Int. j. adv. multidisc. res. stud. 2025; 5(4):1477-1487

Received: 28-06-2025
Accepted: 08-08-2025

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Occupational Health Hazards Among Solid Waste Scavengers in Owerri North Local Government Area in Imo State

[1] Okpara Barbara Oluebube, [2] Ibe Sally Nkechinyere, [3] Iwuala Chimezie, [4] Egbunonu Rosemary Chiamaka, [5] Ugoji Prince Nnadozie, [6] Nwakire Everestus Chibuike

[1, 2, 3] Department of Public Health, School of Health Technology, Federal University of Technology, Owerri, Imo State, Nigeria
[4] Institute of Oncology, Nnamdi Azikiwe University, Awka, Nnewi Campus, Anambra State, Nigeria
[5] Department of Animal and Environmental Biology, Imo State University, Owerri, Imo State, Nigeria
[6] GOMECS-EVERGLAD Research Laboratory Services Limited, Nekede, Owerri, Imo State, Nigeria

DOI: https://doi.org/10.62225/2583049X.2025.5.4.4784
Corresponding Author: **Okpara Barbara Oluebube**

Abstract

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

Keywords: Exposure, Ergonomic, Hazards, Solid Waste, Occupational Health, Scavengers

Introduction

Occupational health hazards refer to possible adverse health impacts one undergoes in their working environment. They are risks or dangers as a consequence of the nature of the working conditions of a particular work. It can also refer to a work, material, substances, process, or situation that predisposes, or causes accidents or diseases at a workplace (Oluwoye & Oludare, 2018; Kipchumba *et al*., 2022) [15, 8]. While Occupational hazard (OH) is a hazard experienced in the workplace, hazard is the potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources (Igwe *et al*., 2016; Jeong, 2017) [5, 7].

Occupational health hazards are divided into five groups according to their nature. Example; physical hazard is related to exposure to noise, ionizing radiation, and temperature while chemical hazard is related to exposure to gases, vapors, fumes, and chemicals. Biological hazard is related to exposure to viruses, bacteria, blood and blood products while ergonomic hazard is related to the requirement of improper posture, monotony, repetitiveness, work shifts, and situations causing stress. Psychosocial hazard is constantly present at work or, responsible for a large number of occupational health diseases, such as hypertension, stress, and cancer etc (Fikrom *et al*., 2016) [4]. Occupational health hazards also include injuries from sharp objects such as broken glasses, tin cans, knives, needles etc. These needles might be carrying other people's blood possibly contaminated with a number of viruses (Thakur *et al*., 2018) [20]. Hazards can arise at any point during the process, including during transportation, at the locations where solid waste is collected from households, and during recycling or disposal (Senzeni *et al*., 2018) [18].

Solid waste scavenging is a global event as refuse generation cannot be separated from man. Scavenging materials range from bags made of plastics, metals, copper, aluminum, paper, bins, drums, two wheeled or four wheeled containers. The job of solid waste scavengers involves frequent lifting, carrying, pushing or pulling of heavy objects (Ali & Yusuf, 2021) [1]. Solid waste scavengers are expose to variety of occupational health hazards factors such as dust, bioaerosols, volatile organic matter and mechanical stress, which make them susceptible to certain occupational health diseases (Asibor & Edjere, 2017) [2]. Several studies reported that Solid waste scavengers are at high risk for developing disease resulting from exposure to various occupational health hazards (Elenwo, 2015) [3].

Solid waste Scavengers are also exposed to numerous hazards: such as infectious waste from hospitals, smoke and fumes from burning waste, feces, contaminated needles, toxic paper, heavy metals from batteries, bottles, chemical waste containers and harsh weather conditions, solid waste scavengers spend most of the time working in a bent position as such scavengers may suffer from chronic backache. Scavengers of solid are also vulnerable to major health hazards such as accidents, and infections that can cause chronic diseases. Accidents could lead to injury or death and this could be caused by heavy equipment, fire outbreaks, falling from heights etc. Infections is caused by direct contact with infectious waste, bites from dogs (with threat of rabies), and enteric infections transmitted by insects feeding on waste. Chronic diseases such as respiratory diseases are caused from exposure to dust and toxic compounds. Cardiovascular disorders, and heat stress due to exposure to excessive temperature, and hearing function loss result from exposure to excessive noise. Solid waste scavenging also exposes them to human immune deficiency virus (HIV) and hepatitis infection (Igwe *et al*., 2016; Lissah *et al*., 2022) [5, 10].

In Imo State, poverty caused by unemployment has resulted to solid waste scavenging among many individuals. Solid waste scavengers in Imo state may also contract skin and blood infection, eye and respiratory infection as a result of expose to polluted dust, wound and insect bite, inability to use proper equipment and lack of training on safe solid waste scavenging are the main reasons why solid waste scavengers in Imo may suffer from different kinds of occupational health disease. Occupational health hazards assessments should be carried out to identify the hazards that are involved and also look towards eliminating or reducing the hazard to a level as low as possible. The general objective of this research was to determine the occupational health hazards among solid waste scavengers in Owerri North local Government Area Imo State.

