Direct Research Journal of Public Health and Environmental Technology

Vol. 10(3), Pp. 58-67, September 2025
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Research Article
ISSN: 2734-2182
https://journals.directresearchpublisher.org/index.php/drjphet; https://www.ajol.info/index.php/drjphet

Exposure and Health Risks Assessment among Waste Pickers in Obio-Akpor Local Government Area in Port-Harcourt, Rivers State, Nigeria

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ABSTRACT

In Nigeria, waste pickers play a significant role in the management of waste at open dump sites. Waste picking is an income-generating venture for most people with low-income base. The activity of sorting waste at dump sites predisposes health risks to waste pickers of which this study has examined. The study adopted a cross-sectional survey with a convenience sampling method which was conducted among 114 waste pickers in three selected open dump sites in Obio-Akpor local government area in Rivers state, Nigeria. A validated questionnaire was used in eliciting responses from the respondents. The statistical technique employed include logistic regression analysis which revealed significant associations between dump site exposure and respiratory symptoms (P≤0.000P), emphasizing the critical role of site-specific factors in determining health risks. Conversely, no significant associations were found between waste picking and infectious or chronic diseases (P=1.00P = 1.00), suggesting that other factors, such as personal hygiene and healthcare access, may modulate these risks. It is unlikely that waste pickers will have a risk-free environment, but supportive policies such as provision of adequate personal protective equipment (PPE) and more awareness programmes on the health risks related to such enterprises will aid in reducing the associated health risks.

Keywords: *Health risks, Waste management, waste pickers, Obio-Akpor local government, Rivers state*



Article information
Received 20 July 2025
Accepted 9 September 2025
Published 22 September 2025
DOI:https://doi.org/10.26765/DRJPHET13757105

Citation: Kalio-Esien, Q., Ogba, A. A., Wegbom, A. I., Okpara, K. E., & Dollah, O. C.(2025).Exposure and Health Risks Assessment among Waste Pickers in Obio-Akpor Local Government Area in Port-Harcourt, Rivers State, Nigeria. Direct Research Journal of Public Health and Environmental. Vol. 10(3), Pp. 58-67. This article is published under the terms of the Creative Commons Attribution License 4.0.

INTRODUCTION

Globally, the generation of solid waste has increased markedly over the last decade. Hazardous and toxic materials, recyclables, and other useful materials are usually components of the waste stream (Ojeda-Benitez et al., 2013). According to the World Bank, waste generation has intensified to the point where it will be doubled by the year 2025 (world Bank 2020), thus there is indispensable need for improvement practices of solid waste management (Hoornweg et al., 2013). Worldwide, around 1.3 billion tons of waste is generated annually, and it is anticipated that 2.2 billion tons of waste will be generated by 2025 (UNEP, 2015). In variance with the sophisticated approaches employed by developed countries in waste management strategies, many developing countries are still struggling with the disposal of waste generated (Guerrero et al, 2013). In contrast to the developing countries, most developed countries have implemented and adhered strictly to waste classification and separation system which is a critical link in the recycling system. The classification system helps in ensuring that most recyclable resources are separated from household waste and which significantly simplifies waste disposal (Wen et al., 2014).

The Nigerian government has introduced a set of guidelines to support the implementation of the National Policy on Plastic and solid Waste Management. These guidelines, developed between July 15th and 21st October 2020, and was approved by the federal executive council (FEC) to aid in addressing the challenges of improper waste management and disposal of solid and plastic wastes in Nigeria. The waste sector has been acknowledged in the national strategy and policy documents as a sector that can contribute towards economic growth and job creation in the country, (Yusuf et al., 2023). The federal ministry of environment stated that Nigeria produces about 32 million tons of solid waste annually (Iziaq and Salako, 2024). Essentially, plastic bags have become major items in the litter system in Nigeria and have resulted in many harmful environmental effects which includes animal choking, pollution, blockage of channels and rivers/streams and lands cape disfigurement, (Ujeh et al. 2021). The average waste generated per person in Rivers State, Nigeria, particularly in the city of Port-Harcourt, is between 1.1kg and 1.25kg per day (World Bank, 2020).

