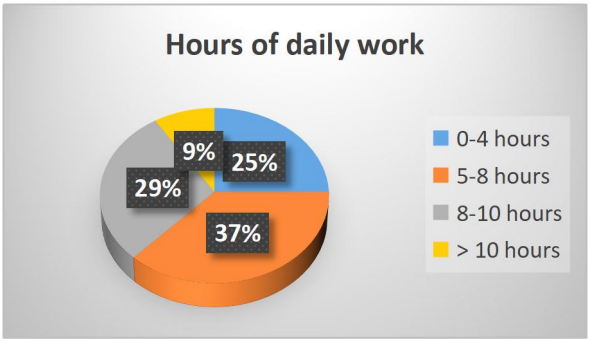

Fig. 4.6. Weekly work duration

Materials Used for Searching Recyclables at the Dump Sites

The survey results indicate that out of the respondents who participated in waste sorting, a majority (62%) utilized rods for the task, while 17% reported using a stick and 13% relied on their bare hands. The remaining 8% chose an alternative method. These percentages offer insights into prevalent methods employed by individuals in waste sorting practices. The notably high percentage of respondents (62%) opting for a rod suggests a potential preference for tools that provide extended reach or facilitate handling from a distance. This inclination could stem from considerations such as hygiene concerns or the desire to minimize direct contact with waste materials. Other choices may be influenced by factors such as accessibility or availability of

resources, as sticks are relatively easy to obtain and may serve adequately for basic waste sorting tasks

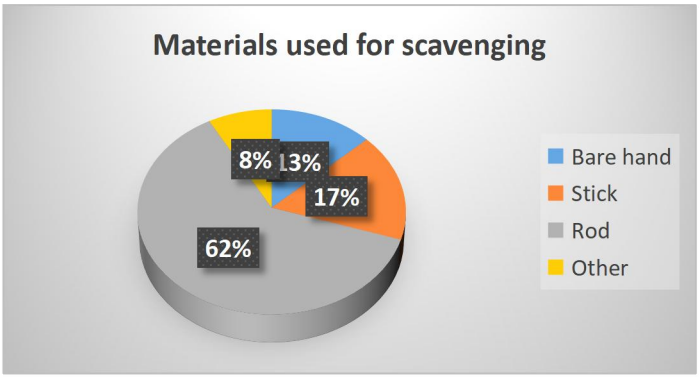

Fig. 4.7: Materials used for scavenging

Scavengers Use of Leg PPE

The subjects were asked about the use of Personal Protective Equipment (PPE) during their scavenging operations. The result is shown in Table 4.8. The largest group, comprising 50 individuals use leather boots, while 23 rely on plastic rain boots. Eleven percent rely on slippers for foot protection. Steel-toe boots are used by only 10% of the total respondents. A small fraction, of 6.0%, use sandals, and none of the respondents works barefooted.

From an occupational safety perspective, the data raises some concerns because although scavengers who use plastic rain boots and leather boots were the majority (73.0%) and are well insulated from hazardous substances, the 11% of them who use slippers is rather alarming in view of the fact that slippers offer minimal protection against hazards such as sharp objects, chemicals, or heavy materials that could lead to foot injuries. Even more concerning is that 6.0% of respondents' wear sandals, exposing themselves to extreme occupational safety risks. In the similar vein, only 10.0% use steel-toe boots, which are generally considered a good protective measure against foot injuries in many industrial settings. The low percentage could imply a lack of awareness or access to such specialized safety gear.

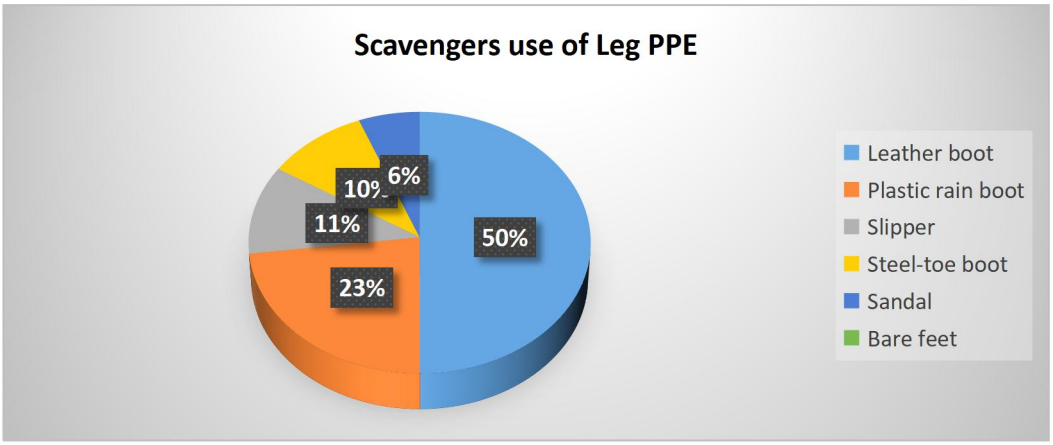

Fig. 4.8: Scavengers use of Leg PPE

Scavengers Use of Face PPE

The majority of the respondents (53.0%) use face masks for protection (see Fig. 4.9). However, 22 or 22.0% of the sample population, use handkerchiefs. 17 respondents or 17.0%, report that they use nothing to protect their face and nose. A small number of respondents (8%), use a piece of cloth for protection. The 17% of the scavengers who do not use cover their faces are vulnerable to bad odours and can readily ingest or inhale hazardous particles in the waste steam

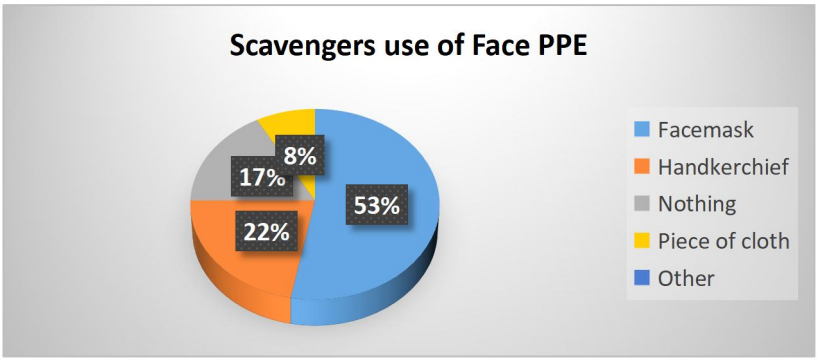

Fig. 4.9: Scavengers use of face PPE during operations.

Scavengers use Head/Hair PPE

Majority of the respondents uses hat/cap (51.0%) and 27.0% use head tie, while 22% use nothing. to protect their head during operation. This is of serious concern as the majority of respondents

which uses nothing stand the risk of getting head injuries, headaches from sun and other ailments that may arise from improper covering of the head/hair

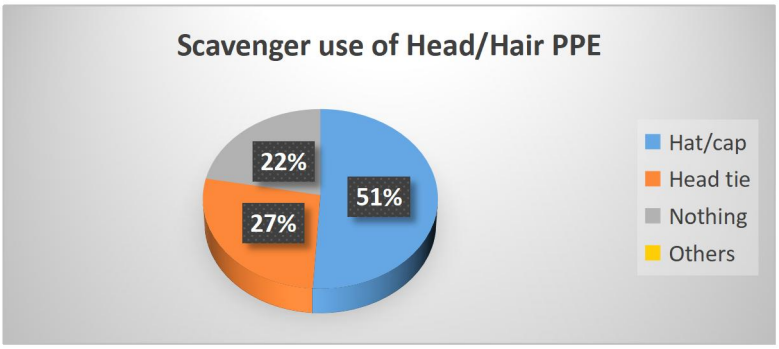

Fig. 4.10: Scavengers use of head/hair PPE

Scavengers use of Body Protection

Body protection is an integral part of any occupation and scavenging is no exemption. The scavengers were asked to provide details about how they protect their bodies from the hazard during their work. Fig 4.11 shows how 100 waste dump scavengers protect themselves from bad weather conditions. The largest group, comprising 41 respondents of the sample population, wears raincoats to shield themselves from adverse weather. This is followed by 31 respondents, who use umbrellas. Twenty-three percent of the respondents wear warm jackets. A very small segment (5%), resort to other unspecified means of protection. None of the respondents' reported that they do nothing to protect themselves from bad weather conditions

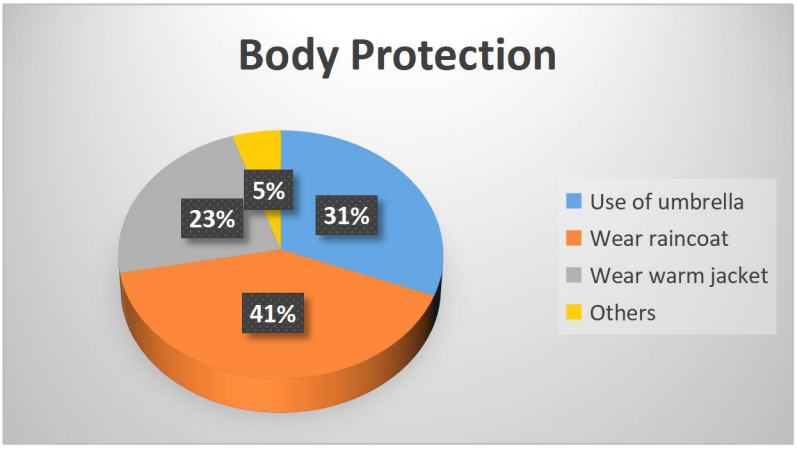

Fig. 4.11: Body Protection

Usage of Hand PPE

The study subjects were asked whether or not they use hand gloves during work. As can be seen from the pie chart in Fig 4.12, majority of them claimed to use hand gloves as a hand protection (67.0%) while 32.0% does not use hand gloves and 1% claims to use others. This is quite significant as the latter are quite susceptible to infections and injuries while working with their bare hands.