Materials and Methods

Study Design

Descriptive design and cross sectional study design was employed in this study. Descriptive design was adopted to obtain information to systematically describe a phenomenon situation or population. Cross sectional study was employed to provide data on the underlying occupational health hazard among solid waste scavengers in Owerri North Local Government Area of Imo State.

Area of Study

The study was conducted in Owerri-North L.G.A, one of the local governments in Imo State. Owerri North L.G.A. was created during the Administration of General Sani Abacha in 1996. Imo state is one of the states in the South East region of Nigeria. The State is otherwise known as Eastern Heartland with Owerri as the Capital with a population of 4.8 million (National Bureau of Statistics of Nigeria, 2007). Imo State has three geographical zones and 27 local Government Areas. According to National Population Commission of Nigeria [NPCN] (2016) the current estimated population of Owerri North LGA is put at 242,800 inhabitants with the area mostly populated by members of the Igbo ethnic group.

Study Population

The target population for this study consisted of 55 scavengers in Owerri-North L.G.A. The number of the Scavengers was derived by the researcher from the current estimated population of scavengers in Owerri-North LGA. The scavengers for the study were selected randomly, 5 scavengers were selected each from 11 communities out of twenty-one communities that make up Owerri-North L.G.A. Some of these communities are rural communities such as Agbala, Akwakuma, Amakohia, Emii, Ihitta-Ogada, Mbaoma, Emekuku, Egbu, Awaka, Orji, Urratta communities for the sample frame.

Sample Size

The sample size for this study consisted of 49 scavengers derived from the 55 scavengers in the study population.

Sampling Methods

Multi-stage sampling method was used for this study. This stage involved the selection of the local government wards, out of twelve wards in Owerri North, six wards was selected. Dumpsites were selected from the six selected communities each in Owerri North Local Government Area in Imo state. The proportional sample size for each of the selected communities was obtained using simple random sampling technique by (balloting without replacement). Solid waste Scavengers were selected from the selected ea dumpsite through purposive sampling technique.

Instruments for Data Collection

Self- structured survey questionnaire, observations and interview was used for data collection, containing closed-ended questions with 6 sections. Section A was on demographic characteristics of the respondents. Section B was on the extent scavengers are exposed to physical health hazards, Section C was on the extent scavengers are exposed to chemicals health hazards, Section D was on the extent of scavengers are exposed to biological health hazards among solid wastes scavengers, Section E was on extent scavengers are exposed to ergonomical health hazards while Section F was on preventive measure taken to prevent occupational health hazards among solid wastes scavengers.

Validity of Instruments

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

Reliability of Instrument

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

Methods of Data Collection

The questionnaire was administered to the respondent by the researcher and research assistant after brief introduction of themselves and the significance of the research must have been explained to the respondent. After which a verbal consent was obtained from the respondent. The respondents that are literate were allowed to fill the questionnaire themselves but for those respondents that are non-literate in English language the questions were asked in local language and their responses were filled by the researcher (or research assistant).

Method of Data Analysis

Data analysis was performed in IBM-SPSS Statistics version 23. Initial analysis involved construction of frequency distribution and manipulations. The average number of responses was used to compute the overall extent and preventive measures taken in each case and such scores were used to establish a cut-off point scoring 1 per point for each question where below 3 is graded as very low extent 4-6 as low extent and 7-9 very high extent as well as for the preventive measure taken Chi square test (χ^2) was used to test for significant association between the extent and the preventive measures taken. Fisher exact test was conducted at 2 by 2 table where chi-square test assumptions were hard to meet. Statistical tests were performed at 5% level of significant and probability value ($p \leq 0.05$) was used to interpret significance.

Informed Consent

The researcher got permission using an introductory letter obtained from the Department of Public Health, Federal University of Technology (FUTO) for the benefits of conducting the study, the method of questioning and confidentiality was attached to the cover page of the questionnaire. Also, Approval to carry out the study was obtained from the Owerri -North LGA Director general through the LGA HPM (Head of Personal Management) and the Head of department Primary Health Care, to the head of environmental health unit of Owerri-North. Also certain aspects of ethics were employed by the researcher before and during the administration of the questionnaire to avoid variables that are extraneous such as bias, labeling etc.

Results

Table 1 shows the socio demographic characteristics of respondents. Majority of the respondents (32.7%) are within the age group of 38-47 while the least age group (6.1%) are within 48-57 and 58-67 respectively. Majority (89.8%), are male. 36.7% of the respondents attain primary and secondary education respectively. Majority (49.0%) are married while 6.1% are widowed. Majority (49.0%), are less than 5 years into the scavenging business while 4.1% have 15-19 years of experience. Majority (40.8%) earn less than N30,000 monthly from the scavenging business while 26.5% earn between N60,000-N89,000 monthly.

