International Journal of Occupational Safety and Health

ISSN: 2091-0878 (Online) ISSN: 2738-9707 (Print)

Original Article

Self-reported occupational hazards among waste management staff in Lalitpur Metropolitan City: A pilot study from Nepal

Pradhan A[1], Thapa A[2], Karki R[3], Kaphle M[4]

[1]Department of Public Health, Nobel College, Pokhara University, Kathmandu, Nepal
[2]Department of Public Health, Yeti Health Science Academy, Purnanchal University, Kathmandu, Nepal
[3]Central Department of Public Health, Institute of Medicine, Tribhuvan University, Kathmandu, Nepal
[4]Department of Public Health, Peoples Dental College and Hospital, Tribhuvan University, Kathmandu, Nepal

Corresponding author:
Maheshor Kaphle
Associate Professor, Peoples Dental College and Hospital, Tribhuvan University, Kathmandu, Nepal
E-mail: kafmahesh@gmail.com
Tel.: +9779841279138
ORCID ID: https://orcid.org/0000-0001-8121-6206

Date of submission: 27.12.2023
Date of acceptance: 24.11.2024
Date of publication: 01.01.2025

Conflicts of interest: None
Supporting agencies: None
DOI:https://doi.org/10.3126/ijosh.v15i1.59722

ABSTRACT

Introduction: Solid waste management is a major environmental and health concern. Workers face occupational health problems due to the equipment used, and emissions from the materials. This study aimed to study the health status and occupational hazards existing among municipal waste collectors.

Methods: A cross-sectional study was conducted among 125 municipal waste collectors in Lalitpur Metropolitan City from April to September 2023. Ethical approval from the Institutional Review Committee, written permission from the organization and informed consent was taken from respondents. Three organizations were selected randomly and a complete enumeration method was applied. Data entry was done in Epi Info 7, and analysis in the SPSS 23 version. The chi-square test was used to measure the association.

Results: Majority of respondents 99(95.2%) faced physical hazard, 65(62.5%) biological hazards. Likewise, 69(55.2%) knew its health effects. Nearly one-third 38(30.4%) used personal protective equipment (PPE) and 55(44%) had been vaccinated for tetanus. The health check-up in the past year of respondents was low 49(39.2%). A statistically significant association was found between the job category and the presence of physical, chemical, and biological hazards (p=0.041, 0.003, and 0.001 respectively).

Conclusion: The study highlights inadequate utilization of PPE, particularly concerning their strenuous work. Most workers had good mental health, but more than half showed poor physical health. The study recommends promoting PPE use, administering tetanus and hepatitis vaccinations, and providing workplace training.

Keywords: Health status; Occupational hazards; Occupational Exposure; Waste management.

Introduction

Solid waste management is a widespread issue in cities across the world.[1] Waste collector workers face greater levels of exposure and risk during their work compared to other workers.[2] Waste collectors face public health issues such as occupational injuries, exhaustion, and accidents.[3] In addition, injuries brought on by work-related accidents, and health effects include musculoskeletal issues, gastrointestinal, and infectious problems, workers are more likely to develop chronic respiratory problems, and injuries from sharp objects.[4] Municipal waste collectors have been exposed to the risks while at work which is directly or indirectly affecting their health.[5] In 2014, waste and recyclables collection was identified as the sixth most hazardous job in the United States, with 27.1 fatalities per 100,000 workers.[6] In Denmark, accidents and injuries

among domestic waste collectors were 5.6 times more prevalent compared to other workers, while a study in Chandrapur highlighted the exposure to various occupational hazards such as allergies, vomiting, malaria, and more.[7, 8] Significant work-related accidents have happened due to not using personal protective equipment (PPE).[9]

Waste management is a major environmental and public health issue in Nepal.[10] The current solid waste management system in Nepal is highly inefficient.[11] Only 25 private enterprises in Kathmandu Valley are responsible for solid waste management. Waste collectors are at the highest risk due to handling hazardous materials, including those discarded by infected personnel during the COVID-19 pandemic.[12] Due to their hygiene practices and living conditions, they are particularly vulnerable to illnesses.[13]

The issue of solid waste management has a detrimental impact on the health of the community.[14] It is crucial to develop a comprehensive solid waste management policy in Nepal, prioritizing the health and safety of the workers. The findings of this study will be useful in identifying the threats that municipal waste workers experience, as well as their practices of dealing with these hazards. This study aims to assess the health status and occupational hazards faced by the municipal waste workers at the workplace, and the sources of causing those hazards.