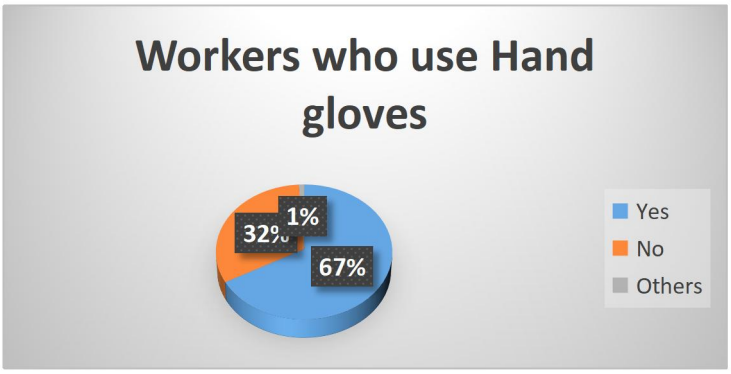

Fig. 4.12: Workers usage of Hand gloves

Eating on duty and Hygiene behind it by Scavengers

Scavengers were also asked if they eat at work despite their exposure to smelly and unhygienic work conditions. The result is shown in Fig 4.13. Whereas the waste scavengers eat while on duty (54.0%), 46% reported that they do not eat during work hours.

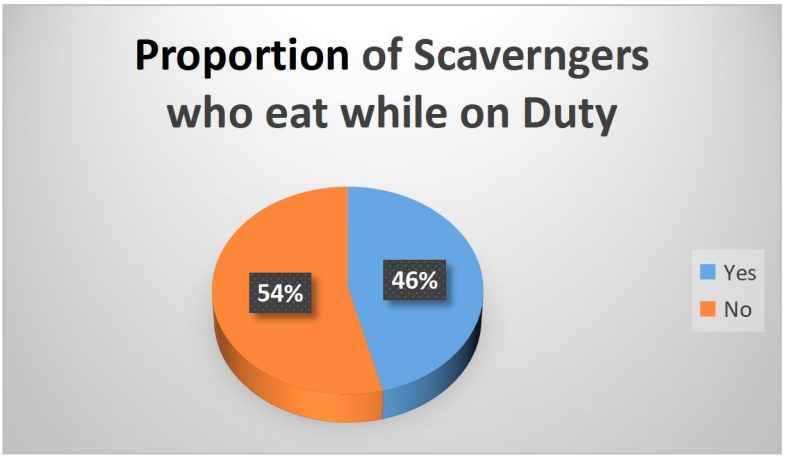

Fig. 4.13: Proportion of scavengers eating on duty

Although eating at work is not necessarily objectionable, they were asked whether or not they wash their hands before and after eating at the dumpsite. The result is shown in Fig 4.14 below. Hand washing is a common practice for ensuring adequate hygiene in all settings. However, not washing ones' hands in an occupation involving municipal wastes in dump sites is even more risky. Thus, the scavengers were asked if they wash their hands before and after eating while in their work environment. Of the total respondents who eat while on duty, 41 or 89.0% report that they do wash their hands both before and after eating. On the other end, 5 respondents, comprising 11.0% of the sample, indicate that they do not wash their hands either before or after eating. This result shows that although a majority of the scavengers wash their hands before and after eating on duty, about 11% do not. These categories of workers are at a greater risk of suffering various health risks ranging from hepatitis, diarrhea, and toxicity to poisonous substances. They are also exposed to helminthes such as ascaris and tape worm etc.

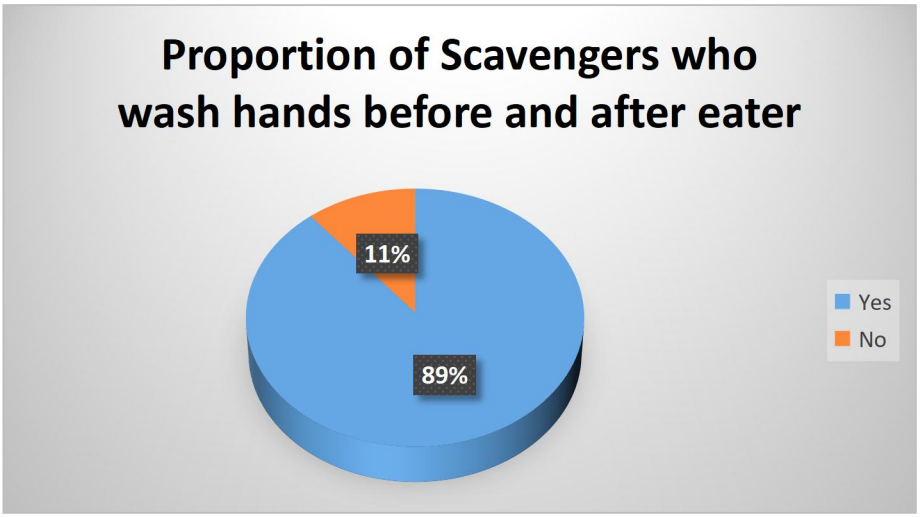

Fig. 4.14: Proportion of Scavengers who wash hands before and after eater

4.3 KNOWLEDGE OF HEALTH IMPLICATIONS

Perception of risk of getting injury during work operations

Fig 4.15 focused on the risk of injury during recycling operations, with 86% of respondents acknowledging the possibility of sustaining injuries. This finding underscores the physical hazards faced by waste scavengers, including cuts, puncture wounds, musculoskeletal injuries, and accidents resulting from handling heavy or sharp objects. The high percentage of respondents affirming the risk of injury highlights the need for them to adopt measures for minimizing these risks such as using personal protection equipment for minimizing their exposure. And because these scavengers are true workers of a company, they aught to be provided all the PPEs as well as first aid facilities.

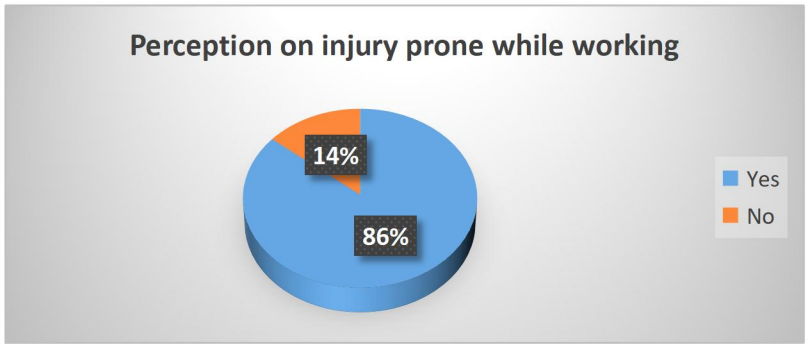

Fig. 4.15: Perception on injury prone while working

Perception on odor making respondents sick

Fig. 4.16 addresses the perception of odors as a potential health risk, with 80% of respondents indicating that they believed odors could make them sick, 20% indicates they do not believe it will. Foul odors emanating from decomposing waste can contain volatile organic compounds (VOCs), ammonia, hydrogen sulfide, and other hazardous gases known to cause respiratory irritation, headaches, nausea, and other health problems. The high proportion of respondents associating odors with potential health impacts underscores the need for interventions to mitigate odor pollution in waste dumpsite environments.

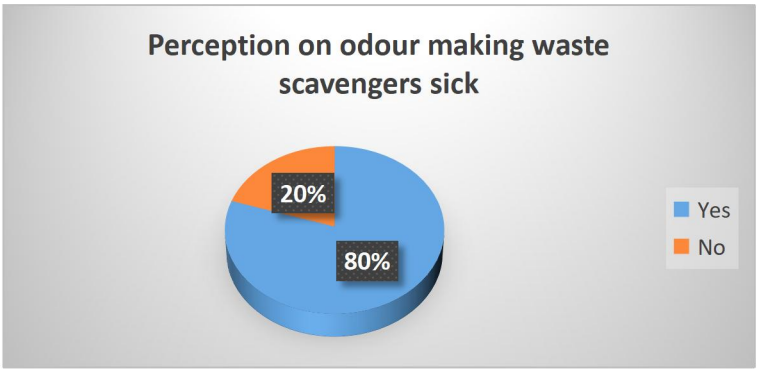

Fig. 4.16: Scavengers use of head/hair **Scavengers Perception to the risk of exposure to serious diseases**

Fig 4.17 elucidates the perceived risk of contracting serious diseases such as hepatitis, worm-related diseases, and respiratory diseases while performing waste scavenging activities. A majority of respondents (64%) acknowledged the possibility of contracting such diseases, reflecting their awareness of the health hazards inherent in handling contaminated waste materials.