Table 2 shows the respondents' exposure to physical health hazards. The majority (49.0%) reported they sometimes experience slips and falls while picking up solid waste, whereas 8.2% had never encountered slip or fall.46.9% stated they sometimes pick waste during heavy rainfall, while 20.4% never so. 49.0% mentioned that they sometimes pick solid waste in excessively hot conditions.55.1% of respondents reported never experiencing excessive noise in their work environment, while 44.9% sometimes encountered it. 69.4% of the respondents indicated that they collect solid waste in very hot weather, with 24.5% stating they never do so. Majority (63.3%) reported always being exposed to sharps while 6.1%said they were not exposed to sharps.

Table 3 shows the exposure of respondents to chemical health hazards. 57.1% said they sometimes encounters burning at the dumpsite while 20.4% never encounter burning at the dumpsite. 51.0% said they are exposed to inhalation of Smoke from the burning dumpsites while 6.1% said they are never exposed to inhalation of Smoke from the burning dumpsites. Majority (59.2%), are exposed to inhalation of dust while picking solid waste while 8.2% are never exposed to inhalation of dust while picking solid waste. 75.5% of the respondents said they sometimes pick batteries while 16.3% said they never pick batteries.

Table 4 shows the exposure of respondents to biological health hazards. 63.3% of the respondents said they sometimes experiences insects bite like mosquito while picking solid wastes at the dumpsites while 4.1% said they had never experienced insects bite like mosquito while picking solid wastes at the dumpsites. 85.7% of the respondents said they have never been bitten by a reptile. 100.0% said they have never been bitten by an animal like dog while picking solid wastes. All the respondents said they have never collected hospital waste during solid wastes picking.

Table 5 shows the exposure of respondent's to ergonomical health hazards 53.1% of the respondents said they always lift solid waste materials picked by themselves while 8.2% said they do not. 65.3% of the respondents said the always push solid wastes materials picked while 4.1% said they do not. 51.0% of the respondents said they have been involved in pulling of solid waste while 2.0% said they do not. Majority (63.3%) of the respondents said they transport solid waste picked by carrying on their head while 36.7% said they uses truck.

Table 6 shows the preventive practices taken by respondents against hazards resulting from scavenging. Majority (93.9%) of the respondents said they never wears rain coat while picking solid wastes under rain fall. 83.7% said they sometimes wear safety boot while picking solid waste while 10.2% never did. Majority (75.5% said they never wear nose mask while picking solid waste while 22.4% said the sometimes do. Majority (89.8%) said they never wears safety goggle while picking solid wastes during sunlight, 85.7% said they never wears hand gloves while picking solid waste. 95.9% said they never wears helmet to cover your head while picking solid waste during hot weather. 69.4% of the respondents said they sometimes wears overall while picking solid wastes. All the respondents said they never wears overall while picking solid wastes. 77.6% said they sometimes wears long sleeve shirts while picking solid wastes. 87.8% of the respondents said they always wears trouser while picking solid wastes. 93.9% of the respondents said they always washes their hands after picking solid wastes and takes bath after picking solid wastes respectively. All the respondents said they have not been vaccinated against tetanus and Hepatitis B respectively.

Table 7 shows the cross-tabulation between Socio-demographic Characteristics of Respondents and Exposure to Physical Hazard during Scavenging activities. No significant association was established between Exposure to Physical Hazard during Scavenging activities and Respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.296, 0.816, 0.794, 0.920, 0,373, 0.442 respectively).

Table 8 shows the cross-tabulation between Socio-demographic characteristics of respondents and Exposure to chemical hazard during scavenging activities. No significant association was established between exposure to chemical hazard during scavenging activities and respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.317, 0.363, 0.743, 0.802, 0.113, 0.161 respectively).

Table 9 shows the cross-tabulation between Socio-demographic characteristics of respondents and Exposure to biological hazard during scavenging activities. No significant association was established between exposure to biological hazard during scavenging activities and respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.617, 0.873, 0.222, 0.918, 0.914, 0.977 respectively).

Table 10 shows the cross-tabulation between Socio-demographic characteristics of respondents and Exposure to ergonomic hazard during scavenging activities. No significant association was established between exposure to ergonomic hazard during scavenging activities and respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.216, 0.136, 1.764, 0.166, 0.679, 0.503 respectively).

Table 11 shows the cross-tabulation between Socio-demographic characteristics of respondents and the preventive practices taken by respondents against hazards resulting from Scavenging. No significant association was preventive practices taken by respondents against hazards resulting from Scavenging and respondents age, sex, educational attainment, marital status, years in business and monthly income (p-value = 0.438, 0.805, 0.202, 0.623, 0.190, 0.357 respectively).

