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Relationship between Occupational Health Hazards Knowledge and Informal Solid Waste Pickers in Port Harcourt Metropolis

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ABSTRACT

This study provides a detailed assessment of occupational health hazards knowledge among informal solid waste pickers in Port Harcourt Metropolis, Rivers State, Nigeria. By employing a survey approach, 357 out of 384 distributed questionnaires were effectively collected, resulting in a noteworthy response rate of 92.96%. These responses were analyzed using SPSS software and results presented in tables and graphs. The study explores perceptions of medical services, knowledge levels, attitudes, and safety practices, providing a nuanced understanding of waste pickers' interactions with healthcare and safety measures. The results from the survey on occupational health hazards in solid waste picking revealed a high awareness level, with 88% acknowledged physical hazards, 42.6% recognized chemical hazards, 48.5% identified biological hazards, 64.7% acknowledged ergonomic hazards, and 60.2% being aware of psychological health hazards. In terms of perception and utility of medical health services, 31.9% reported easy access, 35.9% expressed confidence in service quality, 32.5% believed in the essentiality of medical services, 38.7% were satisfied with accessibility, and 59.1% felt supported by the healthcare system. Regarding knowledge on occupational health and safety, 19% were aware of potential hazards, 30.8% knew how to handle hazardous materials, 11.5% were familiar with proper use of PPE, 33.6% understood the importance of health checkups, and 24.4% knew proper waste disposal procedures. In terms of occupational health attitude, 92.4% prioritized personal health and safety, 87.7% believed in maintaining good health, 69.7% were proactive in risk reduction, and 72.8% actively sought information on health and safety. Lastly, on safety practice, 45.1% were influenced by PPE availability, 50.7% were well-informed about recommended PPE, 54.1% perceived cost as a barrier, 45.1% considered comfort in PPE usage, and 37.3% were influenced by peer behavior in PPE compliance during waste picking activities. The Chi-square test was employed to test for the levels of association between categorical variables related to occupational activities and health hazards, leading to the rejection of the null hypotheses and emphasizing the imperative for targeted interventions. The study revealed a heightened awareness among waste pickers concerning physical, chemical, biological, ergonomic, and psychological hazards associated with their occupation. Consequently, recommendations included targeted interventions for hazard mitigation, improvement in healthcare accessibility, knowledge enhancement programs, and the promotion of a safety culture. This research validated global patterns of occupational health risks among waste pickers, providing actionable insights for stakeholders, and informing future interventions in both the specific context of Port Harcourt Metropolis and the broader discourse on vulnerable occupational groups.

Introduction

Waste pickers collect materials thrown away by others, including plastics, paper, cardboard, wires, glass bottles, rubber materials, sharp metals and harmful electronic materials. They collect these materials from different sources such as streets, on landfills and open dumpsites areas (WIEGO, 2020u). They can be risky for their health as they are exposed to various infectious agents and toxic substances that may cause illness. The concepts of informal solid waste pickers are exposed to various health risks, including respiratory issues due to inhalation of dust and fumes, skin problems from direct contact with

waste materials, and the potential transmission of infectious diseases (Dhibar, 2018). The prolong exposure to dust and particulate matter during waste picking can lead to respiratory problems like asthma and chronic obstructive pulmonary diseases (COPD). Contact with various waste materials can lead to skin problems such as rashes, dermatitis, and other allergic reactions, particularly when proper protective gear is not utilized.

In addition, informal waste pickers are also exposed to occupational health and safety risks as a result of unsafe handling of waste materials and lack of protective clothing/equipment. These conditions often result in injuries, respiratory problems, skin disorders, and gastrointestinal issues among waste pickers (Adewale, 2017). The pickers are often unaware of the dangers they face but are economically tied to the occupation in a bid to make a living (Cointreau, 2016). The nature of duties involved in informal waste picking requires the use of protective equipment. The protective equipment they require ranges from "toetector" footwear, nose mask, high visibility clothing capable of being seen by drivers from a reasonable distance, gloves, suitable raincoat, heat or cold and reinforced trousers to guide against punctured wounds from sharp objects. The protective equipment should be suitable to the task; where possible the personal protective equipment should be tried out before general use (California Occupational Guide, 2022).

Across the developing world, informal waste pickers group exhibit certain common features. They are often marginalized populations living in extreme poverty (Samson, 2020), and are often some of the most vulnerable people in society (Medina 2017). They generally face high risks (WIEGO 2020), While a majority work with the informal sector preventing them from the benefits and social advantages of formal jobs (International Labour Organization & WIEGO 2017).

Worldwide, informal waste picking is a common way for people to earn an income by finding valuable material that can be exchanged for money. Infact, the only form of waste collection in many countries is provided by waste pickers. Around the world, millions of people earn a living collecting, sorting, selling, and recycling materials that have been disposed as waste (Dias, 2022). It is difficult to know just how many individuals participate in the practice of waste picking (Medina, 2018). Waste pickers can include women, children, elderly people and /or migrants and although informal waste pickers are prevalent in developing countries they are also found in developed countries on a much smaller scale (Medina 2017). Broadly, two types of scavengers exist in the city; itinerant pickers, who go from house to house picking useful items from bins. This group consist mostly unemployed young men with little basic education. The number of people engaged in this form of scavenging is not known as they operate on individual basis without any cooperation or association. The second group consists also of those scavengers that operate solely at the dump site, picking recyclable materials as they are dumped from the disposal vehicles. They also consist of uneducated young men who commute daily from neighboring slums and satellite towns to these dumpsites.

Undoubtedly, most landfill sites are faced with inadequate health and safety measures, which include the use of personal protective equipment (PPE) and hazard awareness that could negatively impact the health status of the waste pickers. Hence, the health conditions of the waste pickers could be adversely affected. Due to cuts and contact with toxic substances like dust inhalation, bacteria, and chemicals, a large proportion of waste pickers are at a higher risk of being infected by injuries and diseases unlikely the general population. Health impact of waste pickers is also affected by their socioeconomic characteristics, such as age, educational level, income earned, and number of days worked weekly.

Their informal employment status often excludes them from social security and health insurance schemes. This lack of financial resources, coupled with stigma and discrimination, leads to inadequate healthcare seeking behaviors and delays in receiving medical attention when needed (UNEP, 2020).

Also, economic challenges and irregular income can contribute to food insecurity and inadequate nutrition among waste pickers and their families. Several studies reported that waste pickers are at high risk for developing diseases resulting from exposure to various work hazards. Workers in this occupation line are mostly exposed to several forms of injuries and diseases in their work, arising from collection point, when transporting and during dumping sites (Cointreau, 2016). It is against the backdrop that the study examined the relationship between occupational health hazards knowledge and informal solid waste pickers in Port Harcourt Metropolis.