Over the years, waste pickers have played a vital role in waste management through the recycling process, although in the recycling value chain, waste picking activities are at the lower end (Samson, 2015). Waste pickers are commonly referred to as scavengers, waste scavengers, reclaimers, or garbage pickers (Chvatal and Smit, 2015). Often, waste pickers are self-employed, small-scale agents, typically found in the informal urban sector. Rapid urbanization coupled with the unemployment rate of 4.3% in Nigeria as reported by National Bureau of statistics as at the year 2024 is one factor leading to a rise in informal sector activities such as waste picking. In most developing countries like Nigeria, uncontrolled urbanization leads to an upsurge in urban poverty and inequality, this creates avenues for more people to be involved in informal activities, (Amegah and Jaakkola, 2016).

Waste pickers are often marginalized individuals engaged in picking and sorting of waste for sale, by doing so under a high-risk exposure of health and environmental hazards (Nzeadibe, 2019). Potentially present in open dump sites are several chemicals known to have detrimental effects on Human health (Edokpanyi et al., .2017). Typically, the waste which is accrued in an open dump site is commoditized and created further as reused or recycled goods. Waste pickers build their livelihood around resource salvaging and are mostly unaided and short of adequate health protection measures in place (Binion and Gutberlet, 2016). The understanding that waste picking can pose a serious health risk to human health and the environment is well documented and the associated dump sites exposure can cause health problems such as dermatological symptoms, headache, gastrointestinal symptoms, mental illnesses, chronic and infectious diseases, and allergies among others (Zolnikov and Blodgett, 2016).Most open dump 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 acquiring injuries and diseases unlike the general population (Scarponi et al., 2019). 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 at the dump site (Araujo and Sato, 2018). An over looked but critical research area in Africa, precisely in Nigeria; particularly Rivers State is the associated health risks faced by waste pickers (Viljoen et al., 2018). The aim of this study is to assess the potential health impact associated with waste picking at three open dump sites located at Obio-Akpor local government area. The considered variables among others include health-related symptoms, mental health, use of personal protective equipment, and infectious and chronic diseases. The study results would provide information that can serve as a basic impetus for stakeholders and for further research on the health impact of waste pickers in open dump sites.

MATERIALS AND METHODS

Description of the Study Area

Sampling was carried out at three dump sites in Obio-

Akpor local government area in Rivers State, Nigeria. Obio-Akpor is a local government in the metropolis of port-Harcourt in Rivers State, Nigeria (Figure 1). It is one of the major centers of economic activities in Nigeria, the city covers 260km2(100 sq mi) and at the 2006 Census held a population of 464,789. Its postal code or ZIP code is 500102. Obio-Akpor has its secretariat and City Hall at Rumuodomaya. Obio-Akpor is constituted mainly by the people of the Ikwerre ethnic nationality, they are also known for fisheries and aquaculture. Obio-Akpor is bounded by Port Harcourt local government areato the south, Oyigbo and Eleme to the east, Ikwerre and Etche to the north, and Emohua to the west. It is located between latitudes 4°45'N and 4°60'N and longitudes 6°50'E and 8°00'E.Obio-Akpor, is popularly known as the gateway city, because of its location. It has a land area of approximately 263.1 km2 (120.35 sq mi) and shares boundaries with Emohua, Ikwerre, Etche, Oyigbo, Eleme, Okirika, Port Harcourt Local Government Area of Rivers State and accessible by road, sea, and air transportation. Specifically, there are four prominent Ikwerre Kingdoms that constitute the Local Government Areas, which are: Akpor, Apara, Evo and Rumueme Kingdoms. It also has an average of 2.3% growth rate which puts the population of the Local Government Area as at 2022 to be over 665,000 people.