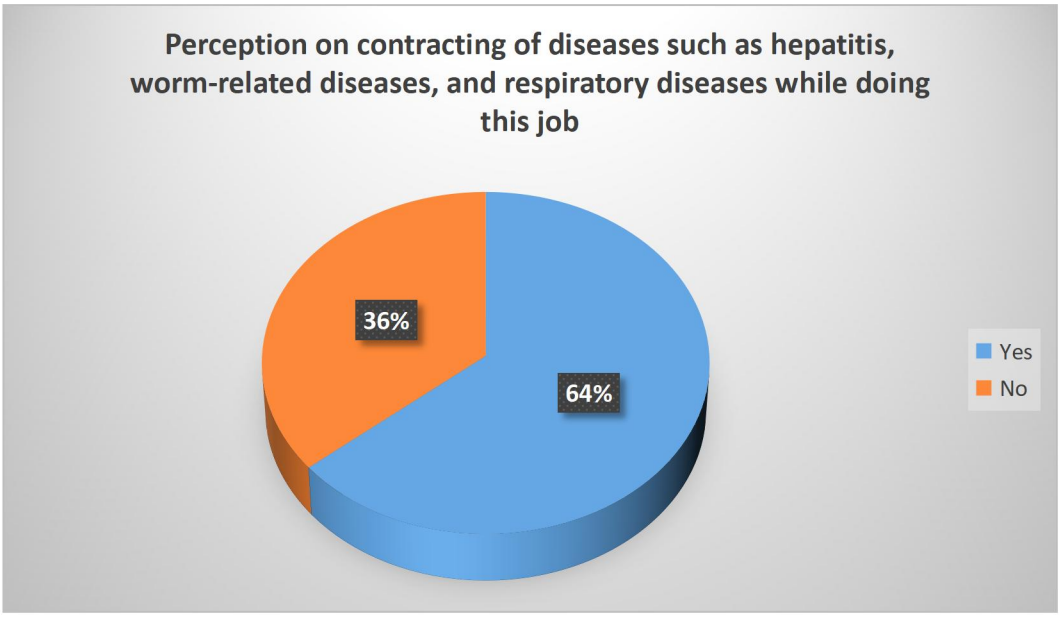

Fig. 4.17: Respondents' risk rate on contracting serious diseases while doing this job

4.4 OCCUPATIONAL HEALTH RISK OF SCAVENGERS

The results obtained from the evaluation of risk factors associated with municipal solid waste scavenging in two dumpsites within Benin Metropolis reveal significant insights into the health implications faced by individuals engaged in such activities. Among the prevalent diseases reported, respiratory/breathing problems, vomiting and nausea, headache, worm-related diseases, and malaria are notably prominent. It is concerning to note that a considerable proportion of individuals, accounting for 47%, reported experiencing respiratory/breathing problems. This finding underscores the potential respiratory hazards posed by exposure to pollutants and airborne particles present in waste dumpsites. These respiratory issues could be attributed to the inhalation of toxic gases, particulate matter, and microbial contaminants released during waste decomposition processes. Similarly, the high percentage of individuals experiencing vomiting and nausea (46%) suggests a significant prevalence of gastrointestinal disturbances among waste scavengers. Exposure to pathogens, chemical toxins, and foul odors emanating from decomposing waste may contribute to such symptoms. Additionally, inadequate sanitation facilities and poor hygiene practices prevalent in dumpsite environments may exacerbate the risk of gastrointestinal infections.

The elevated incidence of headaches reported by 62% of individuals is alarming and warrants attention. Headaches can be indicative of exposure to environmental stressors such as noise pollution, noxious odors, and psychological stress associated with working conditions in waste dumpsites. Moreover, the presence of hazardous substances like heavy metals and organic pollutants in waste materials may contribute to neurotoxic effects leading to headaches (xxxx add a reference here).

The relatively lower percentages of individuals reporting hepatitis (12%) and worm-related diseases (29%) highlight specific health risks associated with waste scavenging activities. However, the prevalence of hepatitis, albeit comparatively lower, signifies the potential transmission of blood-borne pathogens through contact with contaminated sharps or exposure to infected waste materials. Similarly, the incidence of worm-related diseases underscores the risk of parasitic infections arising from contact with contaminated soil, water, or food sources within dumpsite surroundings.

The most alarming finding pertains to the disproportionately high prevalence of malaria among waste scavengers, with 87% of individuals affected. This statistic underscores the heightened risk of vector-borne diseases associated with waste dumpsite environments, particularly in regions endemic to malaria transmission. Factors such as stagnant water accumulation in discarded containers, tires, and other waste receptacles provide conducive breeding grounds for mosquitoes, amplifying the risk of malaria transmission among vulnerable populations working in dumpsite settings.

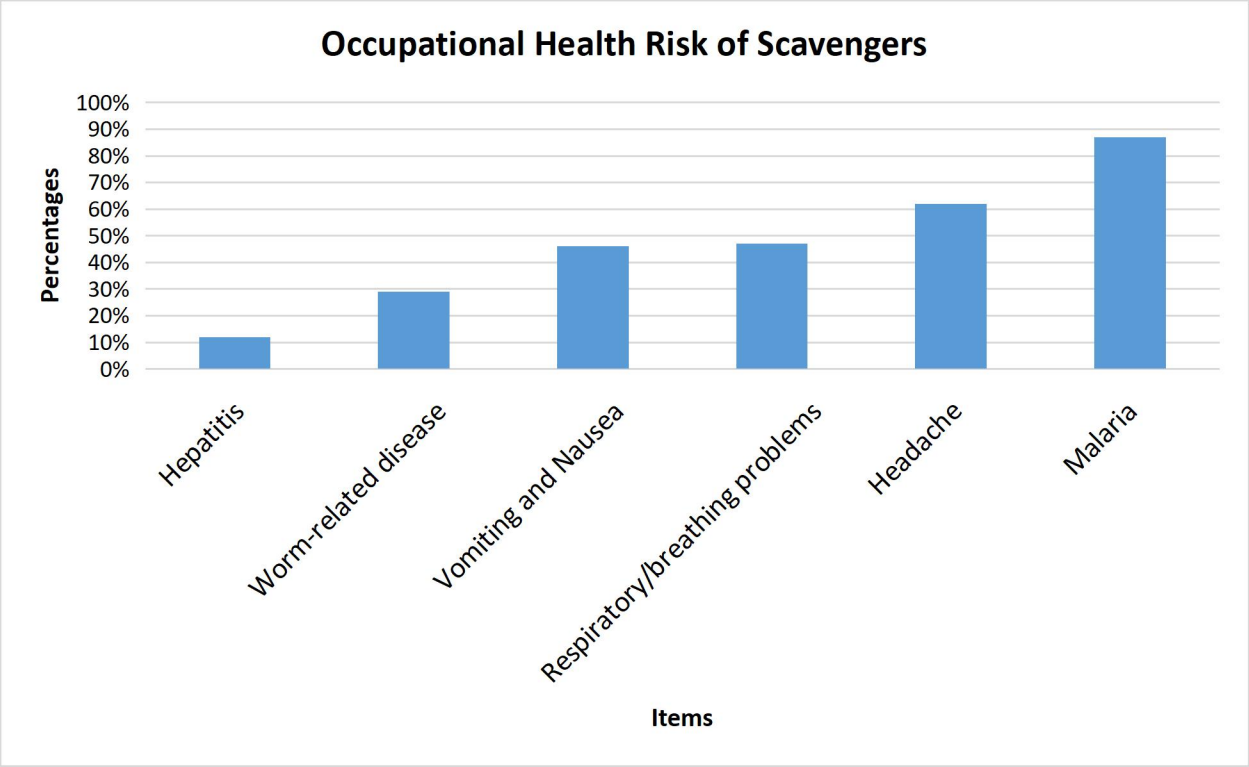

Fig. 4.18: Occupational Health Risk of Scavengers

Among respondents who acknowledged suffering from malaria, 65% reported experiencing it more frequently since they started scavenging, while 22% stated otherwise. This result underscores the heightened risk of malaria transmission associated with waste scavenging activities, as discussed earlier in the context of vector-borne diseases. Waste dumpsites serve as breeding grounds for mosquitoes due to the accumulation of stagnant water in discarded containers, tires, and other waste receptacles, creating conducive environments for mosquito proliferation. Additionally, waste scavengers often work in close proximity to mosquito habitats, increasing their exposure to mosquito bites and the risk of contracting malaria.

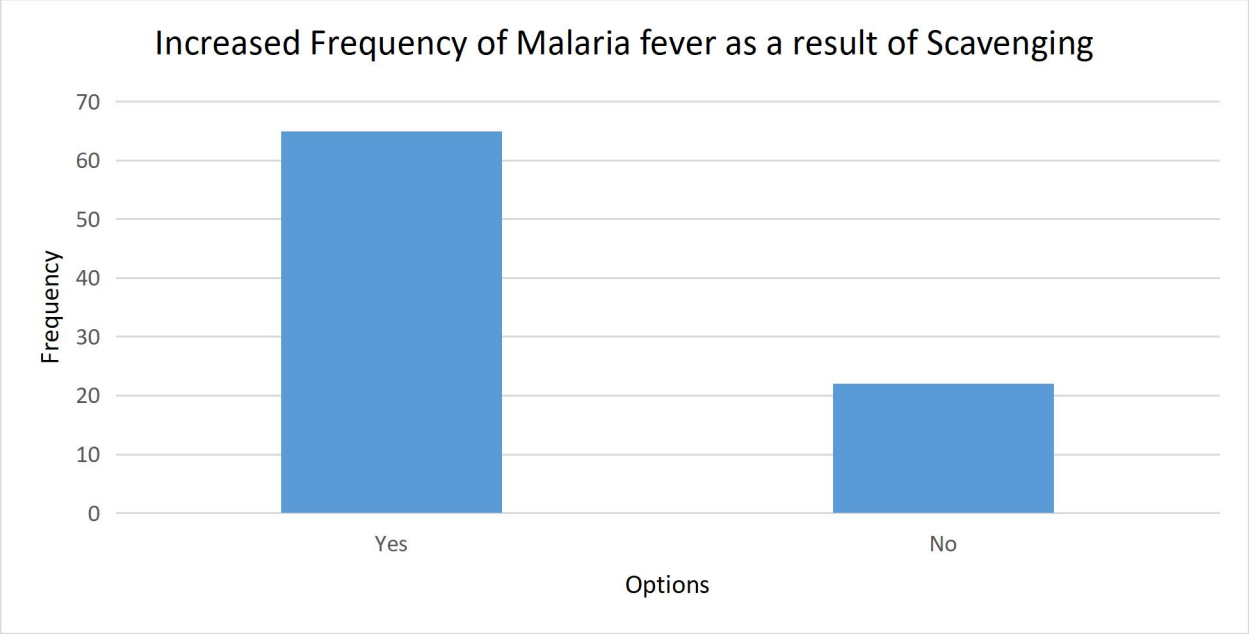

Fig. 4.19: Scavengers' Increased Frequency of Malaria fever as a result of Scavenging

The high percentage of respondents reporting cuts on any part of their body (89%) is particularly alarming, highlighting the pervasive risk of lacerations and injuries resulting from handling sharp objects and jagged materials present in waste materials. Also, a significant proportion of waste scavengers (69%) reported stepping on sharp objects, further emphasizing the prevalence of hazards such as broken glass, metal shards, and needles within waste dumpsite environments. These cuts can be directly related to the percentage of individuals who do not use hand gloves (32.0%) and Leg PPE (22.0%). Lack of appropriate hand protection could explain the high incidence of cuts and encounters with sharp objects. Cuts can lead to infections, tetanus, and

4.5 OCCUPATIONAL HEALTH HAZARDS OF SCAVENGERS

Table 4.1 below shows the range of occupational hazards the Scavengers are exposed to.