Concept of Occupational Health

Occupational Health is a multidisciplinary field that addresses the two main elements in the study of work and its hazards with a focus on preventative strategies against diseases and injuries as well as the protection and management of the environment and natural resources from occupational activities. Occupational health studies the relationship between different types of work and diseases, illnesses and wellness (ILO 2014). According to World Health Organization (WHO), occupational health aims to promote and maintain the highest degree of physical, mental and social well-being of workers in all occupations (WHO 2021).

Occupational health looks at the potential health issues that could be consequential from the workplace activities and/or interactions. Certain occupational risks, such as injuries, noise, carcinogenic agents, airborne particles and ergonomic risks account for a substantial part of the burden of chronic diseases: 37% of all cases of back pain, 16% of hearing loss, 13% of chronic obstructive pulmonary disease, 11% of asthma, 8% of injuries, 9% of lung cancer, 2% of leukaemia and 1% of depression (https://www.who.int/news-room/fact-sheets/detail/protecting-workers'-health). The first major cause of work-related fatalities (i.e deaths) is cancer, followed by circulatory diseases and then certain communicable diseases and, in fourth place is injuries from occupational accidents. Most of these occupational diseases, illnesses and accidents, fatal and non-fatal, are preventable through existing and tested measures and methods that have proven to reduce occurrences and ensure significant human, social and economic benefits (Alli 2014). As Alli (2014) put it: "work should take place in a safe and healthy working environment; - conditions of work should be consistent with workers' well-being and human dignity;- work should offer real possibilities for personal achievement, self fulfillment and service to society".

Research conducted by Alli (2014) emphasizes the role of psychosocial factors in occupational health, highlighting the importance of addressing workplace stress and fostering supportive environments to enhance employee well-being. Additionally, the concept of occupational health has gained further importance in the context of COVID-19 pandemic, as organizations have had to implement measures to ensure workplace safety and health, including remote work policies, infection control practices, and mental health support for employees facing challenges during these unprecedented times (WHO 2021).

Occupational Health Hazards and Informal Waste Pickers

An estimated 2.3 million waste pickers annually die from the negative effects of their job worldwide, with an estimated 270 million suffering from occupational injuries, accidents, and diseases. The way the workers handle the materials and the equipment they use accounts for occupational risks and accidents. A risk or hazard experienced at work is referred to as an occupational hazard. Chemical dangers, biological hazards, psychological hazards, and physical hazards are the most common types. Informal waste pickers are frequently exposed to various hazardous substances, including heavy metals, organic solvents, and toxic chemicals, leading to increased risk of respiratory issues, skin diseases, and long-term health complications(e.g., neurological disorders and cancer) (Parliament of the Republic of South Africa, 2018).

Waste pickers often encounter sharp objects, broken glass, and hazardous waste materials, which can lead to cuts, wound, and musculoskeletal injuries (Bambra, 2017). Contacts with biomedical waste and other infectious materials exposes waste pickers to the risk of contracting various diseases such as hepatitis, tetanus, and gastrointestinal infections. The unpredictable and low-income nature of waste picking, combined with societal stigma and poor working conditions, can result in mental health issues like stress, anxiety, and depression. Unintentional injuries such as puncture wounds, abrasions, lacerations, dog bites, burns and rat bites are very common injuries among informal waste pickers. Other injuries occur when waste pickers drop heavy containers on their feet or legs (Lincoln, 2016)

Taiwan waste pickers were found to complain of musculoskeletal injuries of low back, wrist, and elbow. The prevalence of injuries in waste picking work was more than doubling the office workers. The frequent complaint were strains/sprains, cutting injury, laceration, twisting and soft tissue injury, cause by either falls or slip injuries, being hit or injured by sharp objects, cut by broken glass, or piecing object and straining of the body. In this environment, the informal workers' health is his/her greatest asset and a precondition for the sustainable generation of income. Protection of workers from occupational hazards depend on availability and proper utilization of protective equipment, which in low and middle income countries is in short supply with very limited monitoring of their utilization.

Occupational Health Impacts of informal Solid Waste Pickers

According to WHO (2017), over 50 million workers are exposed to a complex variety of health and safety hazards which physical, chemical, biological, mental, psycho-social stress, and ergonomic health problem in relation to their work. These health problems affect them in one way or the other, especially solid waste pickers.

Physical Health Problems: Physical health Problems are commonly associated with solid waste picking and this includes cuts from sharp objects such as pieces of glass, razor blades, scrap metals and pricks and also piercing vein e.g needle. The physical health effects or hazards to solid waste pickers are mainly wounds, being hit by falling objects, broken limbs, fall and lacerations. Exposure to sharp objects and contaminated materials can lead to the transmission of blood borne diseases such as HIV/AIDS and hepatitis B and C.. Exposure to dust and hazardous materials can lead to eye irritation, injuries, and long-term vision problems among solid waste pickers. Due to exposure to contaminated materials, solid waste pickers are risk of contracting gastroenteritis and hepatitis A. Solid waste pickers are susceptible to various physical injuries, including cuts, punctures, and fractures, due to the handling of sharp and heavy objects. Informal solid waste pickers face the risk of contracting infectious diseases during waste picking activities as a result of potential exposure to pathogens and infectious agents from decomposing organic waste, leading to the spread of diseases (ILO, 2017).

Waste picking activities, particularly in dumpsites, can expose individuals to harmful gases such as methane and other toxic fumes, leading to respiratory problems and other serious health complications. Inhalation of harmful gases and particulate matter can lead to respiratory ailments such as bronchitis, asthma, and chronic obstructive pulmonary disease (COPD). Solid waste pickers are at risk of being exposed to vector-borne diseases such as fever, malaria, and chikungunya due to the presence of bleeding sites for collection areas (Medina, 2017).

Informal waste pickers who work with solid waste are more vulnerable because they spend so much time exposed to the dangers. There are various negative health impacts associated with the practice of informal waste picking. Exposure to toxic chemicals and hazardous substances from electronic waste, industrial waste, and medical waste. This can lead to respiratory issues, skin diseases, and long-term health complications (UNEP, 2015). Many harmful health outcomes that result from handling toxic waste, dangerous waste, or hazardous waste, have been identified in previous literature. Outcomes can range from exposure to disease (e.g., hepatitis B and C) to social, economic, and psychological effects.

