

Factors contributing to occupational injuries among solid waste collectors: across sectional study in a municipal in Tanzania

Abstract

Background: Solid waste collector plays an important role in maintaining the health and hygiene in the city. In Tanzania solid waste collectors are at high risk of occupational injuries since contaminated solid waste are collected manually often by hand with little or no protection from injuries which might contribute to increases the prevalence of occupational injuries.

Objective: The study aimed to assess occupational injuries and associated factors among solid waste collectors in Ilala Municipality Tanzania.

Materials and Methods: The cross-sectional study design was carried out between February to July 2017 involved three hundred and fifty four (354) solid waste collectors selected randomly. Closed and open ended questionnaires used to guide interviews. Categorical data was analysed to proportions and frequencies and measure of association between dependent and covariety by Chi square test and logistic regression.

Results: The overall annual prevalence rate of occupational injury was 40.9%. Most respondents (90.1%) used personal protective equipment during waste collection though not adequately and appropriately. The most common used PPE were reported to be footwear (93.14%), followed by hand gloves (76.57%). More men sustained injuries as compared to the female waste collectors and the difference is statistically significant (OR=2.22, 95% C.I=1.39–3.56). Working experience, alcohol consumption and cigarette smoking noted to be significant factors associated with the sustained injuries.

Conclusion: Solid waste collectors are highly affected by occupational injuries. The utilization of PPE are low and inappropriate among the workers. Working experience, Sex, and risky personal habits like cigarette smoking and consumption of alcohol were factors associated with occupational injuries among solid waste collectors. There is a need to enforce safety working procedure and use of appropriate PPE for the waste handlers in all Municipalities.

Keywords: occupational injury, solid waste collectors, municipal, tanzania, equipment, smoking, gloves

Volume 8 Issue 6 - 2019

Simon Mamuya,¹ Salimu Badi²

¹Department of Environmental and Occupational Health, Muhimbili University of Health and Allied Sciences, Tanzania

²Department of Environmental Health, Ilala Municipality Council, Tanzania

Correspondence: Simon Mamuya, Department of Environmental and Occupational Health, School of Public Health and Social Sciences, Muhimbili University of Health and Allied Sciences, Tanzania, Tel +255787721377, Email Mamuyasimon@gmail.com

Received: November 11, 2019 | **Published:** December 31, 2019

Introduction

Background

Dar es Salaam is the largest industrial and commercial centre in Tanzania. It is among the fastest growing cities in sub-Saharan countries to which people from different parts move in view of socio-economic, cultural and political activities. It has an estimated population of more than 4 million¹ and a population growth rate of 4.3%. The constantly increasing population has led to the production of large amount of solid waste which cause serious problem in urban environment.² The increase in consumption of resources has resulted in large amounts of solid waste from domestic activities and can lead to significant threats to human health. Solid waste management including waste collection is a serious problem due to lack of resources, technologies, low standard of living, low level of education and poor planning.³ Waste collection is a hard work that involves working on contaminated wastes and dangerous vehicles.

Worldwide it is estimated that 330,000 workers lose their lives in occupational accidents each year and 250 millions are injured.^{4,5} Occupational accidents and diseases in many developing countries are increasing in numbers and it is estimated that 270 million occupational accidents and diseases, and over 120 million industrial accidents with over 200,000 fatalities occur each year. Sub-Saharan Africa have the greatest rate per worker of occupational injuries followed by Asia.⁵⁻⁷ Waste collectors especially those who are directly handling the wastes are highly exposed to injuries.^{4,5,8}

In many developing countries like Tanzania, municipal solid waste is collected manually and workers continue to handle a wide variety of objects and containers of variable sizes and weights without using appropriate protective gear. In Tanzania solid waste collectors are at high risk of occupational injuries since contaminated solid waste are collected manually often by hand with little or no protection from injuries and with direct contact. Most waste are composed with sharp objects, toxic materials, pathogens and bottles with chemicals.

As population in Dar es Salaam City increases. The situation increases rate of solid waste generated and tons of solid wastes to be collected and transported to the disposal site. The collected solid waster poses an increased risk to waste collectors during handling since are not sorted and colour coded based on the risk levels.