Table 4.1: Representation of Occupational Health Hazards of Scavengers

Items	**Response**	**Number of Responses**	**Percentage**
Have you ever suffered from burns?	Yes	31	31%
	No	69	69%
Have you suffered from cuts on any part of your body?	Yes	89	89%
	No	11	11%
Have you stepped on any sharp objects?	Yes	69	69%
	No	31	31%
Have you been hospitalized since you started this waste recycling?	Yes	22	22%
	No	78	78%
Have you suffered waist pain?	Yes	68	68%
	No	32	32%
Have you suffered from diarrhea or running stomach?	Yes	46	46%
	No	54	54%
Have you suffered from heat rash?	Yes	62	62%
	No	38	38%
Have you suffered from any other disease condition?	Yes	0	0%
	No	100	100%

The finding that 31% of respondents have suffered from burns highlights another critical occupational hazard faced by waste scavengers, likely resulting from exposure to hot surfaces, open flames, or chemical reactions during waste sorting and processing activities. This can be attributed to the issue of poor use of good head/hair PPE (47.0%) who do not use face mask. It is also attributed to the use of nothing to cover and protect their head/hair (22.0%) Burns can range in severity from minor injuries to life-threatening complications, emphasizing the importance of implementing fire safety measures, providing training on safe handling practices, and equipping waste scavengers with fire-resistant clothing and protective equipment.

The prevalence of other health concerns such as waist pain (68%), diarrhea or running stomach (46%), and heat rash (62%) further underscores the physical strains and environmental stressors inherent in waste scavenging activities. The issue of leg protection might be a predisposing

factor; 23.0% use plastic rain boots while 11.0% wear slippers, neither of which offers adequate protection against mosquito bites or the ergonomic demands of the job, possibly contributing to the high rates of malaria and waist pain.

Addressing these occupational health challenges requires comprehensive interventions focused on ergonomics, hydration, personal hygiene, and access to healthcare services to mitigate the risk of musculoskeletal disorders, gastrointestinal infections, and heat-related illnesses among waste scavengers

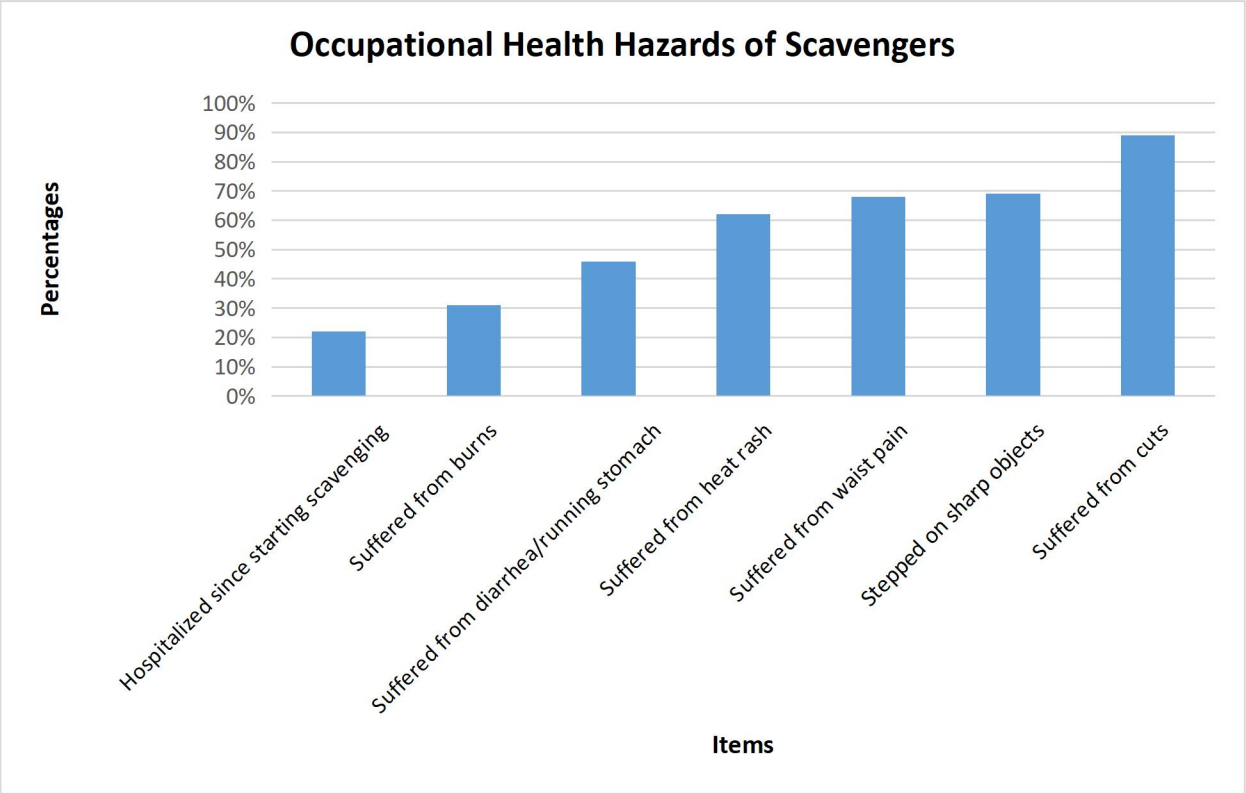

Fig. 4.20: Occupational Health Hazards of Scavengers

CHAPTER FIVE

5.1 DISCUSSIOS

The operational aspects of waste dumpsite scavenging, as revealed by the survey results, shed light on various factors influencing the working conditions and practices of waste scavengers. The duration of occupational experience among scavengers indicates a relatively short tenure for the majority, with 31% engaged for 1-2 years and 28% for less than a year. This turnover rate may indicate challenges in the longevity and sustainability of scavenging as a profession, potentially influenced by factors such as job satisfaction, income stability, and occupational hazards (Adewole, 2009; Meskarpour-Amiri *et al*., 2011). Additionally, the distribution of work hours per day raises concerns regarding occupational safety, with 38% of scavengers working more than 8 hours a day, potentially increasing the risk of fatigue-related accidents or injuries (United States Department of Labor, 2008). Furthermore, the materials used for waste sorting practices highlight prevalent methods and the need for appropriate tools and equipment to mitigate occupational hazards. For instance, the high percentage (62%) of scavengers using rods underscores a preference for tools providing extended reach or minimizing direct contact with waste materials, potentially influenced by hygiene considerations or accessibility of resources (Agarwal & Gupta., 2011). However, the utilization of inadequate personal protective equipment (PPE), such as slippers (11%) and sandals (6%), poses significant occupational safety risks, as these offer minimal protection against hazards like sharp objects or chemicals, corroborating findings from Kuiijer *et al*. (2010) emphasizing the importance of proper PPE in waste scavenging. Similarly, the low usage of steel-toe boots (10%) underscores gaps in awareness or access to specialized safety gear, highlighting the need for interventions to enhance occupational safety measures and provide adequate protective equipment to mitigate the risk of injuries

(Kuiijer *et al*., 2010). Moreover, the findings regarding hygiene practices, particularly hand washing before and after eating at the dumpsite, underscore the importance of promoting hygienic behaviors to prevent the spread of infectious diseases among scavengers, aligning with literature emphasizing the role of hygiene in reducing health risks in waste management settings (Nyathi *et al*., 2020).

The knowledge of health implications among waste scavengers reflects their awareness of occupational hazards and associated health risks, as indicated by the high percentage of respondents acknowledging the risk of injury (86%) and the perception of odors making them sick (80%). These findings align with existing literature emphasizing the physical hazards and health impacts of waste scavenging activities, including injuries, respiratory problems, and gastrointestinal disturbances (Oyelayo *et al*., 2021). Furthermore, the perceived risk of exposure to serious diseases among scavengers (64%) underscores the awareness of health hazards inherent in handling contaminated waste materials, reflecting findings from previous studies highlighting the prevalence of infectious diseases among waste scavengers (Oyelayo and Adekiya, 2021; Meskarpour-Amiri *et al*., 2017). However, the disproportionate prevalence of malaria among scavengers (87%) highlights the heightened risk of vector-borne diseases in waste dumpsite environments, emphasizing the need for interventions to mitigate malaria transmission and promote health and safety measures among workers.