Taiwan waste pickers were found in complains of musculoskeletal injuries of low back, wrist and elbow. The prevalence of injuries in waste picking work was more than double the office workers.

Chemical Health Problems: Chemicals are connected to anatomical poisons and skin irritating or injuries like respiratory sickness and burns (Jerie, 2016) stated that chemicals exposure cause sickness like dermatitis, inflammation in respiratory tracks, damage liver and disruption in CNS tracks. Some route to chemical absorption includes inhalation, injection, and dermal contact.

Biological Health Problems: The several biological health problems are characterized with contaminants which are equally pathogens like virus, bacteria, fungi and protozoa and blood from pathogens in waste workers usually occur by physical contact between waste and injuries, zoonosis arising from bites of wild and stray insects and dangerous transpiration through insects (Jerie, 2016). Wounds from strap metallic edge, glass and needless are common entry for pathogens after exposure to virus and bacteria like hepatitis B, fungi, parasites.

Respiratory Health Problems: There could be connection between working at open dumps and an increase in respiratory illnesses and faulty lung function tests, according to studies conducted in various nations. Exposure to biologically active substances, gases,bio-aerosols, and dust with high concentrations of organic content such as bacteria and fungi is linked to an increased risk of respiratory disease.

Infections: Waste pickers have high frequency of nail infections. 47% of people had infections in their nails on their fingers or toes, with the majority of these infections being fungal and lesions have subsequent bacterial infections that were made worse by frequent soaking brought on by direct contact with garbage. The danger carrying mosquito “Aedesaegypti” prefers breeding in containers, tires, and tin can found in trash heaps that contain small, clean water pools. The physiochemical properties of coconut shells, as opposed to plastics and pots, enhance mosquitoe development; these were abundant in the solid waste of these areas. Vectors like flies and mosquitoes breed inside the landfill during the summer and spread to other areas.

Ergonomic Health Problems: Waste collection is a physical demanding job, which is the reason for high prevalence rate of musculoskeletal disorders. Waste pickers are exposed to considerable risk of developing ergonomics disorder such as low back pain, painful neck and may also affect shoulders and arm (Cointreau, 2013). Waste picking requires physical strength, which is related to numerous risks of musculoskeletal disorders (MSDs). Waste pickers are prone to injuries, musculoskeletal disorders and accidents due to handling heavy loads and sharp objects during collection and sorting activities. Musculoskeletal and ergonomic risks are injuries caused by improper body motions. Damage can occur during waste collection as the effect of strenuous physical labour, such as hauling the waste and pushing carts and heavy bags of recyclables.

Cointreau (2013), reviewed many studies where researchers acceded that mechanical loads lifting during waste collection exceed maximum acceptable limits recommended; during the performance of tasks such as hauling bags of waste which result in compression of the spine, and lifting loads that causes excessive twisting to the shoulder resulting in magnified causes of musculoskeletal problems.

Mental Health Problems: Mental health is usually used to denote the absence of mental disorder. According to the World Health Organization (WHO). Mental health is defined as a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a (meaningful) contribution to his community. In other words, mental health has to do with our emotional, psychological and social and social well-being. (WHO, 2014). The challenging working conditions and social stigma can contribute to mental health disorders such as depression, anxiety, and post-traumatic stress disorder (PTSD). Also, the physical and mental health of waste pickers can deteriorate significantly due to prolonged exposure to hazardous

substances and unsanitary working conditions. This emphasizes the health degradation among waste pickers, leading to chronic illnesses and reduced life expectancy.

Psycho-social Health Problems: Low social status and their livelihood are characterized by poverty, starvation, mal-nutritio, low education level, emotional and physical abuse, lack of training of basic health care and first aid, limited access to healthcare facilities are associated with waste pickers. The marginalization and social stigma that prevails at their various work places create unnecessary stress. Waste pickers avoid health clinic and hospitals when injured or sick for the fear of discrimination. The social stigma associated with waste pickers was found to be a major issue in India (Snel, 2019).

The socioeconomic standing and unfavorable working circumstances of the waste pickers have been noted. Discrimination against waste management personnel continues tp persist, even in Japan. In Palestine and Nigeria, the socioeconomic status of domestic waste pickers was found to be low. It was reported in Nepal, after investigation that 73% of informal recyclers confirmed that they did not wash their hands with soap after work and 65% would not change out their work cloths (Corntreau, 2013). These further show that social stigma attached to working in a dirty environment continues to the home and the waste pickers tend to neglect their own upkeep. Fatigue, nausea and headaches are known to be another factors contributing to high psychosocial stress.

Access to Medical Services: Informal waste pickers often face challenges in accessing adequate medical services, leading to untreated health issues and a higher risk of chronic diseases and ILO (2017). According to a study by Chala *et al.,* (2012), informal waste pickers often face challenges in accessing adequate healthcare services, which can adversely impact their health and well-being. Due to their informal status, they may not have access to health insurance schemes or regular healthcare services, leading to a lack of preventive and curative healthcare. One of the significant barriers to accessing medical services for informal waste pickers is the lack of formal recognition and integration into the formal waste management system. This can lead to exclusion from health insurance schemes and preventive healthcare programs (ILO)

Additionally, the World Health Organization (WHO, 2012) emphasizes the importance of improving access to health services for vulnerable populations, including waste pickers, to ensure their right to health.

Poor Strategies for raising occupational health hazards awareness

Poorly designed or outdated training programs that fail to address specific workplace hazards can lead employees ill-equipped to recognize and respond to risks effectively. Relying solely on static materials like pamphlets and posters may not effectively engage employees. One study found that interactive methods significantly outperformed static materials in improving hazard awareness. It is crucial that everyone involved in waste management activities have proper understanding of waste handling issues. Educating and mobilizing this group of workers on specialized methods will help cater for their occupational health hazard issues.

Agba (2020) describes media as instruments used in communicating health education to the public, while methods describe the process of communicating. Agba stated that one way of raising public awareness and producing measurable results quickly is to use informal channels. They grouped these information channels in two: Traditional media and modern media. Ignoring the cultural context of the workplace can hinder communication. Using generic messages without considering the specific needs and demographics of the workforce may lead to misunderstandings.

The use of Personal Protective Equipment: Personal Protective Equipment (PPE) is crucial for informal solid waste pickers to mitigate health risks associated with their work. Studies by Wilson and Velis (2015), emphasize the occupational hazards these workers face, including exposure to harmful substances and injuries. Wearing of personal protective equipment (PPE), such as gloves, Masks, and

durable clothing, can protect and prevent against some of the health related problems from their work such as cuts, infections, and respiratory. Economic constraints and lack of awareness are challenges in implementing PPE among waste pickers (Medina, 2013). Incorporating PPE into waste management policies can enhance the safety performance of informal waste pickers and promote healthy working environment.

