

Awareness of scavenging waste pickers on occupational hazards in selected dumpsites in Nairobi metropolis, Kenya

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Abstract

Background: Environmental pollution from uncontrolled solid waste disposal is of major concern and generates chemicals or pollutants that reach their surroundings. The increasing amount of municipal solid waste emanating from residential, commercial and industrial areas, together with changing nature of waste over time, have led to the degradation of the quality of the environment. This study was carried out in order to provide baseline information on hazards at the dumpsites and the level of awareness of these hazards among the waste pickers.

Materials and Methods: These cross sectional study was carried out in in three dumpsites situated in Kiambu, Kajiado and Nairobi Counties. The study sampled 183 waste pickers in the three dumpsites. Data was collected using questionnaires and observation checklist. Data was cleaned coded and entered into Excel spread sheet and transferred to Statistical Package for Social Scientists. Analysis involved descriptive statistics and associations of variables using Chi Square test at 95% confidence interval.

Results: Hazard awareness level among the participants was very low since some respondents (24/171) never used gloves while others (47/171) were not sure about using gloves yet they were handling hazardous recyclables. All participants (96/96) from Thika and Kawangware (8/8) dumpsite never wash and change into clean clothing not worn during working hours. About, 73% of participants from Ngong strongly agrees that they suffer back pains as a results of handling heavy weight. There was significant association between level of awareness to hazards and occupational safety and health in the selected dumpsites since the computed chi-square test value ($\chi^2 = 210.995$) was greater than its corresponding critical value ($\chi^2 = 79.082$). The study concludes that most participant's awareness level on hazards exposure was low and also they were hindered by several factors from handling of wastes safely. The study recommends that group officials and NGOs should assist the waste pickers with training on their occupational safety and health, provide proper PPE and other basic needs in order to minimize diseases, injuries and near miss.

Key Word: Awareness, waste pickers, occupational, PPE, hazards, dumpsites, recyclables

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I. INTRODUCTION

Garbage is the solid waste that results from a broad range of human activities. Solid waste management has always been a challenge to modern civilizations. In Kenya, solid waste comes from the garbage discarded by residential households and business premises. The county governments are responsible for the collection, transportation, and disposal of such waste to landfills, and where capacity is insufficient, they register private organizations to supplement these efforts. Human waste pickers recover reusable material from the waste in these landfills for recycling in industries. Dumpsites are notorious for industrial, household, agricultural, and even medical waste disposed of haphazardly, posing significant environmental, safety and health risks to both waste pickers and dumpsite neighbors. The garbage contains plastics, electronics, metals, and discarded food, among other things. Also, much of the waste is not contained in easy to lift load sizes. Therefore, solid waste pickers lift heavier loads than recommended¹. The loads usually have to be manually lifted up to positions higher than shoulders to the waiting trucks. Several studies have been conducted on awareness of waste pickers on hazard exposed to them. Senzeni *et al.*,² in one of the study, noted that, additional health risk behaviour observed at Onderstepoort dumpsite was limited use of safety boots and gloves. Those that were used by a few scavengers were picked from the dumpsite. However, in general, the scavengers did not prioritize protective clothing. These was due to the low hazard awareness level among the participants. Thurarattanasunthonet *al.*,³

also established that scavengers were exposed to injuries at work due to low levels of awareness on the significance of protective clothing. David et al.,⁴ attributed failure to prioritize protective clothing to little education on the part of the scavengers. There are few studies in Kenya on the awareness of scavenging waste pickers on hazard exposed to them. Therefore these study was carried out in order to provide baseline information on hazards at the dumpsites and the level of awareness of these hazards among the waste pickers. This report can be used as a reference point when integrating Occupational Health and Safety in solid waste management projects and activities by interested stakeholders.

II. MATERIALS AND METHODS

Study Area

The study was undertaken in three dumpsites situated in Kiambu, Kajiado and Nairobi Counties. In Kiambu, it is located in Thika at an area known as Kang'oki, located at 1.0500°S, 37.0833°E. In Kajiado County, it is located in Ngong at 1.3667°S, 36.6333°E while in Nairobi, the study was conducted at Kawangware dumpsite which is a waste transfer station located at 1.1656°S, 36.450°E. Fig 1 is the map of Nairobi Metropolitan showing the waste catchment areas.



Fig 1: Map of Nairobi metropolitan showing the study areas

Study design

The research utilized a cross-sectional study design where data is collected in a point in time without follow-ups.