The evaluation of occupational health risks among waste scavengers reveals significant insights into the health implications faced by individuals engaged in scavenging activities. The prevalence of respiratory problems (47%), vomiting and nausea (46%), and headaches (62%) underscores the physical strains and environmental stressors inherent in waste scavenging activities, corroborating findings from previous studies emphasizing the health impacts of

exposure to pollutants and hazardous substances in waste dumpsite environments (Kuiijer *et al*., 2010; Meskarpour-Amiri *et al*., 2016). Additionally, the relatively low percentages of individuals reporting hepatitis (12%) and worm-related diseases (29%) highlight specific health risks associated with waste scavenging activities, aligning with literature emphasizing the risk of blood-borne pathogens and parasitic infections in waste management settings (Dias *et al*., 2018; Yadav *et al*., 2020). However, the disproportionately high prevalence of malaria among scavengers (87%) underscores the heightened risk of vector-borne diseases in waste dumpsite environments, necessitating interventions to mitigate malaria transmission and promote health and safety measures among workers (Chandramohan *et al*., 2009).

The assessment of occupational health hazards among waste scavengers elucidates the prevalent risks and challenges faced by individuals engaged in scavenging activities. The high prevalence of injuries, including cuts (89%) and encounters with sharp objects (69%), underscores the pervasive risk of lacerations and injuries resulting from handling hazardous materials in waste dumpsite environments, corroborating findings from previous studies highlighting the physical hazards of waste scavenging activities (Medina, 2001). Additionally, the incidence of burns (31%) highlights another critical occupational hazard faced by scavengers, likely resulting from exposure to hot surfaces or chemical reactions during waste sorting and processing activities, emphasizing the importance of implementing fire safety measures and providing appropriate protective equipment (Wachukwu *et al*., 2010). Furthermore, the prevalence of gastrointestinal disturbances (46%) and heat rash (62%) underscores the environmental stressors and health risks inherent in waste scavenging activities, aligning with literature emphasizing the prevalence of gastrointestinal infections and heat-related illnesses among waste scavengers (Oyelawo and Adekiya, 2021). Overall, the findings underscore the urgent need for comprehensive

interventions to address occupational health hazards and promote a safe and healthy working environment for waste scavengers.

5.2 SUMMARY OF FINDINGS

1. In operational aspects of waste dumpsite scavenging, the majority of scavengers have relatively short tenure, with concerns emerging over long work hours, potentially leading to increased fatigue. Additionally, prevalent use of inadequate personal protective equipment poses significant occupational safety risks, indicating a need for interventions to improve safety measures.
2. Knowledge of health implications among scavengers reveals a high awareness of occupational hazards, with most acknowledging the risk of injury and associating odors with potential health impacts, highlighting their understanding of the risks involved. Moreover, a disproportionately high prevalence of malaria underscores the heightened risk of vector-borne diseases in waste dumpsite environments, necessitating targeted interventions for disease prevention.
3. Scavengers face significant occupational health risks, with reported respiratory problems, gastrointestinal disturbances, and headaches, indicating the adverse health effects of waste scavenging activities. Despite relatively lower percentages for certain diseases like hepatitis and worm-related diseases, the disproportionately high prevalence of malaria emphasizes the urgent need for measures to mitigate vector-borne disease transmission.
4. Occupational health hazards among scavengers include a high prevalence of injuries such as cuts and encounters with sharp objects, highlighting pervasive risks of lacerations and injuries. Additionally, the incidence of burns and gastrointestinal disturbances underscores the environmental stressors and health risks inherent in waste scavenging activities, necessitating comprehensive interventions to improve working conditions and promote safety measures.

5.3 CONCLUSION

The evaluation of risk factors associated with municipal solid waste scavenging has provided valuable insights into various aspects of scavenger operations and their corresponding health implications. In terms of operational aspects, the findings reveal a relatively short tenure among scavengers, alongside concerns over long work hours and inadequate personal protective equipment, indicating the need for interventions to improve occupational safety measures. Despite a good awareness of health implications, such as acknowledging the risks of injury and associating odors with potential health impacts, there remains a disparity between awareness and actual outcomes, as evidenced by the disproportionately high prevalence of injuries. This suggests potential gaps in the implementation of safety measures or barriers to accessing adequate protective equipment.

Moreover, the disproportionately high prevalence of malaria underscores the heightened risk of vector-borne diseases in waste dumpsite environments, emphasizing the necessity of targeted interventions for disease prevention, especially considering the reported increase in malaria frequency among scavengers since starting their work. Furthermore, while the assessment of occupational health risks highlights significant health challenges faced by scavengers, including respiratory problems, gastrointestinal disturbances, and headaches, disparities in the prevalence of certain diseases such as hepatitis and worm-related diseases indicate variations in exposure levels or susceptibility among scavengers. Despite relatively lower percentages for certain diseases, such as hepatitis and worm-related diseases, the findings underscore the urgent need for measures to mitigate vector-borne disease transmission and improve overall health outcomes.

Lastly, the examination of occupational health hazards among scavengers underscores the pervasive risks of injuries, burns, and gastrointestinal disturbances, emphasizing the need for

comprehensive interventions to enhance working conditions and promote safety measures in waste scavenging environments

5.4 RECOMMENDATIONS

Based on the discussion of results, the study recommends that the operators of the dumpsites should be regulated by the Edo State Waste Management Board, with strict guidelines and punitive measures put in place for lack of compliance. On the part of the dumpsite operators, they should provide all necessary personal protection equipment and enforce their use as a standard operating procedure. Furthermore, first aid equipment for staff, drinking water and bathrooms with soap and water for their sanitation should be provided.

REFERENCES

Abhay, R. (2010). Health hazards of waste picking: A study of waste pickers in Pune city, India. International Journal of Occupational and Environmental Health, 16(4), 308-314.

Aboagye-Larbi, H., Acheampong, M. A., Kyei, S. K., & Carboo, D. (2014). The potential health hazards associated with waste scavenging in Ghana: A case study of three selected dumpsites in Tema Metropolis. *International Journal of Environmental Science and Toxicology,* ***2***(10), 199-209.

Achankeng, E. (2003). Globalization, urbanization and municipal solid waste management in Africa. In Proceedings of the African Studies Association of Australasia and the Pacific 26th annual conference, **1**, 1-22.

Ackerman, F. (2005). Material Flows for a Sustainable City. International Review for Environmental Strategies, **5**(2), 499–510.

Adeniran, A. E., Nubi, A. T., & Adelopo, A. O. (2017). Solid waste generation and characterization in the University of Lagos for a sustainable waste management. Waste management, **67**, 3-10.

Adewole, A. T. (2009). Waste Management towards Sustainable Development in Nigeria: A Case Study of Lagos State. International NGO Journal, **4**(4), 173-179.

Agarwal, D., & Gupta, A. K. (2011). Hazardous Waste Management: Analysis of Indian Scenario and Perspective Governance. *VSRD Technical & Non-Technical Journal (VSRD-TNTJ)*, ***2***(9), 484-495.

Ahmed, H., Khan, B. A., Cheng, L., Khan, A. A. (2015). Healthcare waste management in Asian developing countries: A mini review. Waste management research, **37**(9), 863-875.

Ajani, O. I. Y. (2008). Determinants of an effective solid waste management in Ibadan Metropolis, Oyo state, Nigeria.

Allison, K., & Von Blottnitz, H. (2010). Solid situational analysis, technical document waste management plan. UNEP

Austin, R. L., & Schill, M. A. (2011). Hepatitis B vaccination for municipal solid waste workers. Vaccine, **29**(46-47), 7909-7913.

Austin, T., & Schill, M. (2011). Sustainable social work: An environmental justice framework for social work education. Social Work Education, **34**(5), 513-527.

Beasley, J. C. (2010). Household hazardous waste and its disposal in the developing world. Journal of Hazardous Materials, **178**(1-3), 34-42.

Bryant, W. (2011). Is the concept of a green economy a useful way of framing policy discussions and policymaking to promote sustainable development? Natural Resources Forum, **35**(1), 63-72.

Bullard, R. D. (2011). Environmental racism and health disparities in communities of color. American Journal of Public Health, **101**(3), 377-383.

Chandramohan A, Sivasankar V, Ravichandran C (2009). "Solid Waste, Its Health Impairments and Role of Rag Pickers in Tiruchirappalli City, Tamil Nadu, Southern India". *Waste Management Resource*, published online 12 November 2009.

Cointreau, S. (2006). Occupational and environmental health issues of solid waste management: special emphasis on middle- and lower-income countries. Urban papers, 2.

Danbuzu, L. A. S., Adamu, Y. M., & Ibrahim, A. M. (2014). Associated health risks for urban solid wastes in some parts of Kano metropolis. *Journal of Environmental Sciences and Resource Management,* ***6***(2), 157-165.

Ebenezer, O. S. (2014). Scavenging for Wealth or Death? Exploring the Health Risk Associated with Waste Scavenging in Kumasi, Ghana. Journal of Geography, **6**(14), 63–80.

Egondi, T., Muindi, K., Kyobutungi, C., Gatari, M., & Rocklöv, J. (2015). Measuring exposure levels of inhalable airborne particles (PM2.5) in two socially deprived areas of Nairobi, Kenya. Environmental research, **148**, 500-506.

Ejares, J. A., Paler, M., Kristina O., Aguilar, M., & Erian L. (2014). Socio-Demographic Profile of Scavenging Households in Umapad Dumpsite, Mandaue City Cebu, Philippines. Journal of Sustainable Development Studies, **6**(1), 175-192.

Elenwo, E. I. (2015). Assessment of the Activities of Scavengers in Obio/Akpor Local Government Areas Rivers State, Nigeria. Journal of Environmental Protection, **6**, 272-280.