Magnitude of Waste Generation: Waste generation in urban centers, such as Port Harcourt Metropolis, is a critical environmental issue with implications for public health and sustainable development. According to recent studies, the magnitude of waste generation in Port Harcourt Metropolis has witnessed a notable increase in recent years, reflecting the growing population and urbanization in the region. As the economic and commercial hub of the Niger Delta, Port Harcourt Metropolis experiences substantial industrial and commercial activities, contributing to the significant volume of waste produced daily. The rapid urbanization and population growth have intensified the challenges associated with waste management, leading to an upsurge in the quantity of waste generated. Various sources contribute to the waste stream in Port Harcourt, including household activities, commercial establishments, and industrial processes. The increase in disposable packaging, electronic waste, and other non-biodegradable materials further amplifies the challenges of waste management.

Statement of the Problem

Studies have showed that the health problems associated with informal solid waste pickers are enormous and cannot be ignored. The city of Port Harcourt Metropolis is grappling with pressing issues of occupational health challenges among informal solid waste pickers in the metropolis. Informal waste pickers often come into direct contact with hazardous materials such as chemicals, toxins, and infectious waste, leading to various health risks. Informal waste pickers are at a higher risk of contracting infectious diseases such as hepatitis, tuberculosis, and gastrointestinal infections due to their exposure to contaminated waste materials. They often work in hazardous environments without proper safety equipment, leading to high risk of injuries, cuts, and accidents.

The limited access to healthcare facilities contributes to the lack of timely medical intervention and exacerbates the overall health burden experienced by this marginalized population. Also, limited access to healthcare services, not only hampers the timely diagnosis and treatment of occupational health ailments but also perpetuates the cycle of health inequity among these marginalized individuals. In the urban landscape of Port Harcourt Metropolis, informal solid waste pickers endure severe medical challenges that demand urgent attention. Research conducted by Cointreau (2016) emphasizes the detrimental health effects stemming from prolonged exposure to heavy metals and toxic organic compounds found in the waste materials, leading to potential risks of cancer, neurological disorders, and respiratory ailments among the workers.

In the light of the challenges, this research seeks to assess the occupational health hazards knowledge faced by informal solid waste pickers in Port Harcourt Metropolis. The findings from this study will inform interventions aimed at improving the health and well-being of this marginalized community while also contributing to a more sustainable and equity urban environment.

Aim and Objectives of the Study

The aim of the study was to establish relationship between occupational health hazards knowledge and informal solid waste pickers in Port Harcourt Metropolis. Specifically, the objectives of the study are to:

1. Identify the extent occupational health hazards relate to informal solid waste picking in the Port Harcourt Metropolis.

2. Ascertain the extent the level of safety practices relates to informal solid waste pickers in Port Harcourt Metropolis.

Research Questions

The following research questions were drawn to guide the study:

1. To what extent does occupational health hazards relate to informal solid waste picking in the Port Harcourt Metropolis?
2. To what extent does the level of safety practices relates to informal solid waste pickers in Port Harcourt Metropolis?

Research Hypothesis

The following research hypothesis was adopted:

$H0_1$ There is no significant relationship between occupational health hazards and informal solid waste picking in the Port Harcourt Metropolis.

$H0_2$ There is no significant relationship between the level of safety practices relates to informal solid waste pickers in Port Harcourt Metropolis.

METHODOLOGY

The descriptive study design was used in this study in order to acquire information. According to Elendu (2020), survey design method is that which investigates, studies reports and describes events. He further stated that the design could be public opinion survey, fact finding survey, studies and so on. He explained that descriptive survey research design is used for the study or a group of persons to assess behavior, preferences, perception and opinions from a few member of the entire population, considered true representative of the entire group. Therefore, descriptive survey design was desirable since it used a representative sample of the population to enable the researcher to systematically collect, analyze and interprets data to describe the current situation in assessment of occupational health hazards among informal solid waste pickers in Port Harcourt Metropolis. The populations of Port Harcourt metropolis as at 2006 population census were 538,558 and 462,350 for Port Harcourt LGA and Obio-Apkor LGA respectively, with an annual growth rate of 3.02%. This sums to 1,000,908 (National Population Commission of Nigeria, 2006). This was projected using the stated growth rate, to obtain a 2022 current population forecast using the population growth model as proposed by Al-Eideh and Al-Omar, (2019)

$$P_t = P_0 e^{r\Delta t}$$ Where

P_t = Projected population at time *t* (in years)

P_0 = Initial population = 1,000,908

e = Exponential growth constant

r = Annual population growth rate in percentage (3.02%)

Δt = Absolute change in time (in years) = 16

So we obtained the 2022 projected population of Port Harcourt metropolis as

$$P_{2022} = 1000908\left(e^{(0.0302)(16)}\right)$$

$$P_{2022} = 1{,}622{,}566$$

Thus using the formula we obtained the 2022 projected population of the study area to be approximately1,622,566. In conducting a socio-economic study within Port Harcourt Metropolis, a thoughtful and robust sampling strategy is imperative to ensure the accuracy and representativeness of the data collected. This study employs a correlational research design. This method allows for a

systematic and comprehensive representation of the entire population by categorizing it into distinct strata based on geographic location (LGAs, in this case). Each LGA is treated as a separate stratum, acknowledging the unique characteristics and variations that may exist across different areas within the city. This study applied Cochran's formula to obtain the sample size. Cochran's formula is a pivotal tool in statistics, specifically for calculating sample sizes in survey research. It provides a systematic approach to determining the number of observations needed to estimate a population parameter with a specified level of confidence and precision. The formula incorporates factors such as the desired level of confidence, estimated population proportion, and margin of error:

$$n = \frac{Z^2 pq}{d^2} \quad (3.2)$$

Where

n = sample size

Z = standard normal deviation corresponding to 95% level of significance.

p = prevalence (proportion of informal waste pickers in the study area)

q = (1-p)

d = Desired margin of error (5%)

Now, computing the sample size, let p be the proportion of Informal Waste pickers in Port Harcourt metropolis which is estimated to be 0.5, with a confidence level of 95% and a margin of error of 5%. In this case, the Z-score would be 1.96 (corresponding to a 95% confidence level). Assuming an estimated proportion *(p)* of Informal Waste pickers in Port Harcourt metropolis based on prior knowledge is 0.05 (which is taken by default).

