

Occupational health problems among waste collectors in a metropolitan city: a cross-sectional study

Maheshor Kaphle^a, Sandhya Shahi^b, Anjana Thapa^c, Rajesh Karki^d

^aDepartment of Public Health, Peoples Dental College and Hospital, Tribhuvan University, Kathmandu, NEP (kafmahesh@gmail.com), ORCID 0000-0001-8121-6206, ^bDepartment of Public Health, CIST College, Pokhara University, Kathmandu, NEP (sandhyashahi2018@gmail.com), ORCID 0009-0008-9522-4520, ^cDepartment of Public Health, Yeti Health Science Academy, Purbanchal University, Kathmandu, NEP (thapaanjana44@gmail.com), ORCID 0000-0001-7542-6653, ^dCentral Department of Public Health, Institute of Medicine, Tribhuvan University, Kathmandu, NEP (karkirajesh2022@gmail.com), ORCID 0000-0002-8431-2890

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Abstract

Waste collectors are often exposed to various occupational problems. This study aims to assess occupational health problems of waste collectors and personal protective equipment use in Kathmandu Metropolitan City. A cross-sectional study was conducted in 2022 among 158 household waste collectors. Data was collected using a self-constructed questionnaire through face-to-face interviews from April to September 2022. Twelve wards were randomly chosen among all thirty-two wards, and all workers from the selected wards were included in the study. Data entry was done in Epi-data, and analysis was in the SPSS version 25. The chi-square test measured the association between demographic and occupational diseases. Occupational diseases such as musculoskeletal disorders (65.2%), physical injuries (61%), gastrointestinal tract infections (18.4%), and skin allergies (32.9%) were reported. Almost all workers used masks and gloves. Sociodemographic factors such as age and musculoskeletal disorder (MSD) showed significant association (p -value=0.001). Additionally, variables like sex showed a significant association with occupational health problems, such as disease faced by waste collectors (P -value of 0.049). Similarly, other variables like educational status and using separate clothing at work (p -value 0.004), changing clothes daily (p -value, <0.01), work experience and bathing daily after work (p =0.01), and changing clothes (p =0.003) also showed a significant association. Our study showed that almost all workers experienced occupational diseases. These findings highlighted the need to emphasize occupational health within municipal solid waste management to develop a safer and healthier work environment for waste collectors.

1. INTRODUCTION

Occupational health concerns exist at every stage, from the collection point at residences to transportation, recycling, or disposal sites (Marahatta, Katuwl, Adhikari, & Rijal, 2017). Household waste collectors collect waste from people's homes from door to door. The municipal waste in Kathmandu comprises a mixture of organic and inorganic materials, along with both hazardous and non-hazardous components. People are not yet consistently practicing waste segregation (Pandey, 2004a). Domestic waste collection is also an occupation that requires a lot of continuous, heavy physical strain and repetitive activities requiring effort-encompassing actions such as lifting, carrying, pulling, and pushing. Waste collectors may be exposed to several health risks and diseases during regular handling (Aminuddin & Rahman, 2015). Household waste becomes unsafe and creates health risks for waste handlers without protective equipment and proper knowledge of handling these potentially hazardous substances (Gutberlet & Uddin, 2017). Kathmandu Metropolitan City produces more than 500 tons of solid waste per day, and the metropolitan City has appointed waste collectors to collect waste (Rana, 2013). No mechanical devices are available for this activity, requiring waste handlers in Nepal to handle waste directly (Alam, Chowdhury, Hasan,

Karanjit, & Shrestha, 2008; Rana, 2013). They may have severe health impacts, occupational diseases, worker risks, and environmental hazards (Khadka, Safa, Evans, KC, & Poudel, 2021). Waste collectors in low-income countries frequently lift big loads to higher-loading locations, as the overpopulation in Kathmandu produces a large amount of waste (Pandey, 2004b).