Elugoke, N. O., Owoh, A. C., Balogun, B. O., Olorunyomi, K. P., & Aileru, J. T. (2019). An assessment on the waste dump practices among residents of IFE Central Local Government Area, Osun State, Nigeria. *International Journal of Trend in Research and Development,* ***6***(2), 298-304.

Ezeah, C., Clive, L. R., Paul, S. P., Mbeng, O. L., & Nzeadibe, T. C. (2014). Evaluation of Public Health Impacts of Waste Scavenging in Abuja Nigeria, Using Q Methodology. Accessed at: https://www.researchgate.net/publication/235418470, 22-01-2024.

Ezeah, C., Roberts, C. L., Watkin, G., Philips, P. S., & Odunfa, A. (2010). Evaluation of public health impacts of scavenging in Abuja, Nigeria using Q Methodology. *The Open Waste Management Journal,* ***3***(1), 33-42.

Frazzoli, C., Orisakwe, O.E., Dragone, R., & Mantovani, A. (2010). Diagnostic health risk assessment of electronic waste on the general population in developing countries' scenarios. *Environmental Impact Assessment Review,* ***30***, 388–399.

Garg, V. K., & Sarkar, B. K. (2013). A study waste management status in health farcicalities of an urban area. International Journal of Pharma and Bio Sciences, **4**, 1107-1112.

Girling, A. (2015). Residents' perceptions and attitudes towards urban solid waste management in the Berekum Municipality, Ghana. *Oguaa Journal of Social Sciences, 7*(2), 25-37.

International Labour Organization (ILO) (2004). Addressing the Exploitation of Children in Scavenging (Waste Picking): A Thematic Evaluation on Action on Child Labour, Geneva, p. 61.

Jerie, S. (2016). Occupational risks associated with solid waste management in the informal sector of Gweru, Zimbabwe. Journal of Environmental and Public Health, 2016.

Karanja, A., & Okoth, R. (2003). The Role of Public Private Partnerships in Enhancing Local Government Service Delivery: The Case of Solid Waste Management (SWM) In Nairobi Kenya. *Policy Briefs on Governance Issues: Special Issue, (7A)*.

Karanja, A., & Okoth, R. (2003). The Role of Public Private Partnerships in Enhancing Local Government Service Delivery: The Case of Solid Waste Management (SWM) In Nairobi Kenya. Policy Briefs on Governance Issues: Special Issue, (7A).

Kristen, G., Goldizen, F.C., Sly, P.D., Brune, M.-N., Neira, M., van den Berg, M., & Norman, R.E. (2013). Health consequences of exposure to e-waste: A systematic review. *The Lancet. Global Health, **1***, e350–e361

Kuijer, P. P. F. M., Sluiter, J. K., & Frings-Dresen, M. H. W. (2010). Health and safety in waste collection: Towards evidence-based worker health surveillance. *American Journal of Industrial Medicine*, ***53***(10), 1040-1064.

Medina, M. (2001). Scavenging in America: Back to the Future? Resources, Conservation and Recycling, **31**, 229-240.

Medina, M. (2008). The informal recycling sector in developing countries: organizing waste pickers to enhance their impact. **5**(25), 20-86.

Medina, M. (2010). Scrap and Trade: Scavenging Myths. United Nations University; Our world 2.0 [online] New York: UNU (Published 2010) Accessed at: http://ourworld.unu.edu/en/scavengingfrom-waste, 20-02-2024.

Medina, R. (2008). Children of the dump: A review of health risks associated with e-waste disposal. Archives of Environmental & Occupational Health, **63**(8), 243-257.

Meskarpour-Amiri, M., Assari Arani, A., Sadeghi, H., & Agheli-Kohnehshahri, L. (2016). Socioeconomic Factors Affecting Informal Payments in the Health Sector. *Transylvanian Review of Administrative Sciences*, ***47***(E), 116-128

Muniafu, M., & Otiato, E. (2010). Solid Waste Management in Nairobi, Kenya. A case for emerging economies. Journal of Language, Technology & Entrepreneurship in Africa, **2**(1), 342-350.

Ngoc, U. N., & Schnitzer, H. (2009). Sustainable solutions for solid waste management in Southeast Asian countries. *Waste management, **29***(6), 1982-1995.

Nyathi, S., Olowoyo, J. O., & Oludare, A. (2018). Perception of Scavengers and Occupational Health Hazards Associated with Scavenging from a Waste Dumpsite in Pretoria, South Africa. *Journal of Environmental and Public Health*, 1-2

Okoye, A. C. (2010). Scavenging: A Latent Means of Environmental Sustainable Livelihood. Celebration of Academic Excellence, Festschrift in Honour of professor L.N. Muoghalu, El 'Demark, 265-269.

Onibokun, T. (2009). Evaluation of solid waste generation, categories and disposal options in developing countries: a case study of Nigeria. Journal of Applied Sciences and Environmental Management, **13**(3), 35-98.

Oyelayo, A. Adekiya. (2021). Assessment of Occupational Health Risk and Awareness of Scavengers to COVID-19 in Abuja Municipal Area Council, Nigeria. *American Journal of Health, Medicine and Nursing Practice*, ***6***(1), 18-31

Parizeau, K., (2015). Household-level dynamics of food waste production and related beliefs, attitudes, and behaviors in Guelph, Ontario. Waste management, **35**, 207-217.

Patan, S., & Mathur, P. (2015). Assessment of biomedical waste management in government hospital of Ajmer city-a study. International Journal of Research in Pharmacy & Science, 5(1), 300-453.

Reddy, P. J. (2011). Municipal solid waste management. The Netherlands: CRC Press/Balkema.

Rotich, B. R. (2015). An Assessment of How Various Types of Solid Wastes Affect Their Management in Laini Saba Location, Kibra Sub-County, Nairobi County, Kenya. *4(2)*, 1-5. www.paperpublications.org

Rushton, L. (2003). Health hazards and waste management. British medical bulletin, 68(1), 183-197.

Siddharudha, S., & Sowmyashree, H. (2015). Occupational exposure to infection: a study on healthcare waste handlers of a tertiary care hospital in South India. The Journal of the Association of Physicians of India, **63**(11), 24-27.

Tchobanoglous, J. (2003). Municipal solid waste management in Asia: A comparative analysis. In Workshop on sustainable landfill management **35**, 3-15.

Un-Habitat. (2010). Solid waste management in the world's cities. Un-Habitat.

United Nations Environment Programme. (2005). Development of waste management practices in Indonesia. European journal of scientific research, **40**(2), 199-210. doi: http://www.eurojournals.com/ejsr.htm

United States Department of Labor. (n.d.). Hours Worked. Retrieved from https://www.dol.gov/general/topic/workhours. Accessed 21st February, 2024

United States Department of Labor. (n.d.). Occupational Safety and Health Administration. Retrieved from https://www.osha.gov/faq

Van, Eerd, (1997). Mobilizing resources to collect municipal solid waste: illustrative East Asian case studies. Waste Management & Research, **17**(4), 263-274.

Wachukwu CK, Mbata CA, Nyenke CU (2010). "The Health Profile and Impact Assessment of Waste Scavengers (Rag Pickers) In Port Harcourt, Nigeria". *J. Applied Sci.,* ***10***, 1968-1972.

Wang, X., Miller, G., Ding, G., Lou, X., Cai, D., Chen, Z., Meng, J., Tang, J., Chu, C., Mo, Z., *et al*. (2012). Health risk assessment of lead for children in tinfoil manufacturing and e-waste recycling areas of Zhejiang Province, China. *Science of The Total Environment,* ***426***, 106–112.

APPENDIX

QUESTIONNAIRE

Site _____ Survey Number____

UNIVERSITY OF BENIN, DEPT. OF ENVIRONMENTAL MANAGEMENT/TOXICOLOGY

RECYCLERS SURVEY

Instructions**:** *Kindly tick the correct answer to the following question*:

i. Sex: a. Male ( ) b. Female ( )
ii. Age: a. 7 – 18 ( ) b. 19 – 30 ( ) c. 31-50 ( ) d. >50 ( )
iii. Marital Status: a. Single ( ) b. Married ( ) c. Divorced ( )
iv. Education: a. Primary 6 ( ) b. Secondary ( ) c. Tertiary ( ) d. Post-graduate
v. How long have you been practicing Recycling as a job? a. < 1 Year ( ) b. 1 - 2 years ( ) c. 2-4 Years( ) d. 4 – 6years ( ) e. > 6 years ( )
vi. How many hours do you work every day? a. 0 – 4hrs ( ) b. 5 – 8hrs. ( ) c. 8-10 hrs. ( ) d. > 10 hrs.