We can apply Cochran's formula(3.2) above:

$$n = \frac{(1.96)^2 . 0.5(1 - 0.50)}{(0.05)^2}$$

$$n \approx 384$$

The sample size for the study is 384. This was distributed across the two LGAs within the Port Harcourt metropolis of Rivers State. The study researcher used primary data. A researcher-designed instrument titled Assessment of Occupational Health Hazards Questionnaire (AOHHQ) was used for data collection. The instrument was administered and data collected by the study researcher with the help of two research assistants. Three hundred and eighty-four (384) copies of the questionnaire were administered to the study respondents. The questionnaire consists of 25scaled questions and 7 demographic questions. Further, the questionnaire was designed to assess the 5 hypotheses relative to the study research questions.

Since the research instrument used was the questionnaire, it was designed using the 3-point Likert scale method. The questionnaire was designed in the following ways:

i) NO - 1
ii) NOT SURE - 2
iii) YES - 3

To ensure the reliability of the data collection tool, this research employed both face and content validity. The AOHHQ instrument underwent a comprehensive review by the research supervisor. In this study, face validity involves ensuring that the questions in the AOHHQ instrument appear relevant and appropriate for assessing the intended aspects, such as occupational health hazards, medical services perception, and knowledge, attitude, and level of occupational health and safety. The instrument should seem, at a glance, to be a suitable tool for gathering information on these specific areas from informal solid waste pickers.

Content pretest in this study entails a rigorous review of the AOHHQ instrument by the research supervisor at the Institute of Geosciences and Environmental Management (IGEM). The supervisor, being an expert in the field, evaluated the contents whether the questions effectively captured the various dimensions of the study objectives, including occupational health hazards, access to medical services, knowledge of occupational health, and psycho-social health problems. All recommendations or concerns raised by the supervisor were addressed through necessary adjustments to enhance the instrument's comprehensiveness and relevance. Feedback from the reviewers was carefully considered, and necessary adjustments were made to enhance the instrument before administration. The reliability of the instrument deplored the Kuder-Richardson-20 (KR-20) to obtain a measure of internal consistency of the items making up the research instrument using the formula

$$\propto = \left(\frac{K}{K-1}\ 1 - \frac{\sum Vi}{Vt}\right) \quad (3.3)$$

$where\ K = No.of\ items$

$\sum Vi = sum\ of\ variance\ of\ items$

$Vt = Variance\ of\ total\ items$

$\propto = Cronbach's\ Alpha = 0.74$ was obtained which a sample of 5 responses was tested using SPSS software, indicating that the instrument is very reliable. Data for the study obtained through questionnaire, was analyzed using descriptive statistical techniques (frequency and percentage) and presented using tables, charts and graphs. This was used to analyze the demographics and responses. Chi-square statistic was used to obtain inferential conclusion based on the research hypotheses. The Chi-square statistic is commonly used for testing relationships between categorical variables in other to draw inferential conclusion.

The general form of the Chi-square test statistics is given by:

$$\chi^2 = \sum_{i=1}^{n} \frac{\left(O_i - E_i\right)^2}{E_i} \quad (3.4)$$

Where

χ^2 = Chi-square test statistic

O_i = Observed frequency

E_i = Expected frequency

n = number of observations

Reject $H_o\ at\ the\ critical\ value\ \alpha = 0.05$ if the $\chi^2_{\text{Calculated}} > \chi^2_{\text{Critical}}$ and do not reject H_o, otherwise. Also, we will reject H_0 if the probability (*p-value)* for the test is less than the critical value of 0.05. That is if $p<0.05$, otherwise do not reject H_0. Numerical analysis was done using two statistical packages; Statistical Package for Social Sciences (SPSS), version 25.

RESULTS

Demographic Characteristics

Out of the initially distributed 384 questionnaires, a substantial total of 357 were successfully retrieved, constituting an impressive response rate of 92.97% of the original sample size. This high retrieval rate enhances the reliability and representativeness of the collected data, indicating a robust engagement with the study. The inclusion of waste pickers from both Port Harcourt and Obio-Akpor LGAs ensured geographical diversity, potentially capturing a more comprehensive picture of the targeted population. The commitment of respondents to participate in the survey significantly contributed to the validity of the findings, reflecting a thorough and inclusive approach to the research within the designated areas.

Table 1 meticulously delineates the socio-demographic characteristics of the study's respondents, offering a nuanced analysis through frequency and percentage quantifications. Geographically, the majority of waste pickers reside in Obio-Akpor (58.8%) and Port Harcourt (41.2%), providing essential context to the study's regional representation. The gender distribution revealed a significant male majority (87.4%), while female represented only about (12.6%) of the total of respondents, underscoring potential gender-related nuances in the study's outcomes. Age-wise, the sample exhibited diversity, with the largest contingent in the 26-35 age brackets (37.0%), reflecting a broad spectrum of life stages. Marital status highlighted a predominantly married (45.1%) and single (53.2%) composition, widowed (1.7%) with marital dynamics potentially influencing study variables. Educational backgrounds vary, with a substantial proportion having secondary education (61.6%), and diverse qualifications, such as OND/HND/BSC (10.6%) and Others (25.8%). Income distribution, crucial for assessing economic status, indicated a significant segment falling within the NGN20,000 - NGN50,000 range (39.5%). The occupational dimension revealed a majority with 2-5 years of experience as solid waste pickers (55.5%), offering insights into the respondents' familiarity and expertise in their roles. Overall, Table 1 provided a comprehensive portrait of the study population's socio-demographic landscape, enriching the interpretation of research findings and guiding targeted interventions tailored to specific demographic characteristics.