Table 1: Socio-Demographic Characteristics

Variables	Frequency (n)	Percent (%)
Age		
18-27	8	16.3
28-37	7	14.3
38-47	16	32.7
48-57	3	6.1
48–57	12	24.5
58-67	3	6.1
Sex		
Female	5	10.2
Male	44	89.8
Highest educational attainment		
No formal education	13	26.5
Primary education	18	36.7
Secondary education	18	36.7
Marital status		
Divorced	6	12.2
Married	24	49.0
Single	16	32.7
Widowed	3	6.1
Years in the Solid waste scavenging business		
10-14 year	12	24.4
15-19 years	2	4.1
5-9 years	13	26.5
Less than 5 years	22	44.9
Monthly income generated from solid wastes Scavenging		
Less than N30,000	20	40.8
N30,000-N59,000	16	32.7
N60,000-N89,000	13	26.5

Table 2: Exposure of Respondents to Physical Health Hazards

Variables	Frequency (n)	Percent (%)
Involved in slip and fall while picking Solid waste?		
Always	21	42.9
Never	4	8.2
Sometimes	24	49.0
Pick solid waste during heavy rainfall?		
Always	16	32.7
Never	10	20.4
Sometimes	23	46.9
Pick solid waste during excessive heat?		
Always	18	36.7
Never	7	14.3
Sometimes	24	49.0
Presence of excessive noise in the environment where you pick solid waste?		
Never	27	55.1
Sometimes	22	44.9
Pick solid Wastes when the weather is very hot?		
Always	3	6.1
Never	12	24.5
Sometimes	34	69.4
Exposed to Sharps like needles, broken bottles, knifes, Aluminum while picking solid wastes?		
Always	31	63.3
Never	3	6.1
Sometimes	15	30.6

Table 3: Exposure of Respondents to Chemical Health Hazards

Variables	Frequency (n)	Percent (%)
Encounters burning at the dumpsite?		
Always	11	22.4
Never	10	20.4
Sometimes	28	57.1
Exposed to inhalation of Smoke from the burning dumpsites?		
Always	21	42.9
Never	3	6.1
Sometimes	25	51.0
Exposed to inhalation of dust while picking solid waste		
Always	29	59.2
Never	4	8.2
Sometimes	16	32.7
Picks batteries as you pick solid wastes		
Always	4	8.2
Never	8	16.3
Sometimes	37	75.5

Table 4: Exposure of Respondents to Biological Health Hazards

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

Table 5: Exposure of Respondent's to Ergonomical Health Hazards

Variables	Frequency (n)	Percent (%)
Do you lift solid waste materials picked on your own		
Always	26	53.1
Never	4	8.2
Sometimes	19	38.8
Do you push solid wastes materials picked		
Always	32	65.3

Never	2	4.1
Sometimes	15	30.6
Have you been involved in pulling of solid waste?		
Always	23	46.9
Never	1	2.0
Sometimes	25	51.0
How do you transport solid wastes picked to your final destination?		
Carry on head	31	63.3
Truck	18	36.7

Table 6: Preventive practices taken by respondents against hazards resulting from scavenging

Variables	Frequency (n)	Percent (%)
Wears rain coat while picking solid wastes under rain fall?		
Never	46	93.9
Sometimes	3	6.1
Wears safety boot while picking solid waste		
Always	3	6.1
Never	5	10.2
Sometimes	41	83.7
Wears nose mask while picking solid wastes		
Always	1	2.0
Never	37	75.5
Sometimes	11	22.4
Wears safety google while picking solid wastes during sunlight?		
Never	44	89.8
Sometimes	5	10.2
Wears hand gloves while picking Solid waste?		
Always	2	4.1
Never	42	85.7
Sometimes	5	10.2
Wears helmet to cover your head while picking Solid waste during hot whether?		
Never	47	95.9
Sometimes	2	4.1
Wears hat while picking solid wastes under hot whether?		
Always	7	14.3
Never	8	16.3
Sometimes	34	69.4
Wears overall while picking solid wastes		
Never	49	100.0
Wears long sleeve shirts while picking solid wastes		
Always	11	22.4
Sometimes	38	77.6
Wears trouser while picking solid wastes		
Always	43	87.8
Sometimes	6	12.2
Washes your hands after picking solid wastes		
Always	46	93.9
Sometimes	3	6.1
Takes bath after picking solid wastes		
Always	46	93.9
Sometimes	3	6.1
Been vaccinated against tetanus		
No	49	100.0
Been vaccinated against hepatitis B		
No	49	100.0

Table 7: Association between Socio-demographic Characteristics of Respondents and Exposure to Physical Hazard during Scavenging activities