Occupational health and the well-being of working people are crucial for productivity and are important for overall socio-economic and sustainable development. One of the targets of Sustainable Development Goal number 3(SDG 3) is to reduce injuries and deaths from accidents, prevention of occupational accidents, injuries, diseases and the protection of workers against physical and minimizing the unnecessary loss of human and material resources. Work-related injuries (WRIs) and illnesses are multifactorial and still injuries is a major problems of public health magnitude requiring the attention of all stakeholders.⁸⁻¹⁰ Municipal solid waste in Ilala is collected manually which requires repeated heavy physical activities such as lifting, carrying, pulling, and pushing. The collected waste is manually emptied in to a refuse truck and workers are less protected in all efforts of refuse collection. Information to policy makers to improve the working condition as a result is limited. Currently, there is limited published research on occupation health and safety among waste handlers in Tanzania. The purpose of this study is to assess the magnitude of occupational injuries and associated factors pertaining to solid waste handling and recommend possible control measures.

Methods and materials

Study design

A cross-sectional study was conducted to asses occupational injuries and factors among solid waste collectors in Ilala Municipality Dar es Salaam City Tanzania.

Study population and data collection

Solid waste collectors who were above 18 years old (354) in Ilala Municipal Council were taken as study participants. They were informed on the objective of study and requested to participate voluntarily.

Data were collected between February to July 2017 by face to face interview using pre-tested questionnaire. The questionnaire were developed based on the related published studies with some modification. Both open and closed ended questions were used to collect information on social demographic characteristics, occupational injuries, working environment, background characteristics and availability and use of PPE during working. The filled questionnaires were checked for completeness and consistency of information at the end of the day data collected. There after the information were entered in computer software.

Data management, processing and analysis

The data from the completed questionnaires was coded and entered into the computer software for analysis. Data were analysed using the Statistical Package for the Social Sciences (SPSS) Version. 15 computer software for data analysis. A frequencies run aided data cleaning. Chi-square and regression analysis test was used.

Continuous variables for solid waste collectors were analysed to produce frequency distribution, bar and pie charts and means (SD) were used to illustrated the percentages of respondents. Logistic regression analysis was used to determine the association between occupational injuries and independent variables A result which had

significant association were identified on the basis of OR, with 95%CI and with a P value≤0.05.

Results

A total of 354 solid waste collectors were interviewed of which 240 (67.8%) were from 6 selected Companies and 114(32.2%) were from 3 selected CBOs. Data were collected on Socio demographic characteristics, prevalence of injury, characteristics of injuries, work environment and bacground characteristics of the respondents.

Socio-demographic characteristics of participants

The study involved a total respondents, 220 (62.1%) were male with 1:1.6 female to male sex ratio. The majority of the study population 140 (39.5%) were in the age group 25-35, the mean age of the respondents was 36.43±10.0 years . One hundred ninety two (54.2%) of the respondents were married and 250 (70.6%) had primary school education. The majority of the respondents were temporary employed 317 (89.8%) (Table 1).

Table 1 Socio-demographic characteristics of respondents (N=354)

Variables	Frequency, (n)	Percentages, (%)
Sex		
Male	220	62.1
Female	134	37.9
Age group (Years)		
<25	42	11.9
25–35	140	39.5
36–45	94	26.6
>45	78	22
Marital status		
Single	88	24.8
Married	192	54.2
Divorced ¹	25	7.1
Separated ²	29	8.2
Widow	20	5.6
Education level		
No formal education	36	10.2
Primary	250	70.6
Secondary and above	68	19.2
Job category		
Permanent	1	0.3
Contract	35	9.9
Temporary	317	89.8
Monthly income in Tshs		
<100,000	19	5.4
100,000 –200,000	310	87.6
>200,000	25	7

¹Divorce is a legal ending of a marriage; ²separated means still married just living apart.

Prevalence of occupational injuries among respondents

Out of 354 solid waste collectors, 145 (40.9%) reported to be injured in the last twelve months. Therefore, the overall prevalence of occupational injuries was 40.9 percent. Of 145 solid waste collectors who were injured in the last one year, 69 (46.6%) sustained injury 2 to 5 times, and 67 (45.3%) sustained injuries once. The majority of solid waste collectors who were injured, 111 (76.5%) reported to seek treatment themselves (self care) soon after injured. The median of days for those injured off duty because of injuries was reported to be 6 days with minimum and maximum of 3 to 14 days off duty.

Univariate logistic regression analysis of occupational injury with predictor variables among solid waste collectors in Ilala Municipality

Male workers reported more injuries than female, male workers were 2.2 times more likely to be injured than female workers (OR=2.2, 95% C.I=1.39-3.56). Married solid waste collectors were more injured than single solid waste collectors, married solid waste collectors were 1.89 times more likely to be injured than single solid waste collectors (OR=1.89, 95% C.I=1.09-3.28).

Working experience had significant association with prevalence of occupational injury. Solid waste collectors who reported working in more than a year (were more likely to report occupational injury than those working for less than one year (OR=1.73, 95% C.I=1.06-2.84).