Study Population

The target population were waste pickers also referred to as scavengers from Kang'oki, Ngong and Kawangware dumpsites.

Sampling Technique and Sample size

The study utilized a stratified systematic sampling method to come up with a representative sample. The number sampled in each group was in proportion to its known size in the parent population. A sample size of 183 participants was obtained using the Krejcie & Morgan,⁵ formula. The calculated sample size per sites were; 104, 8 and 71 workers from Kang'oki, Kawangware and Ngong, respectively

Data collection tool

Data was collected using questionnaires with both open-ended and semi-structured questions administered to the waste pickers. Observation checklist was also used to collect firsthand information. The data collection tools were pre-tested in Nonkoopir dumpsite which is different from the study site. The pre-test data

was assessed, analyzed and any necessary adjustments was made before proceeding to the intended sites for the real study.

Ethical issues and confidentiality

A written approval from Jomo Kenyatta University of Agriculture and Technology (JKUAT), Institute of Energy and Environmental Technology (IEET) was obtained, indicating that an academic research study within Kang'oki, Ngong and Kawangware dumpsites was to be done. The sample participants agreeing to participate voluntarily in the study were informed of the interview date. Confidentiality was ensured throughout the study period and only code numbers were used instead of the participant's names.

Data Processing and Analysis

The collected data was cleaned coded and entered into Excel spread sheet and transferred to Statistical Package for Social Scientists (SPSS) version 21.0 for analysis. Analysis involved descriptive statistics such as measures of dispersion and central tendency like mean, standard deviations. A Chi Square was used to test statistical significance between variables. The level of significance was considered at 95% (0.05) confidence interval.

III. RESULTS AND DISCUSSIONS

Hazards awareness and PPE usage among the participants

Table 1 presents data on hazard awareness among the dumpsite workers in this study. Among the workers, 41/171 confirmed that they were sensitized by group officials sometimes on how to take care of themselves regarding hazards and their safety in their work place. Others (51/171) were often sensitized while 26/171 were always sensitized by the group officials on the same. Three (3/171) were never sensitized while 50/171 were neutral about being sensitized on the way they should take care of themselves. Those who indicated neutral in the questionnaire either did not want to answer or did not understand the question. From Thika dumpsite majority of the participants answered neutral on the issue of being sensitized while 2/96 did confess that they were never sensitized. Forty eight (48/96) participants were sometimes, often or always sensitized on how to take care of themselves against occupational hazard in the dumpsites. Among the Ngong participants, majority (33/67) were often sensitized on the issue of taking care of themselves in the dumpsite. In Kawangware, most (4/8) respondents were sensitized on taking care of themselves in their work place. The group officials in the dumpsites also supervised waste pickers and linked them with external contacts or buyers of the recyclables collected. These officials were sensitizing their members on safety measures to take while collecting trash for recycling. Health education actions can raise awareness of the risks they face and thereby reduce health impacts among the participants. There were diverse occupational health and safety hazards within the dumpsite hence the group officials were trying to sensitize the waste pickers on the existence of occupational hazards and how to take care of themselves against the hazards. According to Jerie⁶ in a similar study in Zimbabwe, the working conditions and properties of the workers involved in collection and disposal of waste are exposed to diverse occupational safety and health hazards, hence concur with observation of the current study on diversity of OSH issues among the participants. Some waste pickers were not happy with their group leaders since they preferred working freely without supervision as opposed to the proposed job rotations or shifts because some of them saw this as reduction of income. Similarly in another similar study Gonzenbach and Coad⁷ cited advantages of scavenging as working without supervision, formal dress code, and own working shifts.

Gloves are among the PPE that are supposed to be used to protect hands. In this study, majority (54/171) of the participants confirmed that they sometimes utilized gloves while handling recyclables in their respective dumpsites, 30/171 often while 16/171 always use gloves in their respective work place. However, 24/171 never used gloves while 47/171 were neutral about using gloves when handling recyclables. From Thika dumpsite, most (43/96) participants were neutral about gloves utilization when handling recyclables. Majority (34/67) of the respondents from Ngong, and Kawangware (3/8) confessed that they sometimes utilized the gloves. Additional health risk behavior observed at the selected dumpsites was limited use of gloves. Those that were used by a few waste pickers were picked from the dumpsite. However, largely, the waste pickers did not prioritize protective clothing. These findings were similar to other studies conducted in Thailand by Thurarattanasunthon et al.,³ which established that just like in Kenya, waste pickers were exposed to injuries at work due to little awareness on the significance of protective clothing. David *et al.*,⁴ attributed failure to prioritize protective clothing to inadequate levels of education on the part of the scavengers. This was found to be true since the majority of waste pickers interviewed in this study had not gone beyond high school and some did not have formal education.