Municipal solid waste is collected and sorted manually in low-income nations (Melaku & Tiruneh, 2020). Occupational health issues may occur at every stage of the solid waste management process for waste collectors and other staff (Jerie, 2016). In Palestine, waste collectors reported that 45.7% experienced back pain, 34.1% had twisted ankles, 22.1% had muscle strains, and 8.7% had joint discomfort (Abou-Elwafa, El-Bestar, El-Gilany, & Awad Eel, 2012). In Nepal, the majority of the survey respondents who suffered from work injuries were waste collectors (45.55%), followed by sweepers (40%), and loaders (14.44%) (Marahatta et al., 2017). According to several studies, garbage workers had lower lung capacity than non-waste workers (Wankhede & Wanjari, 2021). Musculoskeletal disorders (MSD) are a common complaint among waste collectors. MSD affects the waste collector's body, such as tendons, muscles, ligaments, nerves, and joints (Aminuddin & Rahman, 2015; Jayakrishnan, Jeeja, & Bhaskar, 2013). Policymakers and researchers should pay extra attention to occupational hazards and detrimental health outcomes in the waste collector occupation due to these negative outcomes (Zolnikov, da Silva, Tuesta, Marques, & Cruvinel, 2018).

In developing countries, the occupational health of waste management workers is a primary concern (Emmatty & Panicker, 2019). Common types of solid waste produced at the household level are garbage, paper, plastic, and metals, but hazardous materials such as medicine residue, sputum, used batteries, and household pesticides can also be a type of solid waste that may be hazardous to waste handlers (Dangi, Urynowicz, & Belbase, 2013). This study aimed to assess the occupational health diseases faced by waste collectors and the use of protective measures in Kathmandu Metropolitan City, Nepal.

2. METHODOLOGY

An institution-based cross-sectional study was conducted among household waste collectors from April to September 2022 in selected ward offices of Kathmandu Metropolitan City, Nepal. The study population comprised waste collectors who collected household waste from door-to-door and sweepers.

Ethical clearance was obtained from the Institutional Review Committee of CIST College, Baneshwor (IRC, Ref 185/078/79). Before data collection, the purpose of the study was explained to the respondents, and written consent was obtained. None of the respondents were forced to participate in the study, and confidentiality was ensured.

The inclusion criteria were set as all male and female waste collectors and sweepers having experience of at least 5 years and working full-time. Supervisors, loaders, cart operators, workers who were absent or on leave, and those who did not give consent were excluded from this study. There are 32 wards and 422 waste collectors working in Kathmandu Metropolitan City; 12 wards (wards no.2,5,7,8,18,19,25,28,29,30,31 and 32) were selected randomly by the lottery method. All waste collectors from selected wards were interviewed face-to-face. The sample size was calculated using a single population proportion formula using Cochran's formula (Israel, 1992), Equation 1.

$$n_0 = \frac{Z^2 pq}{e^2}$$

Equation 1.

Where z = z table value, i.e., 1.96 in 95% confidence interval, P = population parameter or evidence of occupational injuries from previous study, 25.4% were suffering occupational health problems (Marahatta et al., 2017), q = $1-p$ and e = margin of error, we used 7% as the margin of error. After calculating, 148.48 was obtained as the sample size. We approached 158 respondents as the final sample size.

Semi-structured questionnaires were prepared in English and translated into Nepali to better convey the questions. The questions were then back-translated to English by a language expert in the presence of the study team to maintain consistency. The questionnaire was prepared based on the literature review with modifications made as per the needs of the study setting (Jayakrishnan et al., 2013; Melaku & Tiruneh, 2020; Patil & Kamble, 2017; Thakur, Ganguly, & Dhulia, 2018). Data collection tools consisted of sociodemographic questions in the first section, personal protection equipment (PPE) use in the second, and occupational diseases in the third section. Pretesting was done among 11 waste collectors in ward no 10 and was not included in the final analysis. Study team members immediately checked and rechecked the collected data to maintain quality and ensure valid and reliable information. All the data was rechecked and cleaned after entry. Collected data were entered in the Epi-Data 3.1 version using validation and transferred to the statistical package for social science (SPSS) version 25 for analysis. Descriptive analysis, such as frequency, median (IQR), and percentage, was calculated based on the nature of the variables. The Shapiro-Wilk test was used to check whether the data were normally distributed. Since the data were not normally distributed, we used median and IQR. Pearson's chi-square test measured the association between the independent and the dependent variables. The *p-value* less than 0.05 was considered to be significant.