This study revealed that alcohol consumption and cigarette smoking were statistically associated with occupational injury. Alcohol drinking had odd ratio of 1.85 times more likely to be injured than non drinkers (OR=1.85, 95% C.I=1.14-3.00). Cigarette smoking showed a significant association with prevalence of occupational injury. Cigarette smoking were 2.60 times more likely to be injured than non cigarette smoker (OR=2.60, 95% C.I=1.55-4.34) (Table 2 and 3) (Figure 1).

Table 2 Bi-variate logistic regression of occupation injury with Background characteristics of the participants

Predictor Variables	Injury in the last 12 months		Chi2	p-value
	Yes n (%)	No n (%)		
Training				
Training before job				
Yes	8(36.3)	14(63.6)	0.205	0.65
No	137(41.2)	195(58.7)		
Training on job				
Yes	50(40.0)	75(60.0)	0.073	0.786
No	95(41.5)	134(58.5)		
Alcohol use				
Yes	51(53.1)	45(46.8)	8.06	0.005*
No	94(36.4)	164(63.5)		
Cigarette smoking				
Yes	50(58.8)	35(41.2)	14.75	0.001*
No	95(35.3)	174(64.6)		
Job satisfaction				
Yes	60(63.2)	35(36.8)	0.91	0.34
No	149(57.5)	110(42.4)		

Table 3 Univariate logistic regression analysis of occupation injury with predictor variables among solid waste collectors in Ilala Municipality

Predictor Variables	Injury in the last 12 months		OR	95% C.I of OR		P-value
	Yes n (%)	No n (%)		Upper	Lower	
Sex						
Female	39 (28.9)	96 (71.1)	1			
Male	106 (48.4)	113 (51.6)	2.22	1.39	3.56	0.001*
Age group (Years)						
<25	15 (31.2)	33 (68.8)	1			
25-35	50 (37.6)	83 (62.4)	1.43	0.7	2.93	0.322
36-45	43 (45.7)	51 (54.3)	2.02	0.96	4.26	0.065
>45	36 (47.4)	40 (52.6)	1.95	0.91	4.21	0.086
Marital status						
Single	27 (52.5)	56 (67.5)	1			
Married	89 (46.4)	103 (53.6)	1.89	1.09	3.28	0.022*
Divorced	12 (48)	13 (52)	1.81	0.73	4.5	0.201
Separated	11 (37.9)	18 (62.1)	1.34	0.55	0.301	0.501
Widow	6 (30)	14 (70)	0.98	0.33	2.91	0.973
Working experience						
≤ 1 year	33 (31.4)	72 (68.6)	1			
> 1 year	12 (8.2)	135 (91.8)	1.73	1.06	2.84	0.028*
Alcohol use						
No	94 (36.4)	164 (63.6)	1			
Yes	51 (53.1)	45 (46.9)	1.85	1.14	3	0.012*
Cigarette smoking						
No	95 (35.3)	174 (64.7)	1			
Yes	50 (58.8)	35 (41.2)	2.6	1.55	4.34	0.000*

*Logistic regression, Odds ratio, 95% Confidence Interval, p<0.05.

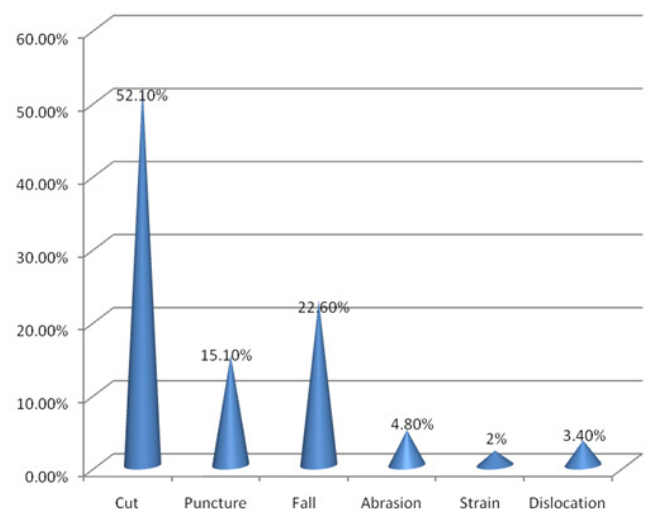


Figure 1 Type of injuries reported by waste collectors in Ilala Municipality.

Discussion

This study was done to assess the prevalence of occupational injury in last twelve months among solid waste collectors in Ilala Municipality.