Regarding wearing protective shoes at work, 48/171 were neutral, 26/171 never wore protective shoes, 33/171 always wear the shoes, 41/171 often wear, while 23/171 always wear protective shoes in all the

dumpsites. From Thika dumpsite, most (44/96) participants were neutral about wearing protective shoes. From Ngong (29/67) and Kawangware (4/8) dumpsite majority of the workers often wear safety boots. Hazard awareness level and the need to use PPE among the participants was very high in the two dumpsites due to more information availed to the waste pickers by the group officials. However the nature of injuries proved that the main contributing factor was failure to use protective clothing. The majority of injuries were cuts sustained on the hands and feet. Most of the injuries could have been avoided if the waste pickers wore gloves or safety boots while working. Similar injuries have since been confirmed by other scholars among the waste pickers^{8,9}.

There was visible dust, fumes, smoke and other gases emanating from the dumpsite according to the observation checklist. In this study 165/171 participants said that they never use dust mask while picking and sorting materials in the dumpsite while 6/171 were neutral concerning the use of dust mask in their work place. Among the participants, 94/96, 64/67 and 7/8 from Thika, Ngong and Kawangware, respectively never utilized dust mask while picking and sorting materials in their respective work place. Majority of the participants never use dust mask yet there was visible dust and smoke in the dumpsites. The study noted that dust was one of the hazard originating from the dumpsites. Similarly, Jerie⁶ in a similar study, also revealed that dust exposure in dumpsites constitutes a major hazard because of its contribution to inhalation; exposure to biological agents and bronchial asthma, cough, and other respiratory problems may result.

Majority of participants in this study were not using dust mask because the masks were not easily available. The authorities or group leaders did not provide them with such protective devices. The findings of the current study regarding dust mask usage are in agreement with the observation of Jerie⁶, he, noted that health officials may not be aware that protective devices are among the least effective safety interventions and that the long distribution intervals, especially for masks, rendered the supply itself absurdum. Usually even when workers are supplied with the protective equipment, they normally do not use it as a result of inadequate awareness on the importance of such equipment as some of the effects of hazards are not immediately visible or felt. A sustainable solution would be to increase positive measures in occupation safety and health among the workers, would be the adaptation of workplace and process design.

Table 1: Hazard awareness and PPE use among the participants

Hazards	Awareness level					Total
	N	R	S	O	A	
Group officials sensitize us on the ways to take care of ourselves						
Thika	2	46	26	16	6	96
Ngong	1	3	14	33	16	67
Kawangware	0	1	1	2	4	8
I use gloves while handling recyclables						
Thika	22	43	17	14	0	96
Ngong	1	3	34	14	15	67
Kawangware	1	1	3	2	1	8
I wear protective shoes while at work						
Thika	24	44	17	8	3	96
Ngong	1	3	15	29	19	67
Kawangware	1	1	1	4	1	8
I use dust masks while picking and sorting						
Thika	94	2	0	0	0	96
Ngong	64	3	0	0	0	67
Kawangware	7	1	0	0	0	8

Key: N-Never, S-Sometimes, R-Neutral, O-Often, A-Always

Hazards awareness and personal hygiene among the participants

Table 2 shows hazards awareness related to personal hygiene and how workers take care of themselves when they get injured in their work place. Majority (48/67), of the respondents from Ngong wash and change into clean clothing not worn during working hours. All participants (96/96) from Thika and Kawangware (8/8) dumpsite never wash or change into clean clothing not worn during working hours. These findings confirmed the need of educating the waste pickers about personal hygiene. Few, if any, understood that dirty clothing are perfect places for bacteria to flourish and that they may transfer infectious organisms into their bodies, home

and their dependents at home and community including children. Low levels of understanding of the significance of personal hygiene among the waste pickers may be attributed to their low level of education since majority of them had either high school education or only went as far as primary school. Information on personal hygiene would also reduce ailments among the participants. Further, insufficient secure space to accommodate the clothing and other personal effects not worn or used during working hours contributed to this observation.