3. RESULTS

3.1 Socio-demographic characteristics of respondents

Out of 158 respondents, 65.2% were from the age group of 40-50, with a median age of 37.1 years. The majority of the respondents were female, 52.5%. and *Janajati* i.e., 90.5%. Most (92.4%) of the respondents were Hindu. However, 37.3% of respondents could not read and write, and more than half were illiterate. More than 56% of respondents have more than 25 to 30 years of experience, and more than two-thirds have Nrs*. 30000-35000 salary per month (Table 1).

Table 1. Socio-demographic characteristics

Variables	Class	Frequency (n=158)	Percentage (%)
Age	Median	37.1 yr. (2.49 IQR)	
	30-40	6	3.8
	40-50	103	65.2
	50-60	48	30.4
	60-70	1	0.6
Sex	Male	75	47.5
	Female	83	52.5
Ethnicity	<i>Janjati</i>	143	90.5
	Others	15	9.5
Religion	Hindu	146	92.4
	Others	12	7.6
Education Status	Can't read and write	59	37.3
	Just Literate	84	53.2
	Primary level	11	7.0
	Secondary level	3	1.9
Duration of job(years)	Higher Secondary	1	0.6
	15-20	17	10.8
	20-25	27	17.1
	25-30	89	56.3
	30-35	25	15.8
Monthly salary* (In Nepali currency)	20000-25000	11	7
	25000-30000	42	26.6

30000-35000

105

66.5

*1\$= Nepali currency 133.59(5/16/2024 exchange rate)

3.2 Use of personal protective equipment and vaccine

Almost all of the ward offices had provided PPE to the respondents (91.1%. n = 144); regarding the type of PPE, almost all of the ward offices provided masks, 97% (n=144) of the ward offices provided gloves, and more than half of the offices provided boots to workers. But sometimes more than 55% (n = 87) bought PPE alone, and almost all (96.8%, n=153) used it during work.

Among the interviewees, 86.7% (n = 137) of the ward offices had provided immunization. All the ward offices provided COVID-19 vaccines, and 25.5% of wards provided tetanus vaccines. All respondents had taken COVID-19 vaccines, and 15.9% had taken tetanus when experiencing cuts and injuries during work (Table 2).

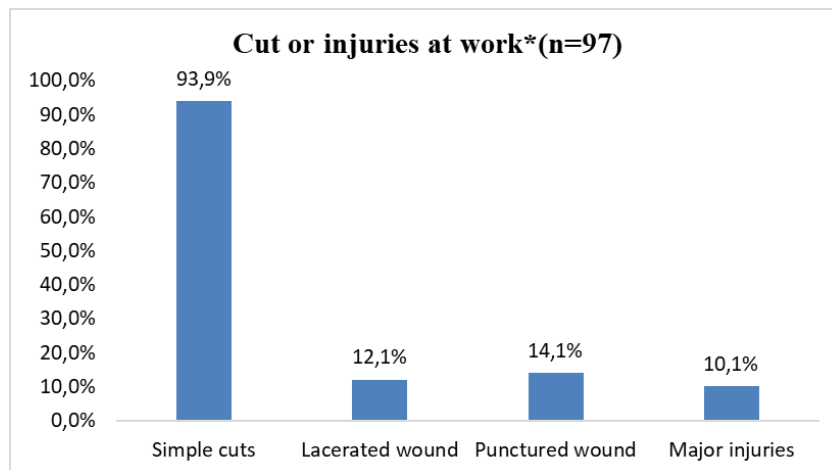
Table 2. Supply and use of personal protective equipment (PPE) among Waste Collectors

Supply and use of PPE	Frequency (n=158)	Percentage (%)
Provision of PPE by office		
No	14	8.9
Yes	144	91.1
Types of PPE provided by office*(n=144)		
Masks	143	99.3
Gloves	140	97.2
Apron	14	9.7
Boot	76	52.8
Cap	11	7.6
Raincoat	2	7.7
Buy own PPE		
No	71	44.9
Yes	87	55.1
Use PPE at work		
No	5	3.2
Yes	153	96.8
Immunization provided by the office		
No	21	13.3
Yes	137	86.7
Type of vaccine provided*		
COVID 19	158	100
Tetanus	35	25.5

3.3 Occupational diseases among waste collectors

Cut or injuries

Workers were asked about the cuts or injuries they faced during work and the waste collection process. Out of the respondents, 97 (61%) of the respondents having cuts or injuries at work, 93(93.9%) had simple cuts, and 10(10.1%) of them had major injuries. None of the ward offices had provided treatment for these injuries (Figure 1).