The overall prevalence rate of occupational injury in this study was 40.9 per 100 exposed solid waste collectors in a year. The prevalence of injuries of this study found to be lower than the studies conducted in Addis Ababa (43.7) and North West Ethiopia respectively.^{8,11,12} The finding is slightly similar to other studies reported elsewhere. A study conducted in Brazil reported prevalences of 41% and 38% respectively.¹³ Other study conducted in four zones of Amhara Region, Northwest Ethiopia reported lower prevalence of occupational injury (34.3%) compared to this study.¹¹ The high prevalence in this study area may be justified as unavailability of complete PPE and incomplete wear of available PPE.

Most of solid waste collectors wore incomplete PPE and they are not always using them at work. It was rare to find out workers in their complete PPE wear. Few of them didn't wear PPE at all. Another justification may be due to variation in waste composition. Waste composition collected from small towns are expected to be less hazardous and more garbages in nature than waste composition collected from big city. Of 145 respondents who were injured, (46.6%) reported to sustain injured more than once in the last one year.

The most common type of injury reported in this study was cut 52.1% and the rest were fall, puncture, abrasion, strain and dislocation. Contrary to our study, the study conducted in Egypt, cut were reported (74.4%).¹⁴ Other similar studies reported cut as the most type of occupational injury among waste collectors.^{9,15-17}

The possible explanation for this may be due to the fact that majority of solid waste collectors, collects wastes manually using their hands and workers continues to handle a wide variety of objects and containers of variable size and weight without using appropriate protective equipment which increase the possibility of being injured.

Regarding the body parts injured, the study found that the most common body parts injured were hands and legs (35.8%) and respectively. Other body parts injured were back (22.3%) and fingers (20.3%). Similar finding were shown in Ethiopia where hands (22.7%), legs (21.8%) and back (17.2%) were the most commonly injured parts of the body.⁸

In this study it is revealed that availability of PPE was high (90.1%) but the level of utilization among respondents was incomplete and inappropriate. The results indicated that footwear (gumboots) were the most common used PPE (93.14%) followed by hand gloves, nose/mouth masks and the least was helmet. Inappropriate or non-use of PPE by solid waste collectors may be an important contributor to occurrence of occupational injury. The similar study conducted by Gonese et al 2002, reported that 72 (84%) of workers who reported using PPE were protected from injuries. However, in bi-variate logistic regression analysis, the relationship between occupational injury and use of PPE had no a significant different.

The reason for not using PPE, 41% responded that they do not use PPE because they are neither not available and their employers did not supply PPE to workers. Some respondents indicated that the PPE were unpleasant to use due to hot weather conditions. OSHA in Tanzania clearly states that there should be safe means of access and safety working place¹² Occupational Health and safety Act 2003.

This study find out whether sex, marital status, working experience, alcohol consumption and cigarette smoking were determinants for occupational injury.

The study revealed that Male workers had higher risk of being injured than female (OR=2.2, 95% C.I=1.39-3.56). This can be explained as most of male performing heavy work such as pulling, lifting and loading trucks than female who majority of them perform work such as waste transfer from road side to the near by transfer station.

The study showed that married solid waste collectors has higher risk of being injured than other marital status category (OR=1.89, 95% C.I=1.09-3.28).

This study revealed that working experience had significant association with prevalence of occupational injury. Solid waste collectors who reported working experience of more than 1 year were more likely to report occupational injury than their counterparts (OR=1.73, 95% C.I=1.06-2.84). The result is similar with the study conducted in Ethiopia where those worked more than 3years were more likely to report work related injury.⁸

The result of the study revealed that occurrence of occupational injury were statistically associated with alcohol consumption. Alcohol drinking were 1.85 times more likely to be injured than non drinkers (OR=1.85, 95% C.I=1.14-3.00). The result is supported by another done in Ethiopia reported that those drinking alcohol were 3.632 times more likely to be injured than non drinkers.⁸ Alcohol consumption may increase rate of injury as drinkers may not be aware of hazardous environment.

The study also find out that Cigarette smoking had significant association with prevalence of occupational injury. Cigarette smoker were 2.60 times more likely to be injured than non cigarette smokers (OR=2.60, 95% C.I=1.55-4.34).

The study also find that about (93%) of the respondents did not receive training before employment and 64.7% didn't get on job training. The absence of safety training before employment and during working (on job training) may affect the use of PPE that contribute to the occurrence of injury. Training before employment and on job training are important to solid waste collectors to enable them to take care when dealing with waste especially hazardous wastes. In this study it is noted that the majority of solid waste collectors did not get neither on job training nor prior training. Similar finding were described by another study done in Ethiopia.¹²

Conclusion

This study demonstrated that solid waste collectors in the study area are highly affected by occupational injury. Utilization of PPE are inappropriate. The most common type of injury were cut and the common body parts injured were hands and leg. Working for long service years more than one year, Sex, and risky personal habits like cigarette smoking and consumption of alcohol were factors associated with occupational injuries among solid waste collectors (Figure 2).

