

Cross-Sectional Study on the Health Risk of Municipal Solid Waste Management Workers: A Case Study of Warri, Delta State, Nigeria

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How to cite this paper: Issa, B.R., Abubakar, A.B., Birma, G.J., Tanko, A.A. and Muazu, I. (2024) Cross-Sectional Study on the Health Risk of Municipal Solid Waste Management Workers: A Case Study of Warri, Delta State, Nigeria. *Open Journal of Safety Science and Technology*, 14, 86-95.
<https://doi.org/10.4236/ojsst.2024.143007>

Received: July 26, 2024

Accepted: August 31, 2024

Published: September 3, 2024

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Abstract

The increasing generation and indiscriminate dumping of municipal solid waste (MSW) in Sub-Sahara Africa has reached a record high. The MSW collection poses a significant health risk to the workers both physically and health-wise. The workers of MSW collectors are constantly subjected to cycles of physical labour such as pushing, pulling, hauling, and lifting. This article sought to evaluate potential health risks, symptoms, and the efficiency of using personal protective equipment (PPE). The respondents of this study are workers in the metropolis of Warri, who work for small and micro businesses. The response of the respondents was collected by utilizing a structured questionnaire. A total of 150 questionnaires were distributed to MSW workers (n = 150). The study's findings revealed that just a small percentage (12%) of waste collectors are routinely equipped with personal protective equipment. Furthermore, 92% of the respondents are reported to have encountered sharp objects during waste evacuation. About 85.3% and 89.3% of respondents have encountered mosquitoes and bacteria/fungal growth in MSW waste, respectively (disease-carrying insects). The study found that the MSW collectors are highly at risk of developing respiratory-associated symptoms with about 67.3% reported to have shown symptoms such as wheezing, coughing, and asphyxiation. Approximately 70%, 91%, and 91.6% of the respondents experienced headaches, musculoskeletal, and dermatological symptoms respectively. In addition, about 56% were reported to have shown gastrointestinal symptoms such as diarrhea and nausea. This paper concludes that MSW personnel should be completely equipped with PPE due to the various health hazards outlined in this study.

Keywords

Health Risk, Municipal Solid Waste, Waste Collector Workers, Warri Metropolitan City

1. Introduction

Solid waste is generally classified into three categories depending on the source of generation: municipal waste (household waste), industrial waste (hazardous waste), and biomedical waste (hospital waste) [1]. Approximately 2.1 billion tons of waste is generated all over the world [2]. The United Nations World Urbanisation Prospects (2014) has projected a 66% increase in urban populations in the next two decades. The economic informality nature of Sub-Saharan Africa (SSA) such as street vending is becoming more prevalent, thereby contributing to the indiscriminate dumping of solid waste. Many low-income developing countries struggle with waste collection, resulting in poor waste management methods and inadequate disposal sites [3].

Nigeria is reported to be among the top three African countries with an increasing dumping of municipal solid waste (MSW), while the other two nations are Ethiopia and Senegal. Senegal tops this list of waste generators with an estimated 2.4 million tons of waste generated annually [4]. MSW management has become a widespread challenge, especially in fast-growing cities like Warri, Delta State [5]. This waste is generated because of increasing human populations and the necessity for industrialization, urbanization as well as growing human consumption [6]. A total volume of 66,721 metric tons of solid waste is reported to have been sent directly to landfills every month in Nigeria; among these are organic waste, plastic, paper, glass, and tin [7]-[9].

Landfilling is the most widely used form for disposing of MSW [10]. Despite the use of this method, there are growing concerns about the availability of land and the rising contamination, which includes pollution of groundwater, emissions of methane gas, and some offensive odour releases coming from such areas [11]-[14]. Accordingly, controlled dumping is rated the least advantageous strategy for MSW treatment (Directive 2008/98/EC 2008).

Aminuddin & Rahman [15] in their study found that MSW negatively affects human health due to its chemical and biological compositions. It is evident that waste collectors are faced with a greater risk of pollution compared to other workers all over the world. Ziraba *et al.* [16] reported that some of the health risks contracted by waste workers are transferred partially to the general population but at a lesser severity. Furthermore, the rate of accidents recorded among MSW collectors is higher compared to other general workers [17].