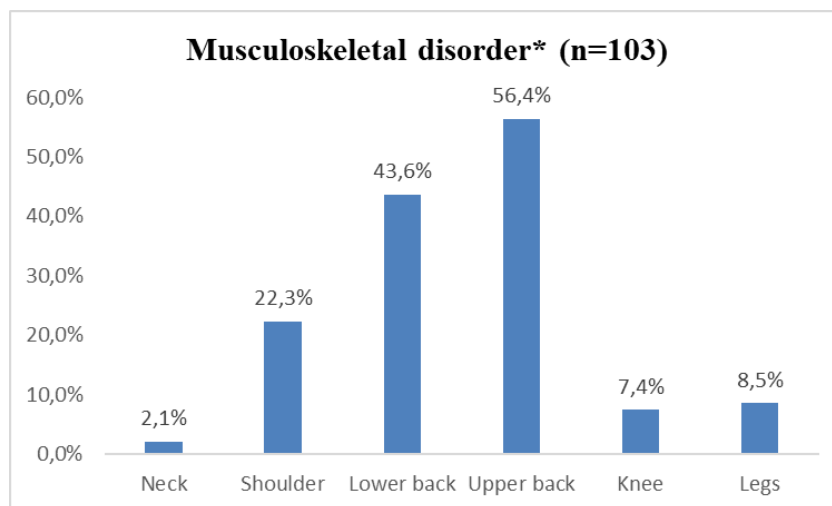


*Multiple response

Figure 1. Cuts or Injuries among Waste Collectors

Musculoskeletal disorder (MSD)

Out of the total workers, nearly two-thirds (65.2%, n=103) had MSD within six months. Among those who reported musculoskeletal disorders, the majority (56.4%, n = 53) felt pain in the upper back, followed by (43.6%, n = 41) lower back (Figure 2).



*Multiple response

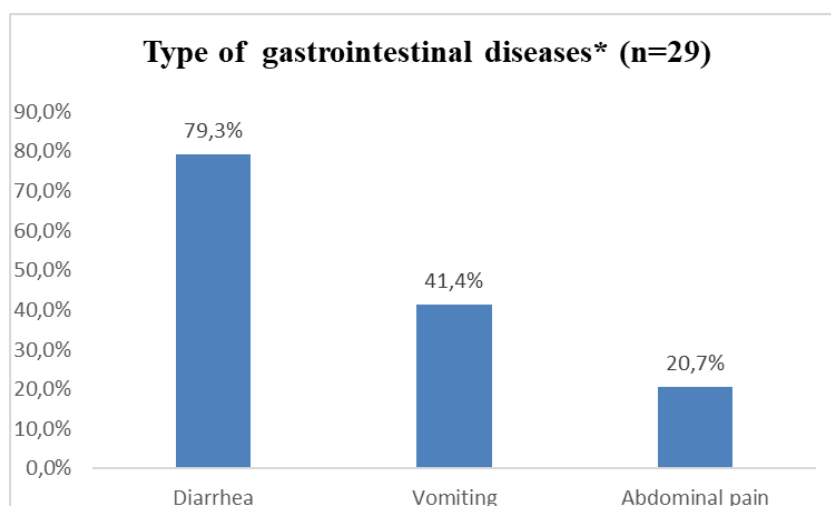
Figure 2. Musculoskeletal disorders

Gastrointestinal Diseases

In the study, a notable proportion of the workers (18.4%, n = 29) reported experiencing gastrointestinal (GI) diseases within the past month. Among these respondents, diarrhea was the most commonly reported symptom, affecting 79.3% (n = 23), followed by vomiting in 41.4% (n = 12) of cases and abdominal pain in 20.7% (n = 6) of cases (Figure 3).

Skin problems and hygiene practice

The prevalence of skin diseases is the most common problem for waste collectors. Of the respondents, 52(32.9%) had allergies or rashes when working. Only 27(17%) of workers bathed daily, 30(19%) changed their clothes daily after work, and 28(17.7%) workers had separate clothes for work. Almost all workers, 151(95.6%), wash their hands after work, and 65 (41.4%) prefer government hospitals for treatment (Table 3).