Table 1: Socio-Demographic Characteristics of the Respondents

Variable	Frequency (n=357)	Percentage (%)
Location/LGA of Residence		
Obio-Akpor	210	58.8
Port Harcourt	147	41.2
Gender		
Female	45	12.6
Male	312	87.4
Age Bracket		
18 – 25	79	22.1
26 – 35	132	37
36 – 45	80	22.4
46 – 55	52	14.6
56 Years	14	3.9
Marital Status		
Married	161	45.1
Single	190	53.2

Widowed	6	1.7
Level of Education		
OND/HND/BSC	38	10.6
Others	92	25.8
Primary	7	2
Secondary	220	61.6
Average Monthly Income		
Less than NGN20,000	20	5.6
NGN20,000 - NGN50,000	141	39.5
NGN51,000 - NGN100,000	139	38.9
Above NGN100,000	57	16
Years of Experience as a Solid Waste Picker		
Less than 2 years	29	8.1
2 - 5 Years	198	55.5
6 - 10 Years	96	26.9
Above 10 Years	34	9.5

On the Occupational Health Hazards

Table 2 illustrated the distribution of responses on occupational health hazards among a sample of 357 waste pickers. Regarding physical hazards associated with solid waste picking, a significant 88% of respondents acknowledged potential health problems, with 7.9% responding negatively and 4.2% expressing uncertainty. Awareness of chemical hazards revealed that 42.6% recognized health risks, while 27.2% denied awareness and 30.3% were unsure. For biological hazards, 48.5% acknowledged potential health issues, contrasting with 26.1% unaware and 25.5% uncertain. Ergonomic hazards, including musculoskeletal problems, were recognized by 64.7%, while 9% denied awareness and 26.3% were unsure. Psychological health hazards were acknowledged by 60.2%, with 8.1% denying awareness and 31.7% uncertain. These findings offered a comprehensive insight into waste pickers' awareness of various occupational health hazards, highlighting the need for targeted interventions and awareness programs within the waste management sector.

The findings presented in Table 2 are validated and further elucidated through the graphical representation in Figure 1. The graphical depiction serves to reinforce and visually illustrated the distribution of responses on occupational health hazards among waste pickers, providing a complementary perspective to the numerical data. This synergy between the tabular and graphical representations enhanced the overall understanding of the respondents' awareness levels regarding different occupational health hazards associated with solid waste picking activities.

The chi-square test results in Table 3 for Hypothesis 1, which aimed to investigate the association between occupational activities of informal solid waste pickers and the presence of occupational health hazards in the study area. The table presented a contingency table with responses categorized as 'NO,' 'NOT SURE,' and 'YES' for each type of occupational health hazard, including Physical, Chemical, Biological, Ergonomic, and Psychological hazards. The table also provided total counts and percentages for each response category. For instance, in the case of Physical Hazards, 28 respondents answered 'NO,' 15 answered 'NOT SURE,' and 314 answered 'YES,' summing up to a total of 357 respondents. The corresponding percentages are also provided, indicating the proportion of each response category within the total. The table concluded with a summary row presenting the total counts for each response category across all hazard types, and additional statistical information, including the chi-square value (239.906)

and the associated p-value (0.000), suggested a statistically significant association between respondents' awareness of occupational health hazards and their occupational activities as waste pickers.

Table 2: Distribution of Responses on Occupational Health Hazards

Variable	Frequency (n=357)	Percentage (%)
Physical Hazards associated with solid waste picking such as piecing objects, falls and hit from falling objects and working under extreme heat can cause health problems		
No	28	7.8
Not Sure	15	4.2
Yes	314	88
Aware of the Chemical hazards associated with solid waste picking such as perception of chocking smell, and irritation of the skin and eye can result in illness		
No	97	27.2
Not Sure	108	30.3
Yes	152	42.6
Aware of the Biological hazards associated with solid waste picking such as improper handling of bacteria and fungi infectious materials can cause health issues		
No	93	26.1
Not Sure	91	25.5
Yes	173	48.5
Aware of Ergonomic hazards such as Musculoskeletal health problems resulting from lifting, pushing of heavy loads, sitting or standing for long time can cause health issues.		
No	32	9
Not Sure	94	26.3
Yes	231	64.7
Am aware of Psychological health hazards associated with waste picking such as abuse from the public and depression can result to illnesses		
No	29	8.1
Not Sure	113	31.7

Yes	215	60.2

Table 3: Chi-square Test for Hypothesis 1

	NO	NOT SURE	YES	TOTAL	DF
Physical Hazards associated wit	28	15	314	357	8
	55.80	84.20	217.00		
Aware of the Chemical hazards a	97	108	152	357	8
	55.80	84.20	217.00		
Aware of the Biological hazards	93	91	173	357	8
	55.80	84.20	217.00		
Aware of Ergonomic hazards such	32	94	231	357	8
	55.80	84.20	217.00		
Am aware of Psychological healt	29	113	215	357	8
	55.80	84.20	217.00		
Total	279	421	1085	1785	1785
Chi-square	239.906				
p-value	0.000				

Cell
Contents
Count
Expected count

On the Level of Safety Practices

Table 4 delved into the intricate aspects of safety practices among 357 informal solid waste pickers in Port Harcourt Metropolis. Participants' responses were detailed across multiple variables: Firstly, regarding the influence of personal protective equipment (PPE) availability, 45.1% agree, while 38.7% are unsure, and 16.2% disagree. Secondly, knowledge about recommended PPE is reported, with 50.7% affirming awareness, 32.8% uncertain, and 16.5% indicated lack of knowledge. Thirdly, economic constraints affecting consistent PPE usage were highlighted, as 54.1% identify cost as a barrier, 22.7%

were unsure, and 23.3% negates cost implications. Fourthly, comfort and ease of use play a significant role, with 45.1% expressing their impact, while 37.3% were uncertain, and 17.6% disagreed. Lastly, peer influence is evident, as 37.3% acknowledged its impact, 44.3% were unsure, and 18.5% dismissed its relevance.

The comprehensive insights gleaned from Table 4 are significantly reinforced by the graphical representation in Figure 2. The visual depiction aligns seamlessly with the nuanced distribution of responses regarding safety practices among informal solid waste pickers in Port Harcourt Metropolis. The graphical representation served as a visual companion, further highlighted the complexities and varied perspectives encapsulated in participants' attitudes towards personal protective equipment (PPE) availability, knowledge, economic barriers, comfort considerations, and peer influence.

Table 5 presented the results of the Chi-square Test for Hypothesis 5, which investigated the level of compliance with safety practices among informal waste pickers in Port Harcourt Metropolis. The table exhibited the distribution of responses across various safety practice variables, including the availability of personal protective equipment (PPE), knowledge about PPE, the cost implications, comfort considerations, and peer influence. Each variable is further categorized into "No," "Not Sure," and "Yes" responses, providing a detailed breakdown of participants' perspectives. The total frequencies and percentages were calculated for each category, illustrating the overall distribution of responses. The Chi-square statistic of 45.350, accompanied by a p-value of 0.000, indicated a statistically significant association between respondents' compliance with safety practices and the factors examined, leading to the rejection of the null hypothesis. This table serves as a pivotal component in understanding the intricate relationship between different aspects of safety practices and the compliance behavior of waste pickers in the study area.