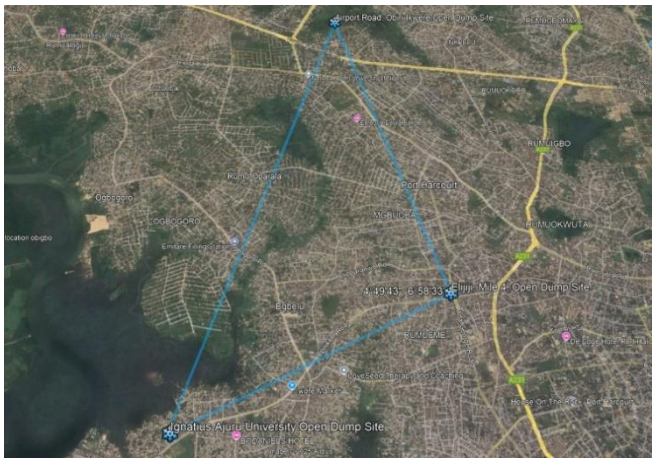

Figure 1: Map showing the study areas

Data Collection and Sampling Method

This study adopts a cross-sectional survey design conducted at three selected open dump sites in Obio-Akpor LGA, Port-Harcourt, Rivers State. The exposed subjects (waste pickers) were proportionally drawn from three selected open dump sites. Due to differences in open dump sizes and number of waste pickers, 80, 23, and11 participants were drawn from the Obiri-Ikwere/ Airport road, Ignatius Ajuru University, and Elijiji/Iwofe mile-4 open dump sites respectively, making a total of 114 participants. The dump sites are hence forth represented as site1, site2 and site3 respectively. This study employed a statistical equation in calculating the sample size from the target population. The sample size was obtained based on three factors: (i) the desired confidence level, (ii) the assumed proportion of the sample and (iii) margin of error. The Cochran equation was adopted to ascertain the sample size, as recommended by Godden (2004). The formula is expressed as:

$$n = \mathbf{z}\frac{2p(1-p)}{\mathrm{m}^2} \quad (1)$$

Where *n* = sample size.
Z = *z* value (1.96 at 95% confidence level).
p = proportion of the estimated sample
M= margin of error (assumed at 0.05)

$$n = \frac{2(1.96)\times 0.05(1-0.05)}{0.05^2} = 114$$

Participation in the study was solely voluntary, and an informed consent form was signed prior to data collection. The waste pickers at the three dump sites is volunteers. However, they have to be registered with the dump site management before access is granted to them to engage in any activity as deemed necessary by the dumpsite management. To ensure quality assurance and quality control of the data to be collected, the questionnaires were pretested before the main survey with adjustments and corrections made based on the responses to improve clarity. The questionnaires used in eliciting data from the respondents were self-administered, semi structured, and divided into four sections. Section A entails demographic and socioeconomic characteristics information including gender, age, marital status, educational level, income earned, and the number of dependents. Section B includes the type of waste sorted and the use of PPE. Section C entails questions dealing with associated health symptoms in the last one year which include respiratory, gastrointestinal, dermatological, musculoskeletal, eye, and ear symptoms. Section D dwells on self-rated health conditions such as mental health, use of alcohol, smoking habit, and dump site safety. For convenience and simplicity, the questionnaires were administered in English language.

Data Analysis

Data cleansing and statistical analysis were carried out using Statistical Package for the Social Sciences (SPSS) version 24 developed by International Business Machine (Armonk, NY, USA). Descriptive statistics were applied in analyzing the sociodemographic profile of the respondents captured data. The logistic regression analysis was used to analyze the association between dumpsites exposure and health symptoms or outcomes. The analysis of variance (ANOVA) was used to compare the association difference between two or more independent groups, while

differences in numerical variables were determined using the *t* test. Logistic regression analysis was employed to determine the association between waste picking and health status of the respondents. The maximum likelihood ratio was used to ascertain the model goodness-of-t, describing the association between dump site exposure and the independent variables such as gender, age, educational level, income, and associated health symptoms. The method of validating the goodness-of-t of the regression model is the Hosmer and Lemeshow test ($\chi 2$ test), and it is considered more robust, particularly if the samples are small. The presented results were in crude and adjusted odds ratios, confidence interval (95%). The level of statistical significance of 0.05 was considered.

Ethical Clearance

Ethical clearance was obtained from the research Ethical committee faculty of Basic Medical Sciences Collage of Medical Sciences Rivers State University, Port-Harcourt Rivers State, Nigeria, to ascertain the avoidance of harm to the participants, informed consent of the participants was obtained prior to the commencement of the study. Necessary permissions were obtained from the dump site management and appropriate government authorities on site.