The continuous exposure of MSW workers to volatile compounds such as lead, methane gas, and copper, as well as bioaerosols, is attributed to being the cause of some skin and gastrointestinal health-related issues [15]. The need to

comprehensively study the impact of MSW exposure on waste collectors stems from the increasing contraction and transmission of diseases. This paper is aimed at investigating the effects of MSW on waste workers in Warri metropolis. Therefore, by conducting a detailed health risk assessment among waste collectors in Warri metropolis, appropriate identification, management, and safety precautions can be taken.

2. Research Methodology

2.1. Study Area

Warri metropolis is a famous oil-producing city in the southern part of Nigeria. The city, which is 20 feet above sea level, is located just a few kilometers north of the Atlantic Ocean at longitude and latitude of 5°31'N and 5°45'E, respectively. Warri City is the most densely inhabited city in the entire Delta State. The survey was conducted in the top five most populous Local Government Areas, which are: Uvwie, Warri South, Okpe, Udu, and certain sections of Ughelli South. The age of waste per capita of Warri City was assessed at 0.5 kg per individual each day comparing a sum of 4395 kg altogether per day [18].

2.2. Sampling Techniques

The questionnaires were administered by research assistants to MSW workers from different Small and Medium Enterprises (MSE) in the metropolis. This study was carried out by collecting data from regular waste workers who are involved in gathering, transporting, and disposing of MSW at landfills. This study utilizes a cross-sectional study, which involves 150 waste workers from different MSEs. A structured questionnaire was randomly distributed to MSW workers to get a direct assessment of the respondents on various topics. For a comprehensive evaluation, the structured questionnaire was divided into three sections. The first section contains information about the demography of the respondents, which includes the following: age bracket, gender, ethnic group, duration of work, smoking habit, work frequency monthly, and education level. The second section includes the health and safety details of the respondents. The third section deals with safety precautionary practices, such as the use of personal protective equipment (PPE); furthermore, the section assesses the employer's willingness to provide the necessary PPE and adequate training to the MSW workers.

2.3. Data Management and Statistical Analysis

The primary data for this study was collected in the field through a survey, which was evaluated and analyzed using a statistical package (SPSS version 27) in addition to the Excel package used for plotting graphs (Microsoft 365). Descriptive statistics (graphical and numerical) were adopted to assess the various parameters and variables of interest.

3. Results and Discussion

3.1. Sociodemographic Characteristics of MSW Collectors

The questionnaire was completed by 150 waste collection workers. The summaries of the respondent's sociodemographic characteristics are depicted in **Table 1**. Approximately 26.7% of them are under the age of 25, while about 17.3% are over 45 years of age. The age bracket of 25 - 35 years has the highest frequency of MSW workers. The difference between the male (70.7%) population compared to the female population 29.3% was marginally large. Considering the duration spent by employees working, the frequency in both extreme brackets (less than one year and over 5 years) is equal, which has a percentage of 20.0% each. The highest percentage (36%) was observed between the work duration of 4 - 5 years. Most of the workers have secondary school education (36%), while about 32.7% and 31.3% have primary education and no formal education, respectively. Approximately 56.7% of them have no job training, while 23.3% and 20.0% have annual training. The number of respondents who smoke (either frequently or not) is higher than those who do not smoke (36.7%).

Table 1. Sociodemographic characteristics of MSW collectors.

Characteristics	Frequency (n = 150)	Percentage (%)
Age (years)		
Under 25	40	26.7
25 - 35	53	35.4
35 - 45	31	20.6
Over 45	26	17.3
Gender		
Male	106	70.7
Female	44	29.3
Employment duration		
Less than one year	30	20.0
1 - 3 years	43	28.7
4 - 5 years	47	31.3
Over 5 years	30	20.0
Level of education		
No formal education	47	31.3
Primary	49	32.7
Secondary	54	36.0

Continued

Shift of work		
Day	150	100
Night	0	0.0
On the job training		
Annual	35	23.3
Biannual	30	20.0
Non	85	56.7
Smoking habit		
Little	40	26.6
Chain	55	36.7
Not at all	55	36.7