1. What did you use in sorting the wastes? a. Bare hand ( ) b. Stick ( ) c. Rod ( ) d. Others ( )
2. How do you protect your legs while working? a. Leather boot ( ) b. Plastic Rain boot ( ) c. Slippers ( ) d. Steel-toe boot ( ) e. Sandals ( ) f. bare feet ( )
3. How do you protect your face and nose at work? a. Face mask ( ) b. Handkerchief ( ) c. nothing ( ) d. piece of cloth ( ) e. others specify _____
4. How do you protect your head/hair? a. Hat/cap ( ) b. Head tie ( ) c. nothing ( ) d. others (please specify)_____
5. How do you protect yourself from bad weather conditions (i.e., rain and sun)? a. Use of Umbrella ( ) b. wear rain coat ( ) c. wear warm Jacket ( ) d. Others (Please specify _____
6. Do you use hand glove always? a. Yes ( ) b. No ( ) others specify _____
7. Do you eat while on duty? a. Yes ( ) b. No ( )
8. If yes, do you wash your hand before and after eating? a. Yes ( ) b. No ( )
9. Do you think that during your recycling operations you can get injured? a.Yes ( ) b.No ( )
10. Do you think the odor perceived can make you sick? a. Yes ( ) b. No ( )
11. Do you think that you can contract serious diseases such as hepatitis, worm-related diseases, and respiratory diseases while doing this job? a. Yes ( ) b. No ( )
12. What diseases have you suffered from more since you started this work?
    a. Respiratory/breathing problems a. Yes ( ) b. No ( )
    b. Vomiting and Nausea a. Yes ( ) b. No ( )
    c. Headache a. Yes ( ) b. No ( )
    d. Hepatitis a. Yes ( ) b. No ( )
    e. Warm-related disease a. Yes ( ) b. No ( )
    f. Malaria Yes ( ) No ( ) If yes, Do you suffer from malaria more frequently now after you started this job? a. Yes ( ) b. No ( )
    g. Skin diseases
    h. Other diseases (Please Specify) _____

13. Have you suffered from burns? a. Yes ( ) b. No ( ) If so how many times _____
14. Have you suffered from cuts on any part of your body? a. Yes ( ) b. No ( ) If so how many times _____
15. Have you stepped on any sharp objects? a. Yes ( ) b. No ( ) If so how many times _____
16. Have you been hospitalized since you started the waste recycling? Yes ( ) No ( ) If so how many times _____
17. Have you suffered waist pain? a. Yes ( ) b. No ( ) If so how many times _____
18. Have you suffered from diarrhea or running stomach? a. Yes ( ) b. No ( ) If so how many times _____
19. Have you suffered from Heat rash? a. Yes ( ) b. No ( ) If so how many times _____
20. If you have suffered any other disease or condition, please specify_____
21. Do you think you are healthier now than when you started this job? a. Yes ( ) b. No ( )
22. Do you get stigmatized while doing the work? a. Yes ( ) b. No ( )
23. Do you love this type of work? a. Yes ( ) b. No ( )

    If Yes, why? a. I make good money ( ) b. I am saving the world's resources ( ) c. It makes me resourceful ( ) d. I don't like to beg for money ( )

    If you don't like the job, why? a. It is not good for my health but I have no choice ( ) it exposes me to security issues but I don't have a choice now ( ) c. The income is not much ( ) d. Other reasons Please specify):……..

24. Safety Gloves a. Yes ( ) b. No ( )
25. Protective Clothing/Coveralls a. Yes ( ) b. No ( )
26. Steel-Toe Boots a. Yes ( ) b. No ( )
27. Hard Hat a. Yes ( ) b. No ( )
28. Safety Goggles a. Yes ( ) b. No ( )
29. Face Masks/Respirators a. Yes ( ) b. No ( )
30. High Visibility Vests a. Yes ( ) b. No ( )
31. Safety Aprons a. Yes ( ) b. No ( )

THANK YOU FOR YOUR CO-OPERATION

LIST OF PLATES

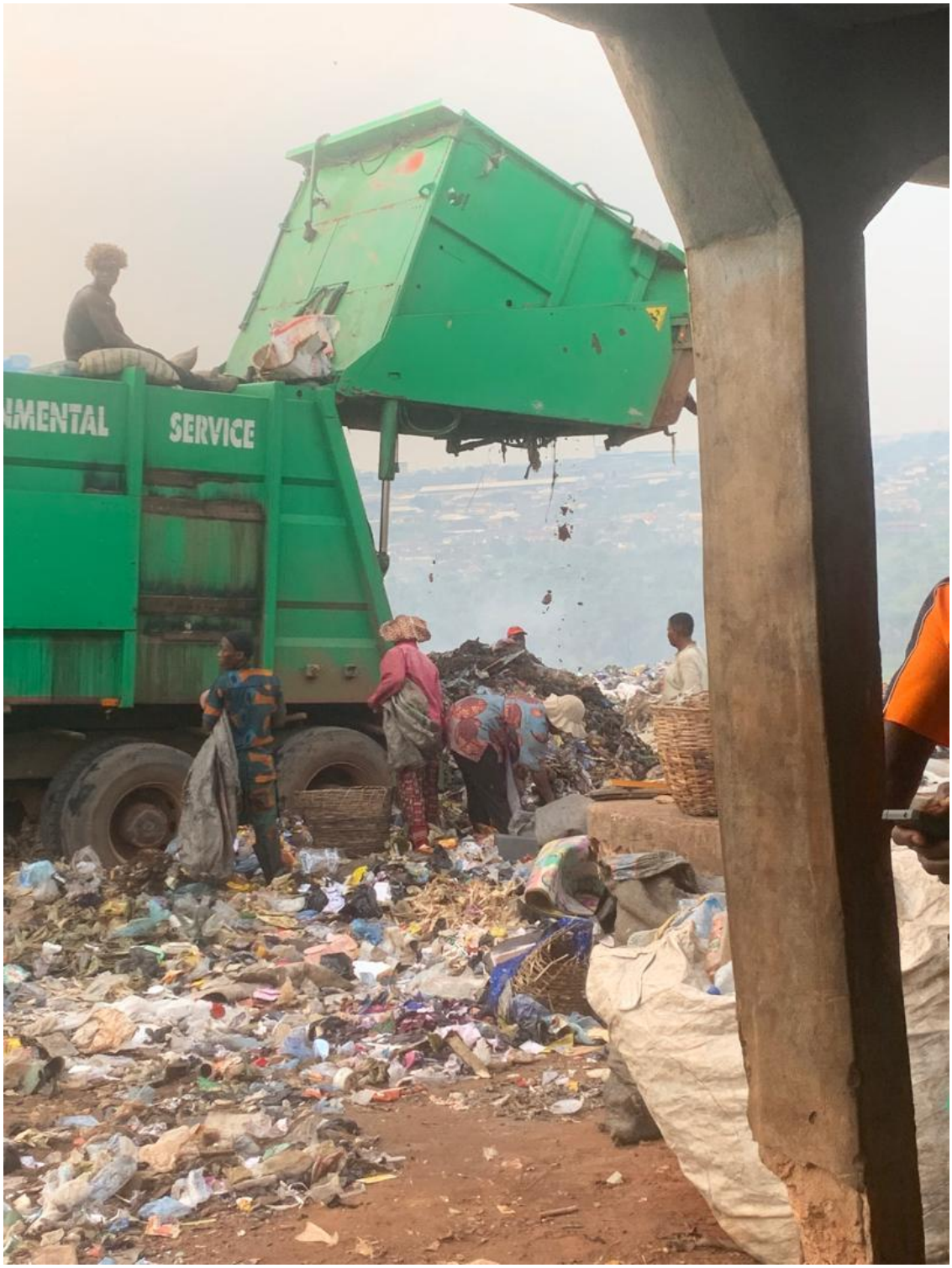

Plate 1: Scavengers at WEPTAP dumpsite

Plate 2: Scavengers at Anthas dumpsite

Plate 3: Project student at dumpsite

Plate 4: Project student with scavengers

ECONOMIC IMPLICATIONS

Fig. 4.21 elucidates the perceived health status of waste scavengers compared to when they started their job. The majority of respondents (66%) indicated that they do not consider themselves healthier now than when they began scavenging, while only 34% reported feeling healthier. This finding underscores the challenges and occupational health hazards faced by waste scavengers, including exposure to physical injuries, environmental pollutants, and infectious diseases, which can adversely affect their well-being over time.

Figure representing Occupational Health Hazards of Scavengers

Fig. 4.22 expresses on the issue of stigma experienced by waste scavengers in the course of their work. Interestingly, 34% of respondents reported experiencing stigmatization, highlighting the social marginalization and discrimination faced by individuals engaged in informal waste picking activities. Stigmatization can manifest in various forms, including negative stereotypes, social exclusion, and discrimination in accessing public services and employment opportunities. The experience of stigma can exacerbate the social and economic vulnerabilities of waste

scavengers, hindering their integration into mainstream society and perpetuating cycles of poverty and marginalization.

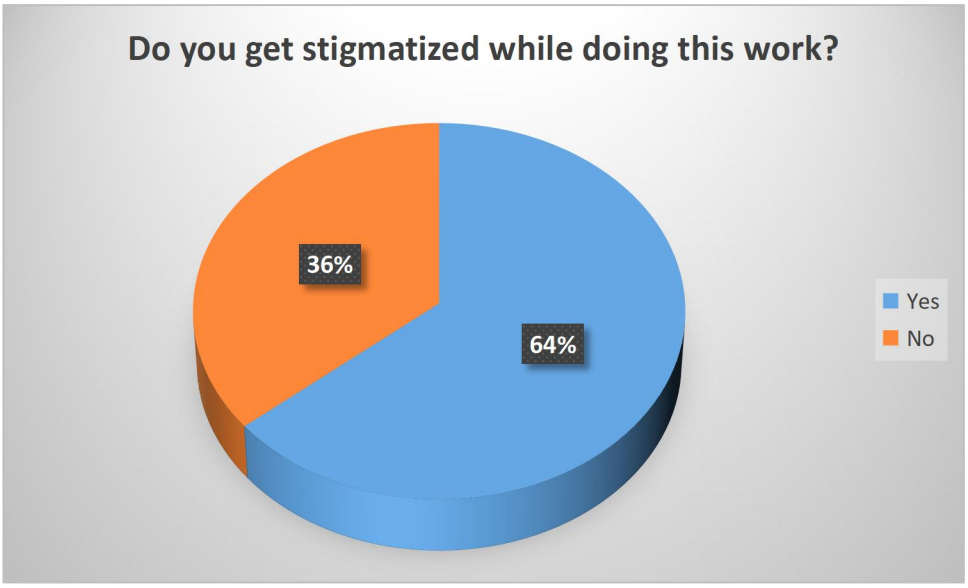

Fig. 4.22: Stigmatization of Scavengers

Do you love this type of work?