RESULTS

The sociodemographic characteristics of the respondents as presented in (Table1) indicated that there were 77 male and 37females waste pickers across the three open dump sites. A majority of the waste pickers were within the age group of 31–40 years, representing 58.75% of the total sample. The age distribution also showed variability among respondents. At Dump Site 1, the majority were aged 31–40 years (47, 58.75 %), followed by those aged 20–30 years (20, 25%) and 41- 50 years (11, 13.75%), with a smaller group aged 51 and above (2, 2.5%). At dump Site 2 most respondents age range was 31–40 years (15, 65.22%), followed by 20 -30 years (6, 26.1%) with smaller proportions in the 41–50 years age range (2, 8.69%). At Dump Site 3, the largest group was aged 31–40 years (7, 63.64%), followed by aged 20–30 years (2, 18.18% each) and 41–50 years (2, 18.18%). Notably, children were part of the waste pickers as at the time of this study, moreover, it was discovered that most of these waste pickers have their homes built at dump site 2 and they live with their families. The marital status indicated that at dump Site 1, most were married (50, 62.5%), followed by singles (28, 35%), and a smaller proportion of divorced individuals (2, 2.5%). At Dump Site 2, singles formed the largest group (13, 56.52%), followed by married respondents (10, 43.48%). Similarly, at Dump Site 3, the majority were single (7, 63.64%), with fewer married individuals (4, 36.36%).

Educational attainment among respondents was diverse. At Dump Site 1, most had secondary education (45, 56.25%), followed by primary education (31, 38.75%), with tertiary education being the least represented (4, 5%). At Dump Site 2, the majority also had secondary education (12, 52.17%), followed by primary education (11, 47.83%). At Dump Site 3, primary education was most common (8, 72.7%), followed by secondary education (3, 27.3%).

Monthly income distribution revealed that at Dump Site 1, most respondents earned ₦21,000–₦30,000 (33, 41.25%), followed by those earning ₦31,000–₦40,000 (32, 40%), then those earning ₦41,000 and above (10, 12.5%). The least was ₦5,000 - ₦20,000 (5, 6.25%). At Dump Site 2, the majority earned ₦31,000 - ₦40,000 (8, 34.8 %), and ₦21,000–₦30,000 (8, 34.8%) then less earned ₦31,000–₦40,000 (6, 26.1% each), the least was ₦5,000 -₦20,000 (3, 13%). At Dump Site 3, most respondents earned ₦21,000–₦30,000 (4, 36.3%), followed by those that earn ₦41,000 and above (3, 27.3%), followed by those who earn ₦31,000 - ₦40,000 (2, 18.2%) and ₦21,000 - ₦30,000 (2, 18.2%).

As indicated in Table 1, majority of the respondents at Dump Site 1 had worked as waste pickers for a period of 2–4 years (53, 66.25%), followed by those that have worked for 1–2 years (16, 20%), then those working up to 4 years and above (11, 13.75%). Similarly, at Dump Site 2, most respondents had worked for 2–4 years and (15, 65.2%), while smaller proportions had worked for 1–2 years and 4 years and above (4, 17.4%) and (4, 17.4%) respectively. At Dump Site 3, majority had worked for 2–4 years (6, 54.5%), with fewer respondents working for 1–2 years (5, 45.5%). The reported number of days worked per week varied. At Dump Site 1, majority worked five days weekly (40, 50%), followed by six days (25, 31.25%) and four days (10, 12.50 %). At Dumpsite 2, most respondents also worked five days (10, 43.47%), followed by four days (6, 26.08%) and then six days (5, 21.75%). At Dump Site 3, five and six days were equally common (4, 36.36%) and (4, 36.36%) respectively, with less working for four days (3, 27.27%).

Table 2 indicates the perceived health outcomes of waste pickers. Across the three investigated open dump sites, 29.8% rated their health condition as very good, 33.3 % as good, 20.2 % as average or fair, and 8.8% rated their health status as poor and 7.9% did not comment. A total 96 (84.2%) respondents claimed that they are at risk to respiratory symptoms, whereas, 18 (15.8%) others indicated that they are not at risk. The response to Gastrointestinal symptoms of waste pickers shows that 82(71.9%) asserted that are risk, while 32(28.1) claimed that they are not at risk.

For Dermatological (skin) related symptoms 62(54.4%) claimed that they are not at risk, however, 47 (41.2%) respondents indicated that they are risk. The response to body pain 63(55.3%) reported no body pain, 31 (27.2%) did not comment, whereas, 20 (17.5%) agreed to be at risk of body pain associated with waste picking. For Eye symptoms 68(59.6%) reported that they are not at risk, 8(7.0%) did not comment, but 35 (30.7%) claimed that they are at risk as a result of their waste picking occupation.

Table 1: Socioeconomic demography of waste pickers.