3.2. Health Risk Characteristics of MSW Workers

The breakdown of health risks and symptoms based on the responses collected from MSW workers is summarised in **Table 2**. About 12% of the respondents reported that PPEs are routinely provided to them. About 92% of the workers have observed sharp objects while collecting MSW while 84.7% of the respondents do experience body vibration. Furthermore, approximately 94.7% of them expressed that collection of MSW involves activities that require heavy lifting, and about 91.3% complained of musculoskeletal symptoms such as elbow, wrist, and low-back pain. Some other workers, with a proportion of 67.3%, experienced one of the following respiratory symptoms: wheezing, coughing, or phlegm, while about 91.6% of respondents complained of diarrhea and nausea (gastrointestinal symptoms). In addition, about 70% of the participants experienced skin diseases (rashes and itching).

Table 2. Descriptive statistics of various health risks experienced by MSW collectors.

Characteristics	Frequency (n = 150)	Percentage (%)
Observation of sharp objects while working?		
Yes	138	92.0
No	12	8.0
Body vibration is one of your problems?		
Yes	127	84.7
No	23	15.3
Activity required heavy lifting job?		
Yes	142	94.7
No	8	5.3

Continued

Effect of heat from the environment while working (day shift)?		
Yes	93	62.0
No	47	38.0
Provisions of PPE during work?		
Yes	18	12.0
No	132	88.0
Musculoskeletal symptoms (Low back pain, elbow and wrist pain)		
Yes	137	91.3
No	13	8.7
Respiratory symptoms (Cough, phlegm, asphyxiate and wheezing)		
Yes	101	67.3
No	49	32.7
Headache		
Yes	84	56.0
No	66	44.0
Dermatological symptoms (Itching and rashes)		
Yes	105	70.0
No	45	30.0
Gastrointestinal symptoms (Nausea and diarrhea)		
Yes	79	91.6
No	71	6.6
Any observation of poisonous/dangerous animals?		
Yes	93	52.7
No	57	47.3
Observation of insect carrying disease (mosquitoes)?		
Yes	128	85.3
No	22	14.7
Observation of bacteria/fungal Growth on waste?		
Yes	134	89.3
No	16	10.7

The major health issues experienced by the respondents are depicted in **Figure 1**. Musculoskeletal and dermatological health risks among MSW workers were observed to be highest with a percentage of 91% and 91.6%, respectively,

while respiratory disease and headache percentages were 67.3 and 70%, respectively. The least experienced disease is gastrointestinal symptoms, which had a proportion of 56%.

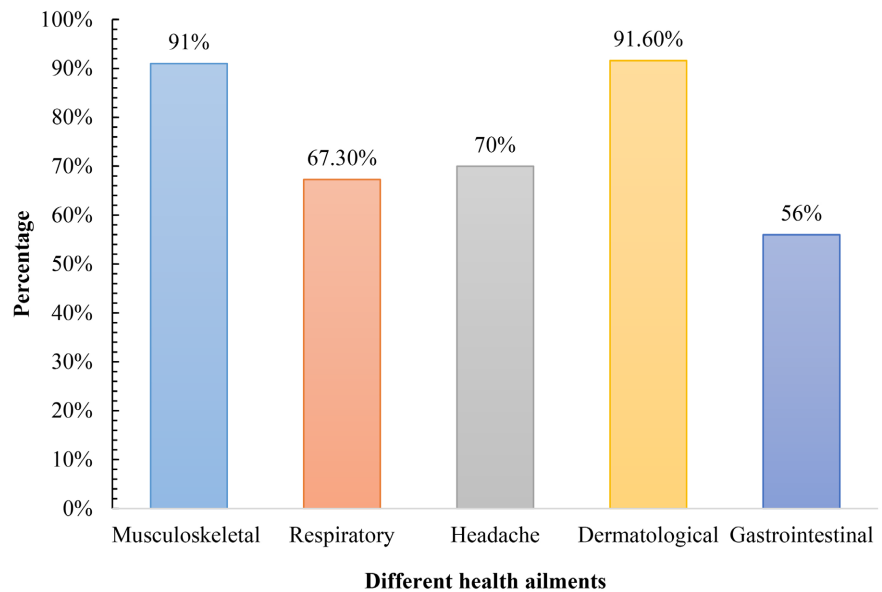


Figure 1. Major health issues experienced by MSW workers.