Methods

A cross-sectional study was conducted among municipal solid waste management workers of Lalitpur Metropolitan City between April 1 to September 30, 2022. The study population comprises solid waste management workers of Lalitpur Metropolitan City. Written permission was taken from the administration of all the selected organizations of Lalitpur Metropolitan City to conduct the study. Informed consent was taken from all respondents. Confidentiality, anonymity, privacy, and sentiments of all the respondents were maintained. The right to withdraw or skip the question from the study at any time was ensured. Ethical approval was taken from the Institutional Review Committee (IRC) of Nobel College, Kathmandu (Ref. no: 46/079/080). Municipal waste collectors such as sweepers, waste collectors, loaders, and their supervisors working within waste management organizations in Lalitpur Metropolitan City who were willing to participate were included, whereas those who refused to participate, were absent or left at the time of data collection and were denied giving their consent were excluded.

The study sample size was determined by a single Cochrane formula.[15]

$$\text{Sample size } (n) = Z^2PQ/e^2$$

Where, n = sample size,

z = 1.96 in 95% confidence interval

P = Based on a study conducted among informal waste collectors in Nepal, a prevalence of 81.2% occupational injury was used.[16]

Q = 1-p = 0.188

e = margin of error = 7% or 0.07

Therefore, a 95% confidence interval and 7% margin of error, the sample size was calculated because this is a pilot study and helped identify the variability in the population. 119.68 ≈ 120, however, we approached 125 workers for this study. As a reference taken from the Solid Waste Management Association in Nepal, seven organizations are working with municipal waste collectors in different wards of Lalitpur Metropolitan City. Among the seven organizations, we randomly selected three organizations to cover more respondents which is nearly half of the organizations. After that, we used a complete enumeration method for data collection to interview the staff from the selected organization for this study.

Data was collected from participants by semi-structured questionnaire. The questionnaire was developed after performing an extensive literature review. Multiple sites were studied for reference to develop the tool for the questionnaire and modified to fit the local context.[17-19] The questionnaire was divided into four sections: Socio-demographic characteristics in section one, Health status in the second section, Behavioural factors, and occupational health hazards in the

workplace in the third and fourth sections respectively. The health status was measured by using the PROMIS 10 scale.[20] It has ten questions and two 4-item summary scores: general health status, and general mental health status.[21] The cut-off score for a total score below 50 is regarded as within the normal range (indicating better health status) and above 50 is regarded as above the normal range (indicating poor health status).[22] A face-to-face interview technique was used for data collection. Cronbach's Alpha test was calculated to test the reliability of the PROMIS scale questionnaire for health status. The value of Cronbach's alpha of PROMIS scale for this study α was 0.74 for health status. The data collection and entry were done using Epi-Info 7 software and then it was transferred to IBM SPSS version 23 software for analysis. All the collected data were checked and rechecked for completeness. The data was analyzed using descriptive statistics such as percentage, mean, median, frequency, and standard deviation. Pearson's chi-square test was used to measure the association between the dependent variable, and independent variable, and a *p*-value less than 0.05 was considered a significant level.

Results

Among the 125 respondents, the average age was 32.50 years, with a standard deviation of ±8.03 years. More than half of the workers were female, 66 (52.8%), and 91 (72.8%) had completed basic and secondary education. Among the worker categories, the largest group consisted of waste pickers 43 (34.4%), and the majority of the respondents 115 (92.0%) had less than 10 years of work experience. Regarding monthly income, it ranged from NRs. 7000 to a maximum of NRs. 35000 (Table 1).

Table 1: Socio-demographic characteristics of respondents (*n=125)*

Characteristics	Numbers (%)
Age (in years): Mean 32.5, Std. Deviation ±8.03	
Gender	
Male	59 (47.2)
Female	66 (52.8)
Education level	
Hard to read and write	3 (2.4)
General read and write	21 (16.8)
Basic and secondary	91 (72.8)
Higher secondary and above	10 (8.0)
Job category	
Loader	15 (12.0)
Sweeper	26 (20.8)
Waste picker	43 (34.4)
Segregator	32 (25.6)
Supervisor	9 (7.2)
Years in workplace	
≤ 10	115 (92.0)
> 10	10 (8.0)
Monthly income (In NRs)	
7000 –17000	68 (54.0)
17001 –27000	50 (40.0)
27001 –38000	7 (6.0)
Median= Rs.15000, IQR= 11000, Minimum= Rs.7000, Maximum= Rs.35000	