Demography and socioeconomic characteristics	Total Frequency (%)	Dump site 1 (%)	Dump site 2 (%)	Dump site 3 (%)	P Value
Gender					
Male	77(67.5)	51 (37.5)	15 (65.2)	11(100)	0.019
Female	37 (32.5)	29 (62.5)	8(34.8.)	—	
Total	114 (100)	80 (100)	23 (100)	11(100)	≤0.001
Age (years in bracket)					
12–20	—	—	—	—	
21–30	28 (24.6)	20 (25)	6(26)	2 (18.2)	
31–40	69 (60.5)	47 (58.7)	15 (65.2)	7 (63.6)	
41–50	17 (14.9)	13 (16.3)	2 (8.6)	2 (18.2)	
51 and above	—	—	—	—	
Did not tell	—	—	—	—	
Total	114 (100)	80(100)	23 (100)	11 (100)	
Marital status					
Single	45(39.47)	28 (35)	13 (56.52)	4 (36.36)	0.035
Married	67 (58.77)	50 (62.5)	10(43.48)	7(53.6)	
Divorced	2 (1.8)	2 (2.5)	—	—	
Widow/widower		—	—	—	
Did not tell		—	—	—	
Total	114 (100)	80 (100)	23 (100)	11 (100)	
Highest level of education					
No formal education	—	—	—	—	0.153
Primary	50(43.9)	31 (38.7)	11(47..8)	8 (72.7)	
Secondary	60 (52.6)	45 (56.3)	12 (52.2)	3 (27.3)	
Basic degree	4 (3.5)	4 (5.0)	—	—	
Honours degree and above	—	—	—	—	
Total	114 (100)	80 (100)	23 (100)	11(100)	
Years of employment					
1–3	16 (46.5)	16(20)	4 (17.4)	5 (45.5)	≤0.001
4–5	53 (24.6)	53 (66.3)	15 (65.2)	6 (54.5)	
≥6	11 (28.9)	11(13.7)	4 (17.4)	—	
Total	114 (100)	80 (100)	23 (100)	11 (100)	
Monthly income (Naira)∗					
5,000–20,000	1 (0.9)	5 (6.2)	3 (13.0)	2(18.2)	
21,000–30,000	37 (32.5)	33 (41.3)	6 (26.1)	4(36.4)	0.052
31,000–40,000	54 (47.4)	32 (40)	6 (26.1)	2 (8.2)	
41,000 ≥	4 (3.5)	10 (12.5)	8 (34.8)	3 (27.3)	
Total	114 (100)	80 (100)	23(100)	11(100)	
Working days					
3	9 (7.8)	5 (6.2)	2(8.7)	2(18.2)	
4	19 (16.7)	10 (12.5)	6 (26.1)	3 (27.3)	0.004
5	54 (47.4)	40 (50)	10 (43.5)	4 (36.4)	
6	32 (28.1)	25 (31.3)	5(21.7)	2 (18.2)	
Did not tell	—	—	—	—	
Total	114 (100)	80 (100)	23 (100)	11 (100)	

∗1USD equals R 15.6.

The response to the mental health condition of the waste pickers as indicated in (Table 2) shows that 78.87% claimed that they are not at risk as against 21.13% who agreed to be at risk. Clinic/hospital visit in the last year showed that 30.72% claimed to had visited the clinic/hospital for consultation and treatment as against 69.28% who claimed that they never visited the clinic/hospital

For smoking 27 (23.7%) of the respondents claimed to be smokers whereas, 86 (75.4%) claimed not to be smokers and 1(0.9%) did not comment.

A total of 63(55.3%) claimed that they use different types

Table 2: Perceived health outcomes of waste pickers.