The Appropriate and quality PPE should be provided consistent and solid waste collectors be motivated to wear them during waste collection with prior training for proper use. Provision of safety training (before and on job training) are highly recommended as an intervention to minimize the problem. This study was conducted in an urban setup which can not be generalised to the rural areas. The need

to have the longitudinal study to elicit the causal relationship between the outcome and the predictors.



Figure 2 Solid waste collectors working without PPE (Badi S 2017).

Ethical consideration

The study carried out after getting permission from Muhimbili University of Health and Allied Sciences Ethical Research Committee. The participants were asked for their verbal consent after being informed on the purpose of the study and its importance in improving their health and safety at workplaces. Confidentiality was granted for information to be collected from each waste collection companies, CBOs and study participants. The permission to take a photo was asked from the Manager and the participants.

Funding

We are most grateful to NORAD through the NORHED-programme (Norwegian Programme for Capacity Development in Higher Education and Research for Development) via Norhed Project Tan:1300646-12 (North- South -South collaboration for partly funding the study).

Acknowledgement

We would like to thank and express our appreciation Municipal Director together with Directors of six solid waste collector companies and three Community Based Organizations (CBOs) for permission to conduct the study. We are thankful for the solid waste collectors for agreeing to participate the study.

Conflicts of interest

The authors declare that there was no conflict of interest.

References

1. United Republic of Tanzania. Government Census. 2012
2. Salim CJ. Municipal solid waste management in Dar es Salaam city, Tanzania. *Waste Management*. 2010;30(7):1430–1431.
3. Oberlin AS, Szántó GL. Community level composting in a developing country: case study of KIWODET, Tanzania. *Waste Management & Research*. 2011;29(10):1071–1077.
4. Annan. Occupational health and safety a high priority on the global international and national agenda Asian–pacific Newsletter on Occupational and safety. 1997;4:59.
5. Saskia B, Jasper K, van der Ree K. Public–Private Partnership for Sustainable Employment Creation in Waste Management, Dar es Salaam. *International Labour Organization*. 2000
6. The International Labour Organization. Creating Safe and Healthy Workplaces for All. 2014
7. Cointreau S. Occupational and Environmental Health issue of solid waste management: Special emphasis for middle and low income countries. *The world Bank*. 2006;1(1):1–57.
8. Gizaw Z, Gebrehiwot M, Teka Z, et al. Assessment of occupational injury and associated factors among municipal solid waste management workers in Gondar town and Bahir Dar City, northwest Ethiopia. *Journal of Medicine and Medical Sciences*. 2014;5(9):181–192.
9. Black M, Karki J, Lee ACK, et al. The health risks of informal waste workers in the Kathmandu Valley: a cross–sectional survey. *Public Health*. 2019;166:10–18.
10. Jeong BY, Lee S, Lee JD. Workplace Accidents and Work–related Illnesses of Household Waste Collectors. *Saf Health Work*. 2016;7(2):138–142.
11. Eskezia D, Aderaw Z, Ahmed KY, et al. Prevalence and associated factors of occupational injuries among municipal solid waste collectors in four zones of Amhara region, Northwest Ethiopia. *BMC Public Health*. 2016;16(1):862.
12. Bogale Daniel, kumie Abera, Tefera Worku, Assessment of occupational injuries among Addis Ababa city municipal solid waste collectors: a cross–sectional study. *BMC Public Health*. 2014;14:169.
13. Mol MPG, Cairncross S, Greco DB, et al. Urban Waste Collectors in Belo Horizonte, Brazil: Their Perceptions of Occupational Health Risk. *Qual Health Res*. 2019;29(3):371–381.
14. Lesley Rushton. Health hazards and waste management. *British Medical Bulletin*. 2003;68(1):183–197.
15. Ohajinwa CM, van Bodegom PM, Vijver MG, et al. Prevalence and injury patterns among electronic waste workers in the informal sector in Nigeria. *Inj Prev*. 2018;24(3):185–192.
16. Abd El–Wahab EW, Eassa SM, Lotfi SE, et al. Adverse health problems among municipality workers in alexandria (egypt). *Int J Prev Med*. 2014;5(5):545–556.
17. United Republic of Tanzania. The Occupational Health and Safety Act. 2003