*Multiple response

Figure 3. Gastrointestinal Diseases among Waste Collectors

Table 3. Prevalence of skin problems and hygiene practice by respondents

Allergy or rashes at work	Frequency (n=158)	Percentage (%)
Yes	52	32.9
No	106	67.1
Bath in a week		
Daily	27	17.1
Twice a week	76	48.1
Thrice a week	55	34.8
Change clothes in a week		
Daily	30	19.0
Twice a week	67	42.4
Thrice a week	61	38.6
Separate clothes for work		
No	28	17.7
Yes	130	82.3
Wash hands with soap and water after work		
No	7	4.4
Yes	151	95.6
Health institution prefer		
Government hospitals	65	41.4
Private clinics	40	25.3
Private hospitals	53	33.5

Association between sociodemographic and occupational diseases

We also examine the association between sociodemographic variables and occupational diseases. There is a significant association between age and musculoskeletal disorder (MSD) ($p=0.001$). Similarly, sex is also significantly associated with disease from waste (p -value 0.031) and the use of separate clothing during work (p -value 0.049). Educational status is also significantly associated with the use of separate clothing during work (p -value 0.004) and changing clothes daily ($p<0.01$), and work experience was also significantly associated with bath daily after work (p -value 0.01) and changing clothes daily after work ($p=0.003$) (Table 4).

Table 4. Association between sociodemographic and occupational diseases

Characteristics	Class	Faced Disease by Waste	Cut & Injury	MSD	GI diseases	Use Separate clothes at work	Bath Daily	Clothes change Daily
		Yes (%)	Yes (%)	Yes (%)	Yes (%)	Yes (%)	Yes (%)	Yes (%)
Age	30-40	0(0.0)	3(50)	6(100)	1(16.7)	6(100.0)	1(16.7)	2(33.3)
	40-50	43(41.7)	66(64.1)	56(56.3)	19(18.4)	85(82.5)	18(17.5)	18(17.5)
	50-60	15(30.6)	28(57.1)	39(79.6)	8(16.3)	39(79.6)	8(16.3)	10(20.4)
	P-value	0.068	0.602	0.001	0.948	0.46	0.938	0.6
Sex	Male	21(28.0)	49(65.3)	44(58.7)	11(14.7)	57(76.0)	13(17.3)	15(20.0)
	Female	48(57.8)	48(57.8)	59(71.1)	17(20.5)	73(88.0)	14(16.9)	15(18.1)
	P-value	0.031	0.33	0.102	0.339	0.049	0.938	0.758
Educational Status	Illiterate	27(36.5)	47(63.5)	46(62.2)	10(13.5)	54(73.0)	17(23.0)	23(31.1)
	Literate	31(36.9)	50(59.5)	57(67.9)	18(21.4)	76(90.5)	10(11.9)	7(8.3)
	P-value	0.957	0.607	0.45	0.194	0.004	0.065	<0.01
Work Experience	up to 25yrs	19(43.2)	28(63.6)	31(70.5)	8(18.2)	38(86.4)	13(26.9)	15(34.1)
	25-35 yrs.	39(34.2)	69(60.5)	72(63.2)	20(86.4)	92(80.7)	14(12.3)	15(13.2)
	P-value	0.294	0.71	0.388	0.925	0.403	0.01	0.003

4. DISCUSSION

Overall, the study aimed to provide insights into occupational health hazards and the protective measures used by waste collectors in Kathmandu Metropolitan City. Additionally, the study aimed to determine if there were any significant associations between sociodemographic variables and occupational hazards among waste collectors.

Despite Nepal's 2011 Solid Waste Management Act, waste management remains challenging due to indiscriminate and unsorted disposal (Maharjan et al., 2019). Consequently, workers are exposed to many biological and chemical risks. Our study showed that the majority of municipal solid waste collectors experienced various health problems, including Musculoskeletal Disorders (n=103, 65.2%), Cuts or Injuries (n=97; 61.4%), Skin Problems (n=52; 32.9%), and Gastrointestinal Diseases (n=29, 18%) which were higher than previous studies. Previous studies reported Skin Symptoms (n=101; 34.2%), Musculoskeletal Symptoms (n=64, 21.8%) (Melaku & Tiruneh, 2020) and central India (31.4% Skin Symptoms) (Patil & Kamble, 2017) and Kathmandu, Nepal (15.5% skin symptoms) (Marahatta et al., 2017).