	Total Frequency (%)	Dump site 1 (%)	Dump site 1 (%)	Dump site 1 (%)	P Value
Respiratory symptoms					
	96 (84.2)	74 (92.5)	15 (43.5)	7 (45.5)	0.006
No	18 (15.8)	6 (7.5)	8 (39.1)	4 (36.4)	
Did not tell	-	-	-	-	
Total	114 (100)	80 (100)	23 (100)	11(100)	
Gastrointestinal symptoms					
Yes	82 (71.9)	71(88.75)	5 (21.7)	6 (54.5)	0.002
No	32 (28.1)	9(11.25)	18 (78.3)	5(45.5)	
Did not tell	-	-	-	-	
Total	114 (100)	80 (100)	23 (100)	11 (100)	
Dermatological (skin) symptoms					
Yes	47 (41.2)	38(16.67)	7 (30.4)	2 (18.2)	≤0.001
No	62 (54.4)	42 (83.33)	13 (56.5)	7 (63.6)	
Did not tell	5 (4.4)	—	3 (13.1)	2 (18.2)	
Total	114 (100)	80 (100)	23 (100)	11 (100)	
Body pains					
Yes	20 (17.5)	—	13(56.5)	7 (63.6)	≤0.001
No	63 (55.3)	54 (67.5)	7 (30.4)	2 (18.2)	
Did not tell	31 (27.2)	26 (32.5)	3 (13.1)	2 (18.2)	
Total	114 (100)	80 (100)	23 (100)	11 (100)	
Eye symptoms					
Yes	35 (30.7)	21 (26.3)	8 (34.8)	6 (54.5)	≤0.001
No	68 (59.6)	54(67.5)	10 (43.5)	4 (36.4)	
Did not tell	8 (7.0)	5 (5.0)	3 (13.0)	1 (9.1)	
Total	114 (100)	80 (100)	23 (100)	11(100)	
Self-rated health condition					
Very good	34 (29.8)	25 (31.3)	7 (30.4)	2 (18.2)	≤0.001
Good	38 (33.3)	24 (30)	11 (47.8)	3 (27.3)	
Average/fair	23 (20.2)	21 (26.3)	—	2 (18.2)	
Poor	10 (8.8)	10 (12.5)	—	-	
Did not tell	9 (7.9)	—	5 (21.7)	4 (2)	
Total	114 (100)	80 (100)	23 (100)	11 (100)	
Mental health disorders					
At risk	34 (29.8)	20 (25)	10 (43.5)	4(36.4)	0.460
Not at risk	80 (70.2)	60 (75)	13 (56.5)	7 (63.6)	
Did not tell	—	—	—	—	
Total	114 (100)	80 (100)	23 (100)	11 (100)	
Clinic/hospital visit in the last 1 year					
Yes	35(30.7)	25(31.3)	7 (30.4)	3 (27.3)	0.006
No	79(69.3)	55 (68.7)	16 (69.6)	8 (72.7)	
Did not tell	—	—	—	—	
Total	114 (100)	80 (100)	23 (100)	11 (100)	0.617
Smoking habit					
Yes	27 (23.7)	20 (25)	5 (21.7)	2 (18.2)	
No	86 (75.4)	60 (75)	17 (73.9)	9(81.8)	
Did not tell	1 (0.9)	—	1 (4.3)	—	
Total	114 (100)	80 (100)	23(100)	11(100)	
Alcohol usage					
Yes	63 (55.3)	42(52.5)	15(65.2)	6(54.5)	0.015
No	51 (44.7)	38 (47.5)	8 (34.8)	5(45.5)	
Did not tell	—	—	—	—	
Total	114 (100)	80 (100)	23 (100)	11 (100)	
Eating at the open dump site					
Yes	113 (99.1)	80 (100)	23 (100)	10(90.9)	0.954
No	1 (0.9)	0	0	1 (0.9)	

Table 3: Observation of health and hazardous exposures at the open dump sites.

	Observations	Dump site 1	Dump site 2	Dump site 3
Common hazardous substances	Waste pickers were exposed to various hazardous chemical substances deposited at the open dump sites	The open dump site management do not have any special protective area for hazardous waste. All the waste pickers were not using the accurate protective agent equipment's like nose mask , eye goggles , etc.	The open dump site management do not have any special protective area for hazardous waste. All the waste pickers were not using the accurate protective agent equipment's like nose mask , eye goggles , etc	The open dump site management do not have any special protective area for hazardous waste. All the waste pickers were not using the accurate protective agent equipment's like nose mask , eye goggles , etc
Dust	Building rubbles are used in filling of borrow-pits, thus creating/emitting dust which the waste Pickers are exposed to. Other sources of the airborne dust observed in the open dump sites include dust liberated from waste materials by compactor and dump trucks. Dust may comprises of organic matters that could lead to respiratory and dermatological and symptoms.	All of the waste pickers did not make use protective dust mask in order to prevent dust inhalation while hauling out waste materials that can be recycled. Water tankers are used to wet the soil during extreme dry conditions.	All the waste pickers did not make use of personal protective equipment's; they are always exposed to dust inhalation. Water tankers were not used to wet the soil.	Water tankers were not used to wet the soil. None of the waste pickers made use of personal protective equipment's, they were all exposed to dust.

of alcoholic brewages, 51 (44.7%) who reported that they do not use alcohol. An alarming total of 113 (99.1%) reported that they eat at the open dumpsites, except 1of the respondent (0.9%).