Waste pickers used their clothing on average for over a week without washing them. The majority of these waste pickers apparently seemed not to understand the health risks of wearing their clothes for such long periods without washing them. Poor hygienic knowledge among these waste pickers may therefore leave them prone to bacterial infection and related pathogenic diseases. Aboadye-Larbi et al.,¹⁰ identified *Escherichia coli*, *Bacillus* sp., *Enterococcus faecalis*, and *Salmonella* sp. among bacterial microorganisms found in the dumpsites. Waste pickers might not be aware of microorganisms associated with the dumpsite and dirty clothing as well as the health risks they posed though they were not investigated in the current study. This may partially explain why they took their unwashed clothing home after spending several weeks using them without washing. They were not aware that they could be exposing their family members and relatives to disease causing microorganisms also referred to as pathogens.

Competing with others and rushing to incoming trucks of garbage is a common feature in any given dumpsite including the dumpsites under investigation as observed in this study. In this study, 73/171 participants confirmed that they sometimes compete and rush to incoming trucks, 13/171 often, while 6/171 always compete with others and rush towards incoming trucks. Among the respondents, 57/171 never did while 22/171 were neutral about competing and rushing and scrambling for garbage from incoming trucks. The visibility within the dumpsites was also very poor due to smoke from smoldering trash. In this case, those with neutral as an answer are those participants who either did not understand or did not want to give an appropriate answer to the question asked. According to this study, 70/96 participants from Thika dumpsite sometimes compete and rush for garbage, majority from Ngong (46/69) and Kawangware (8/8) never compete for the same. This is explained by the work arrangement at Ngong site whereby the waste pickers have a duty roster that attempts to equitably share these resources amongst them therefore maintaining order. At Kawangware, the waste pickers are few in number and did not seem to have a need to compete for these resources. In this study, those workers that agreed that they rush for garbage from the incoming trucks expose themselves to risks from sharps, microorganism from biological waste and also being run down by incoming trucks. Cruvinelet al.,¹¹ in a similar study, also revealed that waste pickers experience situations which place them at high risk of developing morbidities, mainly external and internal injuries e.g., being caught in processing equipment; being run over by trucks; fires; explosions; being injured by glass, contaminated needles, medical waste and also death hence concurs with observations of the current study.

Regarding avoiding the dumpsites till the wound heals during injury to prevent infection of wounds, 77/171 participants were neutral while 16/171 never avoid the site during injury. However, 23/171 participants sometimes, 25/171 often while 30/171 always avoid the site. Most participants (67/96) from Thika dumpsite were neutral about this issue while others had other opinions. From Ngong dumpsite, 28/67 who were the majority always avoided the site during injury in order to prevent themselves from further infections. Again majority from Kawangware (3/8) often avoided the dumpsite during injury. Waste pickers should avoid working in the dumpsite until they have recovered from an injury. Open wounds are at risk of contamination from dust and the many microorganisms from decomposing waste in the dump. Other injuries such as back-pains, dislocation and muscle injuries require some degree of rest for them to recover fully. Therefore it is very important to avoid working in the dumpsite before recovery. Jerie⁶ in a similar study revealed through risk assessment that most of the waste workers as well as enterprise operators had been affected by cuts and skin rashes that were caused by substances and insects associated with the disposed-off solid waste. The open wounds were also at risk of being infected by tuberculosis in such unhygienic working conditions. It has been observed by Bleck and Wettberg¹² that hepatitis B infections can occur when the cuts are caused by razor blades or syringes which are disposed off in the ordinary waste stream.

Majority (166/171) of the participants always knew that materials being dumped in the sites could cause illness and injuries when handled while 5/171 often had this knowledge. Most participants from Thika (93/96), 66/67 from Ngong and 7/8 from Kawangware always had knowledge that the materials dumped in their work place could cause injuries and illness. Awareness level of the participants regarding hazards in the dumpsites was adequate but due to lack of readily available alternative jobs, waste pickers engaged in these risky venture in order to put food on the table. The waste pickers were sensitized by their group leaders on occupational safety and health within the dumpsites such as use of PPE but this did not seem to effect a change to embrace safety. The PPE use was haphazard and mostly where used, did not look effective as some were used at will and others poorly maintained as observed by the study. Harmful substances in waste products or their spread in waste management should be reduced by elimination, substitution, collection techniques or actions in

working habits. Sirpa and Tiina¹³ in a similar study revealed that, if workers are still exposed to these hazards, it then needed to be prevented by using personal protective equipment. In this case, the workers have to use and be trained on the appropriate use of personal protective equipment and other safety measures. According to the results of this study, participants were aware of the dangers involved while working in their respective workplace. However, some were still working without taking any safety measures. Poverty and lack of readily available alternative employment is the driving force that makes them work in hazardous environment.