Almost 99 (95.2%) workers were reported encountering physical hazards in their workplace. Among these hazards, the workers faced injuries such as cuts/punctures 56 (44.8%), eye/ear injuries 22 (17.6%), 24 (19.2%) including burns, fractures, and noise disturbance. Moreover, interaction with chemical substances was reported by 32 (25.6%) of the workers. Likewise, the workers encountered various biological hazards including animal or insect bites 42 (33.6%), and exposure to bacteria and viruses 72 (57.6%). They also confronted ergonomic hazards, such as engaging in heavy lifting activities 68 (54.4%), repetitive hand movements 79 (63.2%), standing or walking for over irregular working hours 112 (89.6%), and working in awkward posture 77 (61.6%). These workplace conditions led to health issues among the workers, such as cough and sore throat 24 (19.2%), itchiness and rashes 46 (36.8%), muscle pain 50 (40%), and more (Table 2).

Table 2: Occupational Hazards Faced by Respondents

Characteristics	Numbers (%)
Type of occupational hazards faced in the workplace **	
Physical	99 (95.2)
Biological	65 (62.5)
Chemical	34 (32.7)
Ergonomic	25 (11.2)
Health Problems **	
Respiratory symptoms	
Cough and Sore throat	24 (19.2)
Asthma	3 (2.4)
Gastrointestinal symptoms	
Diarrhoea and Nausea	16 (12.8)
Dermatological symptoms	
Itchiness and Rashes	46 (36.8)
Musculoskeletal symptoms	
Body stiffness	37 (30.1)
Muscle pain and Fatigue	50 (40.0)

Note: (**) Includes multiple responses, n=125

Respondents in the role of segregators 27 (84.4%) and waste pickers 35 (81.4%) reported a higher incidence of encountering substantial physical hazards compared to their peers in other job categories. Among these segregators exhibited a higher prevalence of 14 (43.8%) of chemical hazards and an even prevalence of biological hazards of 23 (71.9%) when compared to other job roles. Additionally, ergonomic hazards were more commonly observed among supervisors 4 (44.4%), and loaders 4 (26.7%). Furthermore, a statistically significant association was identified between the job category and the presence of physical, chemical, and biological hazards (p=0.041, 0.003, and 0.001 respectively) (Table 3).

Nearly half of the workers, 55 (44%) had received tetanus vaccination. Just over one-third 49 (39.2%) had undergone health check-ups in the past year with a significant portion 17 (13.6%), having visited the doctor only once during that time The use of PPE among workers was low 38 (30.4%), with the primary reason for not using it being discomfort, as reported by 44 (56.4%) of those surveyed. Most of the workers were non-smokers 90 (72%) and the consumption of alcohol was occasional for 70 (56%) of the workers. The hygiene practices were common, with 97 (77.6%) of the workers changing their clothes daily and 65 (52.0%) bathing at least once a week (Table 4).

Table 3: Association of Occupational Hazards and Job Category

Job Category	Physical Hazard		Chemical Hazard		Biological Hazard		Ergonomic Hazard	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Loader	12	3	4	11	4	11	4	11
	(80)	(20)	(26.7)	(73.3)	(26.7)	(73.3)	(26.7)	(73.3)
Supervisor	3	6	1	8	2	7	4	5
	(33.3)	(66.7)	(11.1)	(88.9)	(22.2)	(77.8)	(44.4)	(55.6)
Sweeper	22	4	1	25	7	19	4	22
	(84.6)	(15.4)	(3.8)	(96.2)	(26.9)	(73.1)	(15.4)	(84.6)
Waste picker	35	8	14	29	29	14	9	34
	(81.4)	(18.6)	(32.6)	(67.4)	(67.4)	(32.6)	(20.9)	(79.1)
Segregator	27	5	14	18	23	9	4	28
	(84.4)	(15.6)	(43.8)	(56.3)	(71.9)	(28.1)	(12.5)	(87.5)
***p*-value**	0.041*		0.003*		0.001*		0.311	

Note: * significant at 5% level of significance, n=125

Table 4: Behavioural Practices Followed by Respondents (n=125)

Characteristics	Variables	Number (%)
Received vaccine	Tetanus	55(44.0)
	Tetanus and Hepatitis	41(32.8)
	None	29(23.2)
Health check-ups in the past year	Yes	49(39.2)
	No	76(60.8)
Use of PPE	Yes	38(30.4)
	No	87(69.6)
Smoking status	Smoker	30(24.0)
	Non-smoker	90(72.0)
	Ex-smoker	5(4.0)
Drinking alcohol	Occasionally	70(56.0)
	Daily	13(10.4)
	Ex drinker	42(33.6)
Cloth changing habit (Times in a week)	Daily	97(77.6)
	2	8(6.4)
	3	13(10.4)
	4	7(5.6)
Bathing habit (Times in a week)	Weekly	6(4.8)
	Daily	65(52.0)
	2	21(16.8)
	3	26(20.8)
	4	7(5.6)
Knowledge of occupational health hazards (Yes)		106(84.8)
Knowledge of its health effects (Yes)		69(55.2)

The majority of staff reported a general mental health status of 113 (90.4%) in better health status and only 12 (9.6%) were seen with poor health status. But about 74 (59.2%) of the worker's general physical health status was not good (Figure 1).