Table 3 indicates the occupational and hazardous exposures encountered by waste pickers in the landfill sites. Common hazardous substances and dust from building rubbles and other solid waste materials were observed as the major sources of exposure of the waste pickers in the investigated open dumpsites.

DISCUSSION

In Nigeria and like in most developing countries, the adverse health risks faced by waste pickers have not received much attention. The health risks faced by waste pickers require attention from relevant stakeholders. The study found that waste pickers are significantly at a higher health risk that is associated with their exposure to solid wastes dumped in open dump sites. The gender distribution revealed a predominance of male respondents across all three dump sites, consistent with studies showing that waste picking is often male-dominated due to its physically demanding nature (Wilson et al., 2012). However, the notable presence of female respondents, particularly at Dump Site 1 (36.25%), aligns with findings that women often participate in waste picking as an accessible form of livelihood in informal economies (Anene, 2020). The majority of respondents across all sites were aged 31–40 years, reflecting the economically active demographic that is often engaged in informal waste-picking activities. However, the lack of respondents over 50 years of age may be as a result of the physically strenuous nature of waste picking, which limits participation by older individuals (Babaei et al., 2015).

Marital status varied, with married individuals being more dominant at Dump Site 1 (50, 62.5%), likely due to the site's higher income potential as it is the largest and only Government approved dump site in Obio-Akpor LGA. In contrast, the predominance of singles at Dump Sites 2 and 3 could be attributed to the transient nature of employment at these locations due to the amount of waste deposit in it. Previous studies suggest that single individuals may be more willing to engage in hazardous and informal employment due to low family responsibility (Ibrahima and Lassana 2025).

The low level of formal education among respondents, with most having only secondary or primary education, reflects barriers to better employment opportunities. This pattern is consistent with studies indicating that limited education often confines individuals to informal and low-paying jobs, such as waste picking (Wilson et al., 2012). The predominance of respondents with 2-4 years of experience suggests that waste picking serves as a

medium-term livelihood for many. However, the transient nature of employment observed at Dump Site 3 may reflect fluctuating waste availability or inadequate working conditions, as reported in other studies on informal waste management (Babaei et al., 2015).

Income distribution varied significantly, with Dump Site 1 offering the highest earnings, likely due to its larger waste volume and proximity to urban areas. This finding aligns with previous research indicating that income levels among waste pickers depend on waste volume, recyclables' market value, and site location (Anene, 2020). Respondents typically worked 4–6 days weekly, reflecting the intense labor requirements of waste picking. The higher number of working days at Dump Site 1 may also indicate greater waste availability and economic incentives. Comparable patterns have been observed in other studies on informal waste pickers (Thankur et al., 2018).

Increased occurrences of associated symptoms between waste picking and open dump such as illnesses, self-rated health, and clinic visit have been reported (Made et al., 2020). Although, the result from this study indicates that smoking is not significantly associated with health symptoms faced by waste pickers. The study result, however, reported that, from the three dump sites, 58.2% of respondents engaged in smoking. Studies have documented that the prevalence of respiratory symptoms has a significant association with smoking. Hence, the prevalence of respiratory symptoms increases with smoking (Lui et al., 2015). Studies have also shown that there is a higher occurrence of smoking within low socioeconomic groups, particularly amongst deprived individuals such as waste pickers with negative emotions as a result of coercion and humiliation encountered, hence, as a coping mechanism to help alleviate emotional trauma, some may take up smoking. The study results portrayed the odds that those with a history of smoking are more likely to report respiratory symptoms. Smoking is a known confounder to respiratory symptoms with occupational exposure and negative effects (Liu et al., 2015).Work conditions and practices observed among the three open dump sites were different. Although virtually all waste pickers in open dump sites did not use PPE while working.