In our study, significantly high proportions of waste workers reported experiencing various physical injuries. High proportions of waste workers reported physical injuries, cuts, injuries, wounds, allergies, musculoskeletal disorders, and other skin problems, consistent with the findings of previous studies (Bogale, Kumie, & Tefera, 2014; Mishra, Ali, & Abedin, 2023; Pandey, 2004a). The absence of first aid in time of injury intensifies the problem. In our study, the waste collectors reported that 87.6% got cuts on their hands and 12.4% on their legs, which was similar to the findings of a study of Kathmandu's dumpsite which stated that more than 80 percent scavengers got wounds on their legs and about 70 percent on hands (Pandey, 2004b). Another study from Ethiopia found that more than half of injured workers were injured two or more times in the last year (Eskezia, Aderaw, Ahmed, & Tadese, 2016). The high proportion of physical cuts is likely due to inadequate training, tools, and information to perform their work safely (Black et al., 2019).

Musculoskeletal problems of workers in Kathmandu Metropolitan City are high because of the large amount of waste they have to carry manually instead of using mechanical devices. Our study revealed that almost two-thirds of workers suffer from MSD. This heightened risk can be attributed to several factors, including inadequate training in proper waste handling techniques, the manual lifting of heavy loads, the absence of

appropriate tools for waste retrieval, and the frequent adoption of awkward body positions within the workplace (Poulsen et al., 1995). These factors collectively contribute to the increased susceptibility of workers to musculoskeletal ailments. Previous studies have also found high proportions of muscular-skeletal disorders affecting employees: 70% in India (Reddy & Yasobant, 2015), 61.3% in Nigeria (Inyang, 2007), 82.6% in a German city (Velasco Garrido, Bittner, Harth, & Preisser, 2015), 90.8% in Kelantan (Aminuddin & Rahman, 2015) and 60.8% in Egypt (Abou-Elwafa et al., 2012). This study revealed that upper back pain was the most common symptom to be reported among MSD problems, followed by lower back pain. The finding was similar to a study among municipal solid waste collectors in Ankara (Bulduk, 2019). In our study, the prevalence of symptoms in the upper back, lower back, legs, and knee were 53 (56.4%), 41 (43.6%), 8 (8.5%), and 7 (7.4%), respectively. This prevalence is compared with a study done in Tehran (the capital of Iran). The prevalence of the study complaint in the neck, lower back, and hip were 22%, 45%, and 14%, respectively (Mehrdad, Majlessi-Nasr, Aminian, & Malekhamadi, 2008). The increased incidence of musculoskeletal problems among MSW workers is found in India (Ramitha, Ankitha, Alankrutha, & Anitha, 2021). It might be related to the extended term of employment, the lack of workplace control, and the physically demanding nature of their job (Reddy & Yasobant, 2015).

Allergies and rashes are caused by dust, pollen, or dirt when in contact with naked skin if the worker is not using or uses inadequate protective equipment. The waste may contain bioaerosol, dust-containing bacteria, endotoxin, mold spores, and volatile organic compounds (Poulsen et al., 1995). Among our study population, 52 (32.9%) respondents reported allergies or rashes. It is comparable to a study done in Maharashtra, India, where 40% of the study population had allergies (Raje & Patil, 2020).

Poor hygienic practices cause gastrointestinal conditions. Domestic waste may contain disease-causing agents, baby diapers, and infectious agents. Waste collectors may suffer GI diseases if not handled properly. Within one-month, Gastrointestinal conditions were also reported by 29(18%) of the respondents in this study. It was consistent with other studies (Emmatty & Panicker, 2019; Ivens et al., 1999; Kuijer & Frings-Dresen, 2004). A study conducted on workers in Chandrapur City, Central India, revealed that 15% of the respondents reported GI problems (Patil & Kamble, 2017). Due to their exposure to several disease vectors, waste workers who must spend extended periods handling trash have severe gastrointestinal problems.