Variable	Physical Hazards		Total	X^2	*p*-value
	High Exposure	Low Exposure			
Age					
18-27	6(75.0)	2(25.0)	8	6.366	0.296
28-37	3(42.9)	4(57.1)	7		
38-47	10(62.5)	6(37.5)	16		
48-57	0(0.0)	3(100.0)	3		
48–57	7(58.3)	5(41.7)	12		
58-67	1(33.3)	2(66.7)	3		
Sex					

Female	3(60.0)	2(40.0)	5	0.054	0.816
Male	24(54.5)	20(45.5)	44		
Highest educational attainment					
No formal education	7(53.8)	6(46.2)	13	0.46	0.794
Primary education	9(50.0)	9(50.0)	18		
Secondary education	11(61.1)	7(38.9)	18		
Marital status					
Divorced	3(50.0)	3(50.0)	6	0.495	0.920
Married	14(58.3)	10(41.7)	24		
Single	8(50.0)	8(50.0)	16		
Widowed	2(66.7)	1(33.3)	3		
Years in the Solid waste scavenging business					
10-14 year	6(50.0)	6(50.0)	12	3.124	0.373
15-19 years	1(50.0)	1(50.0)	2		
5-9 years	5(38.5)	8(61.5)	13		
Less than 5 years	15(68.2)	7(31.8)	22		
Estimated monthly income generated from solid wastes Scavenging					
Less than N30,000	13(65.0)	7(35.0)	20	1.634	0.442
N30,000-N59,000	7(43.8)	9(56.3)	16		
N60,000-N89,000	7(53.8)	6(46.2)	13		

Table 8: Association between Socio-demographic Characteristics of Respondents and Exposure to Chemical Hazard during Scavenging activities

Variables	Chemical Hazards		Total	X^2	*p*-value
	High Exposure	**Low Exposure**			
Age					
18-27	4(50.0)	4(50.0)	8	6.075	0.317
28-37	6(85.7)	1(14.3)	7		
38-47	8(50.0)	8(50.0)	16		
48-57	3(100.0)	0(0.0)	3		
48–57	8(66.7)	4(33.3)	12		
58-67	1(33.3)	2(66.7)	3		
Sex					
Female	4(80.0)	1(20.0)	5	0.827	0.363
Male	26(59.1)	18(40.9)	44		
Highest educational attainment					
No formal education	9(69.2)	4(30.8)	13	0.595	0.743
Primary education	10(55.6)	8(44.4)	18		
Secondary education	11(61.1)	7(38.9)	18		
Marital status					
Divorced	4(66.7)	2(33.3)	6	0.998	0.802
Married	13(54.2)	11(45.8)	24		
Single	11(68.8)	5(31.3)	16		
Widowed	2(66.7)	1(33.3)	3		
Years in the Solid waste scavenging business					
10-14 year	10(83.3)	2(16.7)	12	5.969	0.113
15-19 years	0(0.0)	2(100.0)	2		
5-9 years	7(53.8)	6(46.2)	13		
Less than 5 years	13(59.1)	9(40.9)	22		
Estimated monthly income generated from solid wastes Scavenging					
Less than N30,000	15(75.0)	5(25.0)	20	3.657	0.161
N30,000-N59,000	7(43.8)	9(56.3)	16		
N60,000-N89,000	8(61.5)	5(38.5)	13		

Table 9: Association between Socio-demographic Characteristics of Respondents and Exposure to Biological Hazard during Scavenging activities

Variables	Biological Hazard		Total	X^2	*p*-value
	High Exposure	**Low Exposure**			
Age					
18-27	6(75.0)	2(25.0)	8	3.615	0.617
28-37	4(57.1)	3(42.9)	7		
38-47	10(62.5)	637.5)	16		
48-57	1(33.3)	2(66.7)	3		
48–57	9(75.0)	3(25.0)	12		
58-67	1(33.3)	2(66.7)	3		
Sex					
Female	3(60.0)	2(40.0)	5	0.026	0.873
Male	28(63.6)	16(36.4)	44		

Highest educational attainment					
No formal education	8(61.5)	5(38.5)	13	3.011	0.222
Primary education	9(50.0)	9(50.0)	18		
Secondary education	14(77.8)	4(22.2)	18		
Marital status					
Divorced	4(66.7)	2(33.3)	6	0.503	0.918
Married	14(58.3)	10(41.7)	24		
Single	11(68.8)	5(31.3)	16		
Widowed	2(66.7)	1(33.3)	3		
Years in the Solid waste scavenging business					
10-14 year	7(58.3)	5(41.7)	12	0.523	0.914
15-19 years	1(50.0)	1(50.0)	2		
5-9 years	8(61.5)	5(38.5)	13		
Less than 5 years	15(68.2)	7(31.8)	22		
Estimated monthly income generated from solid wastes Scavenging					
Less than N30,000	13(65.0)	7(35.0)	20	0.047	0.977
N30,000-N59,000	10(62.5)	6(37.5)	16		
N60,000-N89,000	8(61.5)	5(38.5)	13		