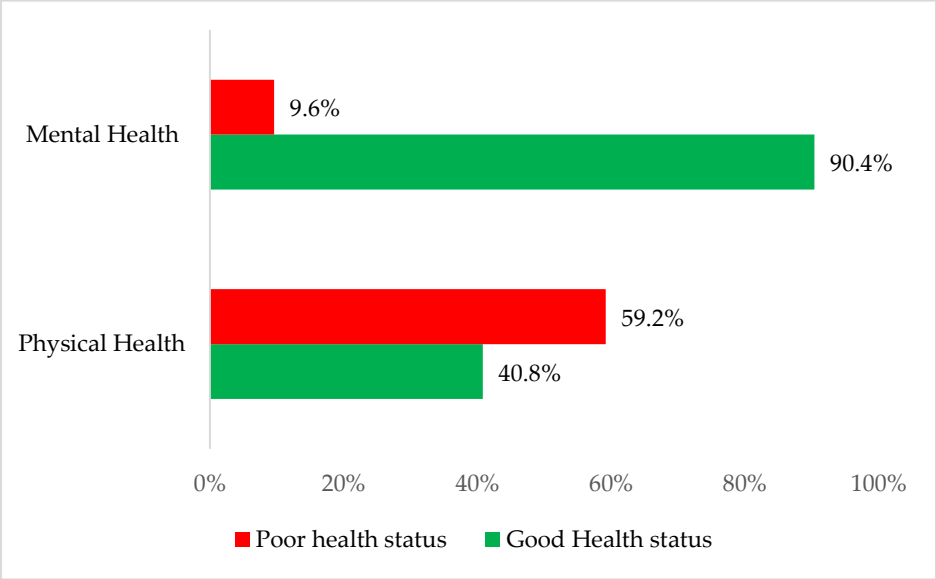

Figure 1: General Physical and Mental Health Status of Respondents (n=125)

Discussion

This study shows that a maximum of the respondents faced physical hazards 99 (95.2%) and the majority faced biological hazards 65 (62.5%). This aligns with the study conducted in a systematic review of informal waste pickers which revealed that common occupational hazards faced by the workers were physical (77.6%) and biological hazards (65.5%).[23] Approximately half of the workers in this study 56 (44.8%) disclosed instances of experiencing cuts, indicating such incidents. These findings are similar to those of a prior study that involved informal waste workers in Kathmandu Valley, where the workers reported experiencing physical injuries, including cuts injuries caused by sharp (44.4%)[13] and 61% among waste collectors in Kathmandu metropolitan city.[24] The high rate of physical hazards is most likely related to the nature of waste collection, which requires handling heavy and potentially dangerous objects. These findings emphasize the need for providing improved safety measures training to workers to protect the general physical health of these workers, while simultaneously addressing and maintaining their general mental health well-being.

Regarding the biological hazards, a significant number of the respondents 72 (57.6%) had reported exposure. This indicates the workers were probable to expose bacterial and viral contamination. This finding strongly indicates that the work nature of municipal waste workers is at high risk of exposure to airborne contaminants, bacterial skin infections, and other airborne infections. Furthermore, the results resonate with similar findings regarding adverse health issues reported in Egypt.[1] In another cross-sectional study reported, a significant number of respondents reported experiencing musculoskeletal symptoms which accounted for (67.2%) of cases[8] which was similar to this study because it shows the majority of respondents reporting musculoskeletal problems such as body stiffness 37 (30.1%), muscle pain, and fatigue 50 (40%). These findings indicate that they have been engaged due to heavy physical activity such as lifting, carrying, and managing heavy objects, resulting in musculoskeletal issues. In the study we conducted, over half of the respondents, 79 (63.2%) faced ergonomic hazards such as performing repetitive hand movements. The prevalence of ergonomic risk highlights the need

for ergonomic interventions and regular physical assessments required among the workers. Similarly, 77 (61.6%) of respondents had to work in an awkward posture. This was comparable to a Malaysian study done among domestic waste management agency workers.[4] This study showed the workers having low gastrointestinal symptoms like diarrhoea and nausea 16 (12.8%). This corresponds to the gastrointestinal issues documented in a study conducted among solid waste workers of the Chandrapur Municipal Corporation.[7] This study shows the workers have also suffered from dermatological symptoms like itchiness and rashes 46 (36.8%). Gastrointestinal and dermatological symptoms indicate exposure to contaminated waste and toxic environments. The waste workers are obligated to engage in physically demanding heavy work environments, often exposed to bacteria and viruses.