3.3. Results Comparisons with Other Similar Studies

Even though proper municipal waste collection has yielded many positive results for human health (environmental sanitation), it has, on the other hand, negatively impacted the health of those collecting and managing it. Some of the risks posed by MSW to the workers could either be fatal or non-fatal, depending on the frequency and degree of exposure [19] [20]. Thus, this study's findings on MSW workers in Warri municipal validate and corroborate the results of previous literature.

First, the demographic data showed the varying social status of the workers. Generally, the work attracts a smaller population of old people and females, and this could be attributed to the norms of society and its nature of lifting heavy loads, which could be difficult for these groups of people. The results of this study contradicted those reported by Eskezia *et al.* (2016) in Ethiopia, which showed that a significant population of the workers were females.

A relatively high incidence of smoking habits among the workers might be seen as an approach adopted by the workers to annul the psychological effects of the job. This could be termed job-related and behavioural characteristics. The result of the field study revealed that a significant proportion of the workers who smoke are addicted, so it would be necessary to caution them about the health implications of such habits.

In Warri and its environs, MSW workers provide door-to-door waste collection from residential and commercial areas. Usually, waste is placed on the ground, which would require the use of a shovel to transfer it to a collection re-

fuse disposal truck or pushcart. However, some residents practice good disposal ethics by placing the waste trash in a plastic bag or basket to be picked up by hand. Hence, the above facts are indications that workers often have direct contact with solid waste and are further exposed to strenuous working conditions.

The findings of these field surveys revealed that PPE is rarely provided to the workers, thus the high prevalence (more than 70% of responses) of health-related issues, such as dermatological, gastrointestinal, and respiratory diseases. A significant number of the workers have encountered sharp objects during waste evacuation. Similarly, different studies have reported that cuts and punctures resulting from sharp objects in MSW are the most prevalent occupational injuries [21]-[23]. Other forms of concern reported by the workers include the high presence of disease vectors as well as poisonous or dangerous animals. Similar conditions have been reported to be commonly experienced by waste pickers and workers in developing and underdeveloped countries [22]. In general, this study showed that MSW workers in Warri and its environs are highly predisposed to different occupational hazards.

4. Conclusion and Recommendations

4.1. Conclusion

This cross-sectional study's findings further provide proof that MSW workers are exposed to various health risks, including physical fatigue and allergies. Some of the health issues experienced by the workers are respiratory, gastrointestinal, and dermatological. Furthermore, ailments like headache, stomach pain, hearing disorders, cough and catarrh, fever, malaria, and typhoid have all been experienced by MSW workers. MSW collection is an activity that necessitates frequent use of physical energy, which involves heavy lifting, hauling, dragging, or pulling and pushing of bins (containers), which could cause muscular contraction and expansion, hence leading to musculoskeletal issues. These various health conditions are also caused by exposure to unsafe environments, pathogenic bacteria, and bites from mosquitoes and flies. In addition, the offensive odours and wet conditions of MSW pose serious health hazards to the waste collectors. Furthermore, continuous and long hours of work, as well as noise exposure, have also contributed to the increasing risk and rate of disease contractions. Workers must be educated about the potential risks and symptoms that could arise from MSW management. They should be encouraged to reduce their exposure time and utilize PPE as a precautionary measure. Along with frequent health check-ups, medical insurance is essential to be provided to the workers by their respective companies. The use of machines should be encouraged to limit human contact with MSW.

4.2. Recommendations

- There is an urgent need to provide health and safety plans and lectures to all waste collectors in MSW at all levels. These plans should include new meth-

ods of waste handling and response procedures in case of accidents such as gas and fire, as well as some toxic releases from other elements (materials).

- Private and government MSW contractors should be cautioned and strictly supervised to provide good wages to waste workers. In addition, good vehicles and other waste management facilities should be readily made available. This will guarantee environmental sustainability.
- Continuous provision of on-the-job training should be encouraged at all levels, as this will ease the collection processes as well as reduce the degree of contracting diseases.
- Further study should be conducted to implement more effective health protection policies and management measures to reduce workers' health risks.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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