Table 10: Association between Socio-demographic Characteristics of Respondents and Exposure to Ergonomic Hazard during Scavenging activities

Variables	Ergonomical Hazard		Total	X^2	*p*-value
	High Exposure	Low Exposure			
Age					
18-27	7(87.5)	1(12.5)	8	6.985	0.216
28-37	5(71.4)	2(28.6)	7		
38-47	9(56.3)	7(43.8)	16		
48-57	3(100.0)	0(0.0)	3		
48–57	10(83.3)	2(16.7)	12		
58-67	1(33.3)	2(66.7)	3		
Sex					
Female	5(100.0)	0(0.0)	5	2.227	0.136
Male	30(68.2)	14(31.8)	44		
Highest educational attainment					
No formal education	9(69.2)	4(30.8)	13	0.586	0.746
Primary education	14(77.8)	4(22.2)	18		
Secondary education	12(66.7)	6(33.3)	18		
Marital status					
Divorced	2(33.3)	4(66.7)	6	5.717	0.166
Married	18(75.0)	6(25.0)	24		
Single	12(75.0)	4(25.0)	16		
Widowed	3(100.0)	0(0.0)	3		
Years in the Solid waste scavenging business					
10-14 year	9(75.0)	3(25.0)	12	1.516	0.679
15-19 years	1(50.0)	1(50.0)	2		
5-9 years	8(61.5)	5(38.5)	13		
Less than 5 years	17(77.3)	5(22.7)	22		
Estimated monthly income generated from solid wastes Scavenging					
Less than N30,000	16(80.0)	4(20.0)	20	1.376	0.503
N30,000-N59,000	10(62.5)	6(37.5)	16		
N60,000-N89,000	9(69.2)	4(30.8)	13		

Table 11: Association between Socio-demographic Characteristics of Respondents and Exposure to Ergonomic Hazard during Scavenging activities

Variables	Preventive Measures		Total	X^2	*p*-value
	Good	Poor			
Age					
18-27	2(25.0)	6(75.0)	8	4.322	0.438
28-37	2(28.6)	5(71.4)	7		
38-47	2(12.5)	14(87.5)	16		
48-57	1(33.3)	2(66.7)	3		
48–57	3(25.0)	9(75.0)	12		
58-67	2(66.7)	1(33.3)	3		
Sex					
Female	1(20.0)	4(80.0)	5	0.061	0.805
Male	11(25.0)	33(75.0)	44		
Highest educational attainment					
No formal education	2(15.4)	11(84.6)	13	3.197	0.202

Primary education	3(16.7)	15(83.3)	18		
Secondary education	7(38.9)	11(61.1)	18		
Marital status					
Divorced	1(16.7)	5(83.3)	6	2.472	0.623
Married	8(33.3)	16(66.7)	24		
Single	3(18.8)	13(81.3)	16		
Widowed	0(0.0)	3(100.0)	3		
Years in the Solid waste scavenging business					
10-14 year	2(16.7)	10(83.3)	12	4.762	0.190
15-19 years	1(50.0)	1(50.0)	2		
5-9 years	1(7.7)	12(92.3)	13		
Less than 5 years	8(36.4)	14(63.6)	22		
Estimated monthly income generated from solid wastes Scavenging					
Less than N30,000	7(35.0)	13(65.0)	20	2.063	0.357
N30,000-N59,000	3(18.8)	13(81.3)	16		
N60,000-N89,000	2(15.4)	11(84.6)	13		

Discussion

The study findings revealed that most solid waste scavengers were from the low economic background and most did not have formal education. Similar findings were reported, which showed that solid waste scavengers in developing countries were generally from poor backgrounds, uneducated and less skilled (Lissah *et al.,* 2020; Melaku & Tiruneh, 2020) [9, 12].There were more male practicing solid waste in the current study likely because solid waste scavenging requires a lot of physical strength. Ziaei *et al.* (2018) [21] also found that most of their participants drawn from African countries were males. Similarly, in Nigeria, Inyang (2007) had only male participants in his study. However, Njoku *et al.* (2019) [14] had more female solid waste scavengers in their study. The study finding's revealed also that most solid waste scavengers in Owerri North are exposed to Occupational health hazards, such as physical, chemical and Ergonomical health hazards, more few biological health hazard because of the lack of PPE. Therefore, solid waste Scavengers in Owerri North experienced injuries from sharps, road accident, cuts from broken bottles skin problems, respiratory problems, joint pain, musculoskeletal pain, respiratory problem, gastrointestinal problem because of the exposure to biological, physical, chemical and ergonomical health hazards which is as a result of lack of PPE during scavenging practice.