Fig. 4.23 explores waste scavengers' attitudes towards their occupation and motivations for engaging in this type of work. A slight majority of respondents (51%) expressed a positive attitude towards waste scavenging, indicating that they enjoy or appreciate this type of work.

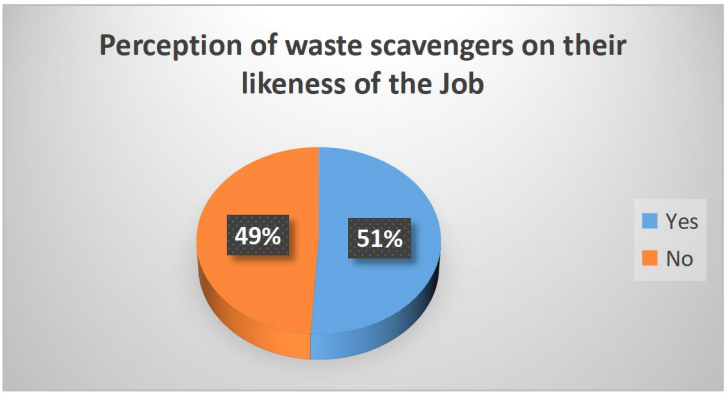

Figure representing Perception of waste scavengers on their likeness of the Job

As seen in Fig. 4.24 the reasons cited for liking the job include the opportunity to earn a good income (36%), resourcefulness (3%), and independence from begging for money (10%).

These findings underscore the economic necessity and livelihood significance of waste scavenging for many individuals, particularly those lacking alternative employment opportunities or facing socio-economic constraints.

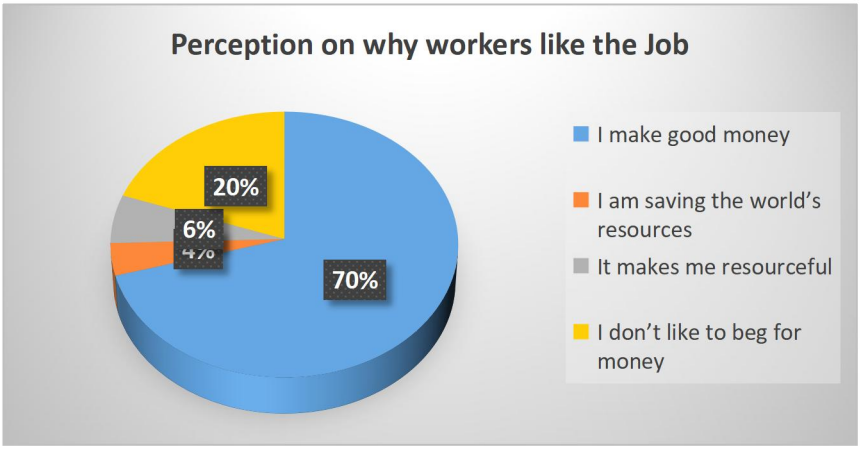

Figure representing Occupational Health Hazards of Scavengers

Conversely, as seen in Fig. 4.25, nearly half of the respondents (49%) indicated that they do not love this type of work. Reasons cited for disliking the job include concerns about its adverse effects on health despite the lack of alternative options (26%), exposure to security risks (11%), and dissatisfaction with the income generated (12%). These responses highlight the complex interplay of economic, social, and environmental factors shaping individuals' perceptions and experiences of waste scavenging as a livelihood option.

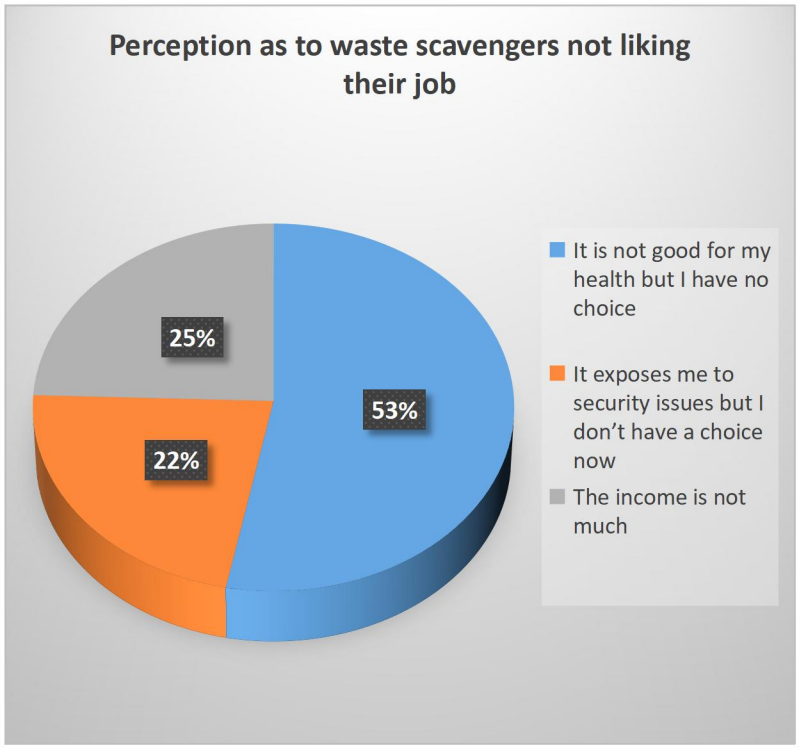

Figure representing Occupational Health Hazards of Scavengers

OBSERVABLE PPE WEARS ON WASTE SCAVENGERS

Question	Response	Number of Responses	Percentage	Total
Safety gloves	Yes	83	83%	100
	No	12	12%	
Protective Clothing/Coveralls	Yes	68	68%	100
	No	32	32%	
Steel-Toe Boots	Yes	67	67%	100
	No	33	33%	
Hard Hat	Yes	37	37%	100
	No	63	63%	
Safety Goggles	Yes	22	22%	100
	No	78	78%	
Face Masks/Respirators	Yes	61	61%	100
	No	39	39%	
High Visibility Vest	Yes	81	81%	100
	No	19	19%	
Safety Aprons	Yes	52	52%	100
	No	48	48%	

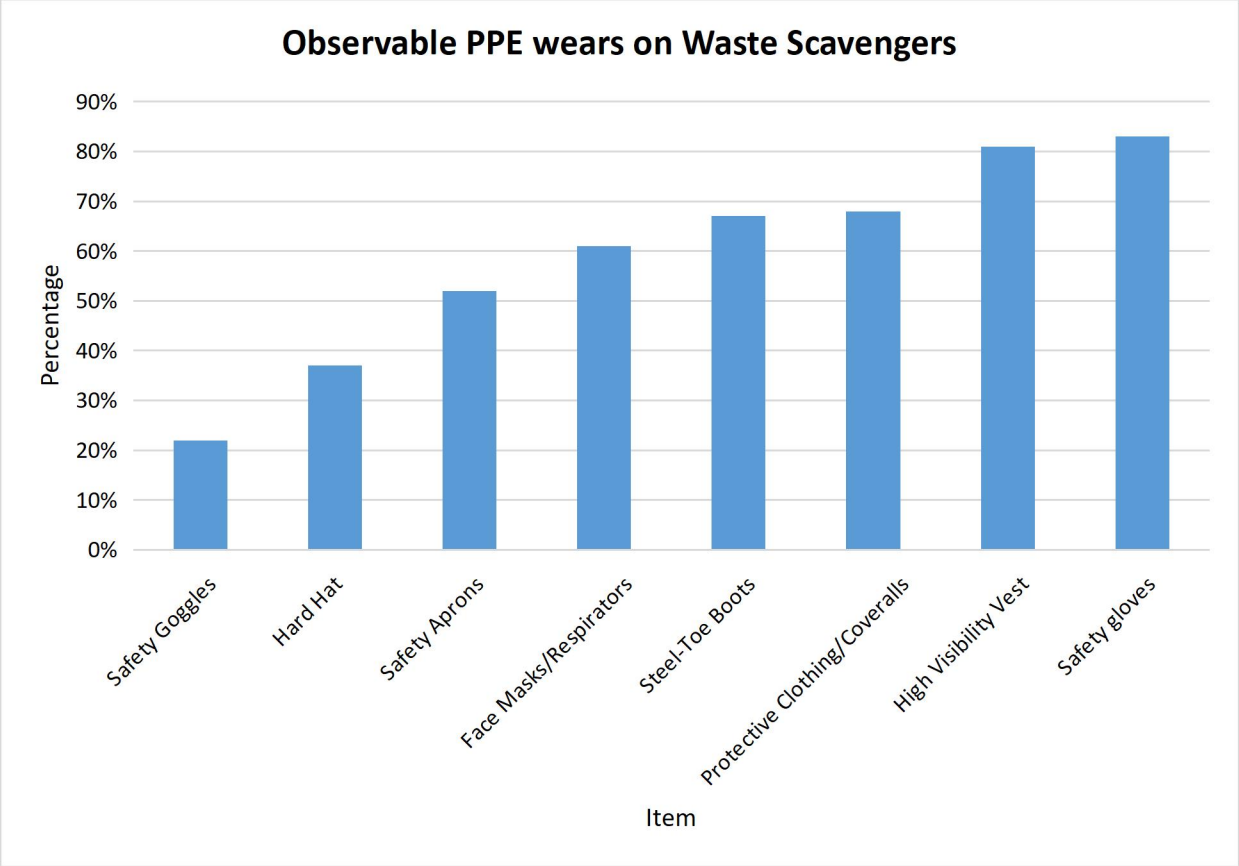

Figure representing Observable PPE wears on scavengers