In this study, just 55 (44%) of the workers had been vaccinated against tetanus, which is slightly less than half of the respondents. This finding aligns with another study in which workers reported a tetanus vaccination status of 46.8%.[16] The low vaccination rates reflect the need for increased awareness and education about the value of immunizations in preventing workplace diseases. Study results suggest implementing regular vaccination programmes and providing workers with easy access to immunizations can improve their overall health and safety. Although it is strongly recommended to use PPE, in this study we observed that only 38 (30.4%) of the total workers were utilizing personal protective equipment (PPE). The finding was similar to the finding of the study conducted among municipal waste handlers, where PPE use was reported to be 45.8%.[25] It is worth noting that this research also looked into the reasons behind the reluctance to use PPE among these respondents. The primary reasons reported by the respondents included a general discomfort with PPE, as expressed by the majority (44 individuals, or 56.4%), and the unavailability of PPE in the workplace, which was reported by 12 individuals (15.4%). These findings align with responses from the study conducted among informal waste workers in Nepal.[5] A significant proportion of the respondents, specifically 106 respondents (84.8%) exhibited a good knowledge of occupational health hazards. However, just slightly more than half of the respondents 69 (55.2%) knew its health effects. These findings emphasized a higher level of awareness and knowledge on occupational health hazards and their effects, in contrast to a study that reported lower knowledge levels regarding occupational health hazards.

The majority of the respondents reported having general mental health within the normal range 113 (90.4%) indicating good mental health status while more than half of them about 74 (59.2%) respondents had poor general physical health status indicating a potential lack of attention to their physical well-being. This study's findings were similar to those reported in a recent study conducted on landfill sites in South Africa.[26] This study indicates that the workers might have coping mechanisms or peer support. However, constant mental health care and intervention are required to be safer.

This study has shown that the job categories such as loader, supervisor, sweeper, waste picker, and segregator serve as predictors for occupational hazards including physical hazards (p=0.041), chemical hazards (p=0.003), and biological hazards (p=0.001). These findings resemble a risk assessment carried out among waste workers, analyzing their occupational health risks, and highlighting the occupational hazards faced by these workers.[10] Different categories of jobs have distinct levels of risk. Therefore, it is crucial to take these job categories into account when assessing the status of occupational safety and injuries among municipal waste workers in Lalitpur Metropolitan City.

Limitations

The assessment was based on self-reported data whereas workers may have been inclined to exaggerate some hazards. A larger sample size would have decreased the margin of error, identifying and reducing false negatives during

the statistical analysis lacking in this study. Clinical examinations were not conducted to validate these hazards, potentially introducing information bias. Workers might have been inclined to underreport or exaggerate certain hazards.

Conclusions

The study reflects broader trends observed both nationally and internationally. This study revealed a concerning lack of personal protective equipment (PPE) utilization among the respondents despite their frequent exposure to hazardous wastes. In many low and middle-income countries like Nepal, PPE utilization is often inadequate due to inconsistent regulations and lack of availability of resources. Additionally, a notable portion of the workers had not undergone health checkups in the past year. We observed a significant association between job category and the presence of physical, chemical, and biological hazards among the municipal waste collectors of Lalitpur Metropolitan City which is a common issue across Nepal. Although most respondents reported mental health within the normal range, signifying better mental well-being, more than half displayed poor physical health status. This study contributes to providing a scenario of the worker's situation and their attitudes toward their work. This highlights the need for organizations to promote consistent PPE use, provide tetanus and hepatitis vaccinations, and offer comprehensive workplace training. Further research with a larger sample size and in different areas can provide necessary insights in developing targeted interventions.

Acknowledgments

The authors would like to thank Nobel College's institutional review committee for providing ethical approval for this study. We would also like to thank the Women Environment Group (WEG), the Nepal Pollution Control and Environment Management Center (NEPSEMAC), the Women Environment Preservation Committee (WEPCO), and individual respondents for providing essential details and information in the data collection process.

Funding

None

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