Similar findings have been reported by Inyang (2007) and Ncube *et al.* (2017) [13] who reported that solid waste scavengers experienced injuries, accidents and work-related diseases because of non-availability and non-use of PPE. The current study findings also concur with those by Melaku and Tiruneh (2020) [12] who reported that solid waste Scavengers in most developing countries were exposed to occupational health problems because of lack of PPE. Personal protective equipment provides the first line of defence against hazards but aren't effective in preventing injuries and accidents. Solid waste scavengers were only provided with face masks and hand gloves but were not given full body cover.

Solid waste scavengers also complained that they were exposed to excessive noise levels from busy streets, heavy garbage trucks and the passing traffic. Thus, some scavengers experienced hearing disorders because they are not supplied with earmuffs. Moreover, high noise levels expose solid waste scavengers to accidents because they cannot hear warning sounds from the cars. Some solid waste scavengers climb and sit on top of the truck full of garbage, thus exposing themselves to falling from the moving truck. Similar findings were reported among solid waste scavengers in Zimbabwe and the Netherlands and the United Kingdom where noise has been blamed for causing most accidents that occurred among solid waste (Ncube *et al.,* 2017; Pereira-de-Paiva *et al.,* 2017) [13, 16]. Also, some noise from solid waste emanates from glass and metal tins during emptying of metal bins on the metal floor of waste collection vehicles (Suthar *et al*., 2016) [19]. Mehlum and Aarhus (2020) also reported that occupational noise exposure in a workplace is a cause of noise-induced hearing loss and tinnitus as well as other health outcomes like hypertension, distress and occupational injuries.

Solid waste scavengers indicated exposure to extreme weather conditions such as excessive sun and cold weather conditions that expose them to health problems such as respiratory symptoms, itching eyes, skin rashes and flu-like symptoms. This is because solid wastes are not provided with suitable PPE. They were sometimes compelled to use plastic bags to wrap their hands or use bare hands when collecting solid waste. Parallel results were also confirmed by several researchers who said solid waste scavenging is an outdoor activity that exposes workers to extreme hot and cold temperatures, thus exposing solid waste scavengers to health problems such as dizziness, skin rashes, asthma and skin cancer if protective equipment were not provided (Inyang, 2007; Ncube *et al.,* 2017 [13]). Solid waste scavengers mentioned that they suffer from body pains, and most of them complained about backaches because of lifting heavy containers and walking for long distances when collecting waste. Similar findings were reported from different studies done on solid waste scavengers who complained about musculoskeletal symptoms such as backache, shoulder ache, wrist pain and joint problems (Lasota & Hankiewicz, 2020; Lissah *et al*., 2020 [9]).

Solid waste scavenging is a labour-intensive occupation that requires strength, which involves carrying, lifting, sorting and loading waste into collection truck or vehicles. There is a need to introduce a hydraulic system for removing waste that can be used in garbage trucks to load, lift and transport solid types of waste. A hydraulic system makes it easier for garbage trucks to load, lift and transport both solid types of waste (Pires *et al*., 2019) [17]. There is a need to develop low-cost measures such as training solid waste Scavengers on correct posture (Ncube *et al*., 2017) [13]. Several researchers from Nigeria, Thailand and South Africa also point out that waste handlers are injured and suffer from bacterial or viral diseases because they do not have proper

PPE. Solid waste Scavengers suffer from health hazards such as dermatitis, cuts, burns, hepatitis, respiratory ailments and bites from snakes or mosquitoes (Made *et al.,* 2020; Ncube *et al.,* 2017) [11, 13]. Solid waste scavengers complained of community harassment and discrimination at work as some of the psychological stressors. Similarly, Pereira-de-Paiva *et al.* (2017) [16] found that municipal waste handlers suffer from historical discrimination because of the low nature of their work. The study further revealed that solid waste Scavengers experience physical violence, verbal abuse and spitting from members of the public.

Conclusion

The findings showed that majority of the respondents were within the age group of 38-47 while the least age group was within 48-57 and 58-67 respectively. Most of respondents attained primary and secondary education respectively. All the respondents never wear overall while picking solid wastes and have not been vaccinated against tetanus and Hepatitis B respectively. There was no significant association between preventive practices taken by respondents against health hazards resulting from scavenging and respondents' age, sex, educational attainment, marital status, years in business and monthly income. Solid wastes scavengers were more exposed to physical, chemical and ergonomic health hazards than biological health hazards due to lack of personal protective equipment (PPE) required for scavenging and ignorance of the health hazards.