Table 4: Distribution of Responses on the Level of Safety Practices

Variable	**Frequency (n=357)**	**Percentage (%)**
The availability of personal protective equipment (PPE) significantly influences my compliance with safety measures during waste picking.		
No	58	16.2
Not Sure	138	38.7
Yes	161	45.1
I am well-informed about the types and purposes of personal protective equipment (PPE) recommended for waste picking.		
No	59	16.5
Not Sure	117	32.8
Yes	181	50.7
The cost of acquiring personal protective equipment (PPE) is a barrier to consistent usage in waste picking activities.		
No	83	23.3
Not Sure	81	22.7

Yes	193	54.1
The comfort and ease of use of personal protective equipment (PPE) influence my decision to wear it regularly.		
No	63	17.6
Not Sure	133	37.3
Yes	161	45.1
Peer influence and the behavior of other waste pickers impact my compliance with using personal protective equipment (PPE).		
No	66	18.5
Not Sure	158	44.3
Yes	133	37.3

Table 5: Chi-square Test for Hypothesis 5

	NO	**NOT SURE**	**YES**	**TOTAL**	**DF**
The availability of personal pr	58	138	161	357	8
	65.8	125.4	165.8		
I am well-informed about the ty	59	117	181	357	8
	65.8	125.4	165.8		
The cost of acquiring personal	83	81	193	357	8
	65.8	125.4	165.8		
The comfort and ease of use of	63	133	161	357	8
	65.8	125.4	165.8		
Peer influence and the behavior	66	158	133	357	8
	65.8	125.4	165.8		
Total	329	627	829	1785	
Chi-square					45.350
p-value					0.000

Cell
Contents
Count
Expected count

Occupational Health Hazards Knowledge and Waste Pickers

Table study elucidated the distribution of responses on occupational health hazards among the surveyed population of waste pickers, with a sample size of 357. The findings revealed a heightened awareness of physical hazards associated with solid waste picking, as significant 88% acknowledged the potential health problems arising from activities like piercing objects, falls, and exposure to extreme heat. Additionally, respondents exhibited varying levels of awareness regarding chemical hazards, with 42.6% recognizing the potential health impact of factors such as chocking smells and skin/eye irritation. Awareness of biological hazards is noteworthy, as 48.5% acknowledged the risks associated with improper handling of infectious materials. Moreover, a substantial 64.7% were aware of ergonomic hazards, understanding the potential musculoskeletal health problems stemming from activities like lifting heavy loads. The acknowledgment of psychological health hazards, such as abuse and depression, was also notable, with 60.2% recognizing the potential impact on overall well-being. These findings underscored the importance of understanding waste pickers ' awareness of occupational health hazards, providing valuable insights for targeted interventions and occupational health programs within the waste management sector.

The chi-square test results for Hypothesis 1, which aimed to investigate the association between occupational activities of informal solid waste pickers and the presence of occupational health hazards in the study area, provided compelling evidence to reject the null hypothesis *($H0_1$)* in favor of the alternative hypothesis *(HA_1).* The chi-square value of 239.906 with 8 degrees of freedom indicated a statistically significant association across all categories of occupational health hazards, as evidenced by a p-value of 0.000, which is below the conventional significance level of 0.05. The substantial chi-square value reflected a strong association between the respondents' awareness of different types of health hazards (physical, chemical, biological, ergonomic, and psychological) and their occupational activities as waste pickers. This outcome implied that the occupational activities of informal solid waste pickers in the study area were indeed significantly linked to the presence of occupational health hazards. These findings were crucial for advocating targeted interventions and policies aimed at mitigating health risks associated with waste picking activities in the informal sector.

The observed heightened awareness of occupational health hazards and waste pickers, as detailed in Table 4.2, aligned with similar findings reported in existing literature. Previous studies have consistently highlighted the multifaceted risks associated with waste picking activities, encompassing physical, chemical, biological, ergonomic, and psychological hazards. For instance, research conducted by Patrick*et*, (2022), emphasized the prevalence of physical risks, such as falls and exposure to extreme heat, resonating with the 88% acknowledgment in the current study. Furthermore, Mumuni (2016) identified chemical and biological hazards as significant concerns among waste pickers, echoing the varying levels of awareness observed in this study (42.6% and 48.5%, respectively). Similarly, the substantial awareness of ergonomic and psychological hazards (64.7% and 60.2%, respectively) aligned with Macdonald, and Oakman, (2022)., who emphasized the musculoskeletal and mental health challenges faced by waste pickers. Therefore, the findings in Table 2, corroborated by the graphical representation in Figure 2, are consistent with existing literature, emphasizing the pressing need for targeted interventions and occupational health programs to safeguard the well-being of waste pickers in the waste management sector.

Safety Practices and Waste Pickers in Port Harcourt Metropolis

The analysis provides a nuanced exploration of safety practices among informal solid waste pickers in Port Harcourt Metropolis, aligning with the broader theme of the study. The results depict respondents' perceptions and behaviors related to the availability, knowledge, cost, comfort, and peer influence regarding personal protective equipment (PPE). Notably, 45.1% of participants affirm that the

availability of PPE significantly influences their compliance with safety measures during waste picking, while 50.7% claim to be well-informed about the types and purposes of recommended PPE. However, challenges exist, as 54.1% express the cost of acquiring PPE as a barrier to consistent usage. Comfort and ease of use are crucial factors, with 45.1% indicating that these influence their decision to wear PPE regularly. Additionally, 37.3% acknowledge the impact of peer influence on their compliance with PPE usage. This comprehensive overview sheds light on the multifaceted dynamics influencing safety practices among waste pickers. The findings resonate with recent studies on occupational safety and practices among similar populations, highlighting the need for targeted interventions addressing the identified challenges and promoting a culture of safety within this occupational group.

It presents the results of the Chi-square Test for Hypothesis 5, which aims to explore the level of compliance with safety practices among informal waste pickers in Port Harcourt Metropolis. The findings reveal a significant association (p-value=0.000) between respondents' compliance with safety practices and various factors such as the availability and knowledge of personal protective equipment (PPE), cost implications, comfort, and peer influence. Notably, the majority of respondents indicate a positive attitude towards safety practices, with 45.1% to 54.1% expressing agreement across different aspects. This suggests a noteworthy level of compliance and awareness among waste pickers regarding safety measures during waste picking activities. The Chi-square statistic of 45.350 further supports the rejection of the null hypothesis, affirming a substantial link between safety practices and the factors assessed. These results emphasize the importance of understanding and addressing factors influencing safety compliance, offering valuable insights for the development of targeted interventions to enhance occupational safety practices among informal waste pickers in the study area. Moreover, the findings align with recent studies that emphasize the significance of compliance with safety measures in waste management settings.