None of the waste pickers wore protective dust masks, surgical masks or eye goggle to protect them from inhaling or having direct contact with dust while they haul out recyclable waste materials. The observation shows that the waste pickers were not properly kitted with the recommended PPE, such as recommended eye goggle and the use of the N95 or dust nose masks. The recommended masks can protect the infiltration of air borne dust from the dump sites which can penetrate through their respiratory system. The use of appropriate and recommended PPE are essential components in safeguarding their health. Often, waste pickers collect worn or old shoes and clothes from dump sites and use it as PPE (Lui et al., 2015). Health impact of waste pickers may be susceptibly enhanced by inappropriate use of PPE (Araujo and Sato 2018). Inter related studies have found that most waste pickers complained of respiratory symptoms from dump sites (Nyathi and Oludare, 2018). There are concerns of visible dust which are a common occurrence in dump sites, mostly when garbage trucks are off loading their waste, thereby exposing them to occupational health risks. Waste pickers in the study area search through the waste for cardboards, cans, wooden materials, and bricks, among others. These collections often increase the amount of dust which can irritate the mucous membrane and the respiratory tract (Scarponi et al., 2019). To further avoid health risks related to dust, there is an urgent need for proper PPE to be worn among the waste pickers.

The result of our findings reveals a significant association between waste picking and dermatological and gastrointestinal symptoms. This is in line with a cross-sectional study conducted among waste pickers in Kota Bharu, Malaysia, which reported that 70.3% had dermatological symptoms and 65.5% had gastrointestinal symptoms (Aminuddin et al., 2015). In the study area, due to the high burden of illnesses associated with waste picking, 54% of the waste pickers reported that they have visited the clinic/hospital in the last 1year. The result differs from that obtained in Brazil by Auleretal (2014) which reported 63% clinic/hospital visit from a sample size of 1000 participants. The study results also contradict the findings of Made et al.(2016), in a study conducted in Johannesburg, where 41% of the respondents indicated visiting the clinic/ hospital in the last 1year which was based on 361 respondents. The result also varies from the findings in Colombia, which was based on 174 respondents. According to Mathema et al. (2017), 32% of the waste pickers reported to be visiting the clinic/hospital in the last year.

The result of our study found that, about 50% of the respondents rated their health condition as good. The finding can be related to a study which reported that 43% of the waste pickers surveyed in Johannesburg reported their health status as good (Weigo , 2018) conversely, another study has reported more than 50% of the participants indicating their health condition as average (Weigo , 2018). This may be attributed to the fact that waste pickers in Nigeria do not consider working in a dump site as a health risk or hazard in the need for money takes priority over their health. However, studies have also revealed that due to possible eviction fears from work, waste pickers are not likely to report their health status as poor.

The odds of exposure to health risks are prevalent with waste pickers that have a history of reported common infectious diseases as with those that do not. According to Thakur et al., (2018), in a longitudinal study conducted in India, waste pickers with poor self-rated health were three times more likely in developing infectious diseases. Waste pickers are always in direct contact with toxic materials in waste at the dump sites (Binion and Gutberlet 2016). Infections from chemical substances, heavy metal,

and other dangerous wastes put waste pickers at adverse risk of developing health hazards, and this is worsened by using inadequate and improper PPE (Made et al,.2020).

Conclusion

This study provides epidemiological evidence faced by waste pickers at the dump sites and serves as a yardstick for future research on the impact of open dumping in Rivers State, Nigeria. There was no statistical significance between waste picking and mental health disorder however, with adjusted cofounders; the result of the multiple logistic regression analysis conducted indicated that, in the last one year, waste pickers exposed to dump sites were 1.5 times likely to develop a common health disorder. The results further indicated significant associations between health of the waste pickers and dump site exposure, number of days worked and age, and infectious and chronic diseases. The study results have implications on the waste pickers due to the occupational and hazardous exposures in the dump sites. It is hoped that this research will serve as impetus to stakeholders, districts, municipalities and Provincial health officers in mitigating the health status of the waste pickers. Furthermore, it is suggested that future research on a larger scale that will include open dump from other provinces should be considered. A cohort study in monitoring and evaluating the health status of the waste pickers will offer a resilient epidemiological path of the adverse effects of dump sites. Additionally, risk management and environmental monitoring will serve as a yard stick for the scientific basis in measuring the health effects of the waste pickers.

Conflicts of Interest

The authors declare no conflicts of interest.

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