Personal protective equipment (PPE) protects from skin diseases, protect from pricks, prevent from respiratory and gastrointestinal diseases, and other protections. Interestingly, our study showed that almost 96.8% of respondents used PPE (mask), gloves 99.3%, boots 14.4% and aprons 5.2%, which is high compared to a similar study done in Kathmandu Valley in which only 45.8% of respondents used PPEs like masks 47%, gloves 32.7%, and boot 3.1% (Marahatta et al., 2017). This contrast might be due to the time difference between the studies. Due to COVID-19, people, including workers, were conscious of using PPE. Among the total respondents of our study, 96.8% were reported using PPEs while they were on duty, which is similar to another study done in Addis Ababa, Ethiopia, where 55% were reported using PPEs while they were on duty (Gebremedhin, Debere, Kumie, Tirfe, & Alamdo, 2016) and Tanzania (Mamuya & Badi, 2019). This difference is also due to the lessons learned from COVID-19 (Kaphle et al., 2023). Our study found that PPE was not provided to the workers, consistent with a study done in India (Ramitha et al., 2021; Thakur et al., 2018) and Nigeria (Inyang, 2007). This highlights the lack of attention to the worker's safety. Personal protective equipment (PPE) such as face masks, gloves, goggles, gowns, and aprons are essential for preventing pathogen and contaminant exposure (Singh, Tang, & Ogunseitan, 2020).

Workers who handle solid waste may be exposed to infectious diseases that might be avoided with vaccination. Waste handlers are required to be vaccinated for tetanus; however, in this study, only 15.9% of the respondents were vaccinated for tetanus, which is compared with the study done in northwest Ethiopia, where only 40% of them were vaccinated for tetanus respectively (Deress, Jemal, Girma, & Adane, 2019). This

contrast is due to the lack of awareness of vaccination among workers, immunization programs for waste collectors, and health care for waste collectors.

In this study, out of a total of 158 respondents, only 17.1% of waste collectors bath daily, and 19% of them change their clothes daily, which is closely comparable to a study done in Kathmandu Metropolitan City, Nepal in which out of the total respondents, only 11% waste workers bath daily and none of them change their clothes daily (Pandey, 2004a). It found that a deficient percentage of workers follow personal hygiene techniques. The possible explanation of low personal hygiene may be due to a lack of awareness of bathing and changing facilities at the ward office. It may also be due to workload and time constraints.

According to our study, musculoskeletal problems were more common in females as compared to males, i.e., 71.1%; similar findings were found in a study done in Maharashtra, India (Raje & Patil, 2020; Reddy & Yasobant, 2015), though the difference was not statistically significant. It contrasted with the findings of a study done in Brazil (Bonini-Rocha, de Oliveira, Bashash, do Couto Machado, & Cruvinel, 2021).

The study's focus on socio-demographic and occupational diseases might neglect the potential influence of other important variables like lifestyle factors and genetic predispositions, which can also contribute to the observed among waste collectors. Another limitation of this study is the sample size; the small size makes it difficult to generalize to the larger population. The study is also subjected to response bias, leading to underreporting or over-reporting of occupational health problems faced by the waste collectors.

5. CONCLUSIONS

Based on our findings, almost all the respondents reported experiencing occupational health hazards. The hazards they experienced ranged from injuries of all kinds, such as musculoskeletal problems, physical injuries, and gastrointestinal infections. The improper method of refuse disposal further increases the health hazards associated with it. We observed a significant association between the age and MSD problem, sex and disease faced, sex and use of separate clothes during work, educational status and use of separate clothes, daily change in clothes, work experience and daily bath, and daily change in clothes. Further research with a larger sample size is necessary to investigate this issue more comprehensively. The majority of the respondents reported that the office did not provide PPE. Yet the majority of the workers reported using PPE at work, which reflects the good knowledge and awareness regarding disease prevention and highlights the loopholes of solid waste management. We recommend that the metropolitan office develop and implement interventions, awareness, training sessions, and a vaccination program to ensure the health and safety of workers and prevent accidents, injuries, and diseases.

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Institutional Review Board Statement: Ethical clearance was obtained from the Institutional Review Committee of CIST College, Baneshwor (IRC, Ref 185/078/79).

Informed Consent Statement: We obtained written informed consent from every worker before data collection. We also ensured anonymity and data will be used for research purposes.

Conflict of Interest: The authors declared no conflict of interest.

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