References

1. Ali AF, Yusuf FI. Prevalence of injuries among waste pickers. A case study in Nigeria. Multidisciplinary Journal of Waste Resources and Residues, 2021; 17:89-96.
2. Asibor I, Edjere O. Assessment of the Activities of Scavengers and their Economic Impacts on Waste Recovery in Warri Metropolis, Delta State, Nigeria. International Research Journal of Public and Environmental Health. 2017; 4(2):22-29.
3. Elenwo EI. Assessment of the Activities of Scavengers in Obio/Akpor Local Government Areas Rivers State, Nigeria. Journal of Environmental Protection. 2015; 6:272-280.
4. Fikrom G, Mesfin KD, Abera K, Zemedu MT, Andamlak GA. Assessment of Knowledge, Attitude and Practices Among Solid Waste Collectors in Lideta Sub-city on Prevention of Occupational Health Hazards, Addis Ababa, Ethiopia. Science Journal of Public Health. 2016; 4(1):49-56.
5. Igwe PU, Anaje EC, Onyegbu CU, Ezechilue FB, Nwatu MT. Exploring the Potential Health Risks faced by Waste Pickers on Landfills: A Socio-ecological Perspective. International Journal of Rural Development, Environment and Health Research (IJREH). 2016; 2(1):23-40.
6. Inyang M. Health and safety risks amongst the municipal solid waste collectors in Port Harcourt Metropolis of the Niger Delta Region of Nigeria. In International conference 'waste management, environmental geotechnology and global sustainable development', University of Ibadan, Dept. of Human Kinetics and Health Education, Faculty of Education, Ibadan, Oyo state, Nigeria. 2017; 7:58-65.
7. Jeong BY. Occupational deaths and injuries by the types of street cleaning process. International Journal of Occupational Safety and Ergonomics. 2017; 23(1):76-82.
8. Kipchumba P, Kelonye FB, Araka GO. Occupational hazard among the solid waste workers in Eldoret Central Business District, Kenya. Journal of Research Innovation and Implications in Education. 2022; 6(3):357-367.
9. Lissah SY, Ayanore MA, Krugu J, Ruiter RA. Psychosocial risk, work-related stress, and job satisfaction among domestic waste collectors in the Ho municipality of Ghana: A phenomenological study. International Journal of Environmental Research and Public Health. 2020; 17(8):2903-2912.
10. Lissah SY, Ayanore MA, Krugu JK, Aberese-Ako M, Ruiter RA. Our Work, Our Health, No One's Concern: Domestic Waste Collectors' Perceptions of Occupational Safety and Self-Reported Health Issues in an Urban Town in Ghana. International Journal of Environmental Research and Public Health. 2022; 19(11):6539-6557.
11. Made F, Ntlebi V, Kootbodien T, Wilson K, Tlotleng N, Mathee A. Illness, self-rated health and access to medical care among waste pickers in landfill sites in Johannesburg, South Africa. International Journal of Environmental Research and Public Health. 2020; 17(7):2252-2267.
12. Melaku HS, Tiruneh MA. Occupational health conditions and associated factors among municipal solid waste collectors in Addis Ababa, Ethiopia. Risk Management and Healthcare Policy. 2020; 13:2415-2423.
13. Ncube F, Ncube EJ, Voyi K. A systematic critical review of epidemiological studies on public health concerns of municipal solid waste handling. Perspectives in Public Health. 2017; 137(2):102-108.
14. Njoku PO, Edokpayi JN Odiyo JO. Health and environmental risks of residents living close to a landfill: A case study of Thohoyandou Landfill, Limpopo Province, South Africa. International Journal of Environmental Research and Public Health. 2019; 16(12):2125.
15. Oluwoye O, Oludare D. Perception of Scavengers and Occupational health hazards associated with Scavenging from a waste dumpsite in Pretoria South African. Journal of Environmental and Public Health. 2018 (5):1-7.
16. Pereira-De-Paiva MH, ConceiçãoCalassa-Albuquerque M, Latham EE, Furtado Bezerra C, Da-Silva Sousa A, Cunha-e-Silva-de-Araújo L. Occupational hazards of Brazilian solid waste workers: A systematic literature review. Revista Brasileira de Medicina do Trabalho. 2017; 15(4):364-374.
17. Pires A, Martinho G, Rodrigues S Gomes MI. Sustainable solid waste collection and management. Springer International Publishing, Cham, 2019, 2-7.
18. Senzeni N, Joshua O, Agboola O. Perception of Scavengers and Occupational Health Hazards Associated with Scavenging from a Waste Dumpsite in Pretoria, South Africa. Sustainable Cities and Society. 2018; 8:90-97.
19. Suthar S, Rayal P, Ahada CP. Role of different stakeholders in trading of reusable/recyclable urban

solid waste materials: A case study. Sustainable Cities and Society. 2016; 22:104-115.
20. Thakur P, Ganguly R, Dhulia A. Occupational health hazard exposure among municipal solid waste workers in Himachal Pradesh, India. Waste Management. 2018; 78:483-489.
21. Ziaei M, Choobineh A, Abdoli-Eramaki M, Ghaem H. Individual, physical, and organizational risk factors for musculoskeletal disorders among municipality solid waste collectors in Shiraz, Iran. Industrial Health. 2018; 56(4):308-319.