Table 2: Hazards awareness and personal hygiene among the participants

Hazards	Awareness level					Total
	N	R	S	O	A	
I wash and change into clean clothing not worn during working hours						
Thika	96	0	0	0	0	96
Ngong	1	2	8	48	8	67
Kawangware	8	0	0	0	0	8
I always compete with others and rush towards the incoming truck of garbage						
Thika	3	4	70	13	6	96
Ngong	46	18	3	0	0	67
Kawangware	8	0	0	0	0	8
When I am injured at work, I usually avoid the site as the wound may get infected						
Thika	10	67	11	7	1	96
Ngong	5	9	10	15	28	67
Kawangware	1	1	2	3	1	8
I know that the materials brought in this site can cause illnesses and injuries during handling						
Thika	0	0	0	3	93	96
Ngong	0	0	0	1	66	67
Kawangware	0	0	0	1	7	8

Key: N-Never, S-Sometimes, R-Neutral, O-Often, A-Always

Ergonomic factors hindering safe handling of waste among the waste pickers

Safe handling of waste materials depends on several factors including quantities being handled daily, types of hazards encountered while handling the waste among others. In Thika dumpsite, most (69%) participant collected 10-15kilograms of materials daily, 50% of respondents from Kawangware dumpsite collected 15-20 kilograms of materials while in Ngong, 70% of the participants collected over 20kilograms daily (Figure 1). Waste pickers were collecting the waste and storing them in designated places in the dumpsites as they await collection by traders. They were also seen loading heavy loads that could predispose them to muscular skeletal disorders including severe back pains. Senzeniet *al.*,² in a similar study noted that dumpsite waste pickers were handling heavy loads and loading onto truckshence concurs with this study regarding loads being handled daily by the respondents. The weight of the loads as observed by the study were more than 20kg per load. According to ILO,¹⁴ a person should load about 23.3kg which is ¼ of standard body weight of a person being 70kg. According to Jerie⁶ the safety interventions in the dumpsite are complicated by the fact that solid waste collection is undertaken through labour intensive systems and hence workers experience high physical loads and inadequately packed waste which is in agreement with observation of the current study.