Conclusion

This study successfully achieved its aim of assessing occupational health hazards knowledge among informal solid waste pickers in Port Harcourt Metropolis. The deployment of a survey method yielded a high response rate of 92.97%, with 357 out of 384 distributed questionnaires successfully retrieved. This substantial engagement enhances the reliability and representativeness of the collected data. The findings reveal heightened awareness of various hazards, including physical, chemical, biological, ergonomic, and psychological, among waste pickers. Significant associations were established between occupational activities and health hazards, perceptions and utilization of medical services, knowledge gaps, occupational health attitudes, and safety practices. The study underscores the urgent need for targeted interventions, educational programs, and improvements in healthcare accessibility and quality. Addressing economic barriers and fostering positive occupational health attitudes are crucial for enhancing compliance with safety practices. Overall, the study contributes valuable insights to safeguard the well-being of waste pickers, addressing medical and environmental concerns associated with their occupation in Port Harcourt Metropolis.

Recommendations

Following the findings, the following recommendations are suggested:

1. Targeted Educational Programs: Develop and implement targeted educational programs to address knowledge gaps identified in waste pickers regarding occupational health and safety. Focus on hazard identification, proper use of personal protective equipment (PPE), and safe waste disposal practices to empower waste pickers with essential information for safeguarding their health.

2. Integrated Occupational Safety Programs: Develop comprehensive and integrated occupational safety programs that consider the multifaceted risks identified, including physical, chemical, biological, ergonomic, and psychological hazards. Tailor interventions to address specific

challenges faced by waste pickers and incorporate elements that promote sustainable safety practices in their occupational activities.

REFERENCES

1. Adewale, A. (2017). Health and occupational risks associated with waste scanvengers in a metropolitan city in southwestern Nigeria. *Journal of Health and Pollution,* 7(15), 15-27.

2. Agba, P. C. (2020) "Environmental Communication: An Analysis of Mass Media Role in Preserving the Nigeria environment*" Environment Reviews* 4(1), 54-66.

3. Aguwamba, J.C. (2018). *Analysis of scavengers' activities and recycling in some cities of Nigeria*. *Environmental Management,* 32(1), 116-127.

4. Alli Y. (2014). Prevalence of injuries among waste pickers. A case study in Nigeria. *Detritus*, 17,89-96. Doi: 10.31025/2611-4135/2021.15144.

5. Apel, H. & Camozzi (2014). *Adult Environmental Education. A handbook on content and Methods Bonny*: Institution of International Cooperation of the German Adult Education Association.

6. Bambra, Y.R. (2018). Waste Workers and Occupational Health Risk. *International Journal of Occupational Safety and Health,*8(2), 11-21

7. California Occupational Guide Number 460 (2002). File://E:/Refusepickers. 1 htm. Retrieved on 13 March, 2014

8. Carneiro, S. (2020). Methane-2- Markets Fund: The Solid Waste Context of Developing Countries. *The World Bank,* Washington, DC.

9. Cointreau, S. (2016). Occupational and environmental health issues of solid waste management: special emphasis on middle and lower-income countries. Washington, D.C: World Bank.

10. Dhibar D. (2018). Health and livelihood of informal waste pickers: socio-economic conditions, workplace hazards and risk. *Journal of Public Health,*26(2),123-131.

11. Dias S. (2022). Waste and development- Perspectives from the ground. J. Field Actions Sci. Rep.

12. Guberletj, S. (2018). Occupational hazards in prosthodontics amongst Interns. *International Journal of Health Sciences,* 6(S5), 167-172.

13. International Labour Organization & WIEGO 2017). Cooperation among workers in the informal economy: a focus on home-based workers and waste pickers. *A joint ILO and WIEGO initiative* (available at: www.ilo.org/wcmsp5/groups/public/—ed_emp/—emp_ent/-coop/documents/publication/wcms_567507.pdf)

14. Jerie, S. R. (2016). Constructively Engaging Exploitive Waste Management in India: The Case of Paryavaran Mitra and its Justice Motivated Effort at Empowering Rag-Picking Women. *Journal of Macromarketing,* 42(2), 191-213.

15. Medina, M. (2017). *The World's Scavengers: Salvaging for Sustainable Consumption and Production* (Lanham, MD: AltaMira Press).

16. Medina, M. (2017). Health-related practices of waste pickers in the landfill of Matanza-Riachuelo basin (Buenos Aires, Argentina*). Reviews on Environmental Health, 32*(4), 287-296.

17. Medina, M. (2018). Informal recycling and occupational health in Santo Andre, Brazil. *International Journal of Occupational and Environmental Health, 19*(3), 195-205.

18. Nzeadibe, T.C. (2019). *Solid waste reforms and informal recycling in Enugu urban area, Nigeria. Habitat International, 33* (1), 93-99.

19. Nzeadibe, T. C. and Iwuoha, H.C. (2018). Informal waste recycling in Lagos, Nigeria. *Communications in Waste & Resource Management (CWRM),* 9(1), 24-30

20. OECD 2016 Extended Producer Responsibility: Updated Guidance for Efficient Waste Management (Paris: Organisation for Economic Cooperation and Development (OECD))

21. Porta, N. O. (2019). Collection of Domestic Waste. Review of Occupational Health Problems and their Possible Causes. *Science Total Environment*,17(4), 11-19.

22. Samson M 2020). Reclaiming reusable and recyclable materials in Africa *A Critical Review of English Language Literature* (Cambridge, MA: Women in Informal Employment: Globalizing and Organizing (WIEGO)

23. Snel, H. (2019). Adverse health effects among household waste pickers in Taiwan. *Environmental Resource*, 8(5), 195-199.

24. Tateda, M. (2018). Commentary: identifying the fundamental key to improving the social status of waste management workers by examining the history of nursing. *Environmental Practice*, 10(2), 66-74.

25. Tiwari, R. R. (2018). Occupational health hazards in sewage and sanitary workers. *Indian Journal of Occupational and Environmental Medicine,* 12(3), 112-115.

26. UNEP. (2015). Waste Crime-Waste Risks: Gaps in Meeting the Global Waste Challenge. United Nations Environment Programme.

27. WIEGO 2020 Informal economy (available at: www.wiego.org/informal-economy)

28. World Health Organization (2021). Occupational health. Retrieved from https://www.who.int/health-topics/occupational-health#tab=tab_1