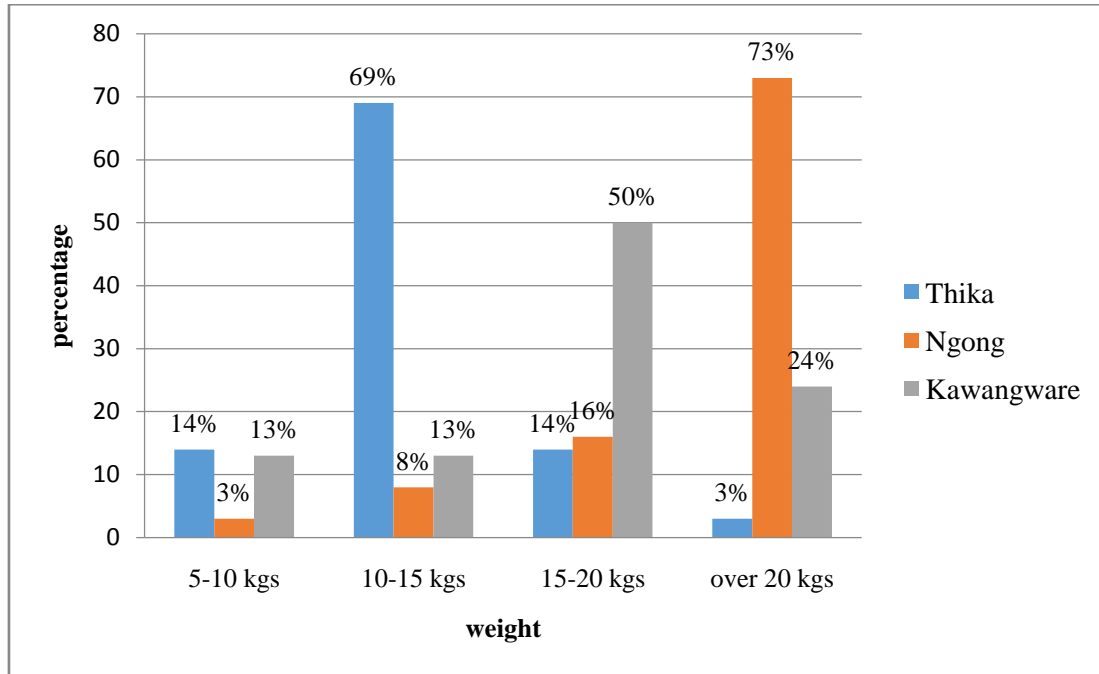


Figure 1: Average quantities collected per day per dumpsite

Figure 2 shows that 73% of participants from Ngong strongly agrees that they suffer back pains as a results of handling heavy weight. Most (74%) participants from Thika agreed that they suffer back pains while 36% from Kawangware dumpsite disagreed that they suffer back pain as a results of handling heavy weights. Few participants, 2% each from Thika and Ngong, and 13% from Kawangware strongly disagreed that they suffer from back pains. In addition to handling heavy loads, the waste pickers interviewed did not seem to understand the significance of maintaining a good posture while lifting or loading heavy goods into the trucks; hence, they were prone to suffering from back pains. Similar sentiments were shared by Perez et al.,⁹ in a similar study, he also confirmed that back pain was prevalent among scavengers. They also attributed them to heavy lifting. However, they further noted that pushing and pulling of waste containers was also another contributing factor.

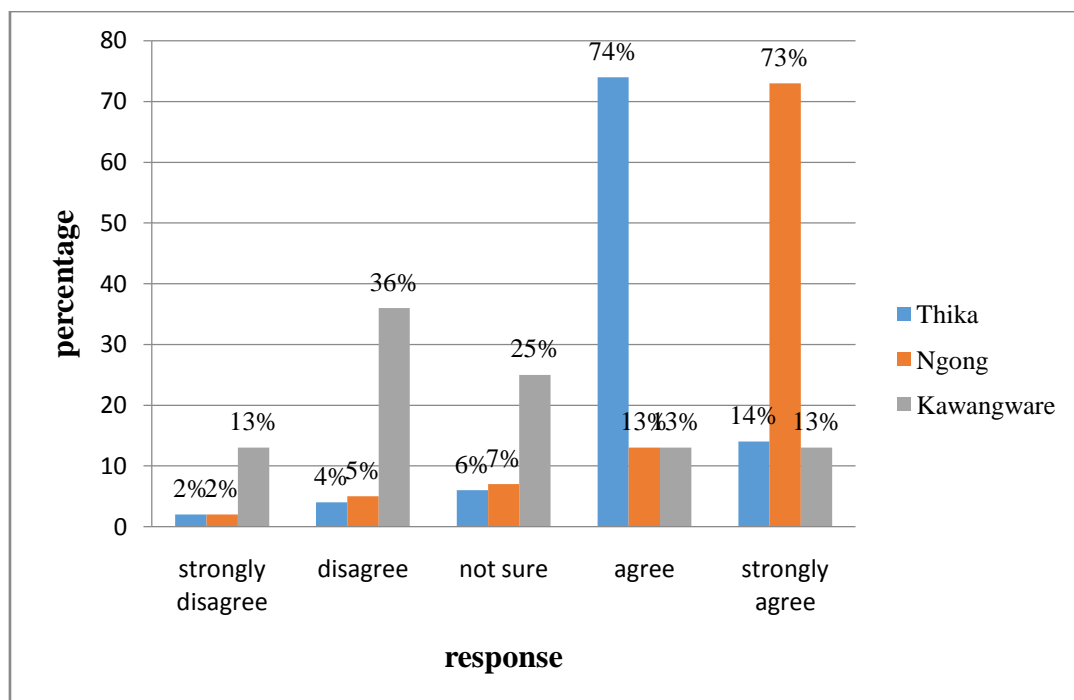


Figure 2: Suffering from back pains as a result of handling heavy weights

The participants cited several control measures taken to prevent injuries among them. These control measures include; occupation safety and health awareness, the use of signages, job rotations and provision of protective clothings. More than 50% of participants from Ngong took occupation safety and health awareness measures seriously. The following measures were taken by the participants;they tend to avoid these hazards (64%), job rotations (71%) and the provision of protective clothings (55%) as their main control measures to protect themselves from injuries. Sixty one (61%) of the participants from Kawangware took occupation safety and health awareness as their main measure of protecting themselves from injuries. Less than fifty percent, (23%) of participants from Thika took occupation safety and health awareness as their main measures for self protection, as well as the use of signages (5%), job rotations (10%) and the provision of protective clothings (35%) as shown in Figure 3. Among the responses from participants, control measures were paid for by government according to the participants from Thika and Ngong dumpsite, however participants from Kawangware paid for themselves.

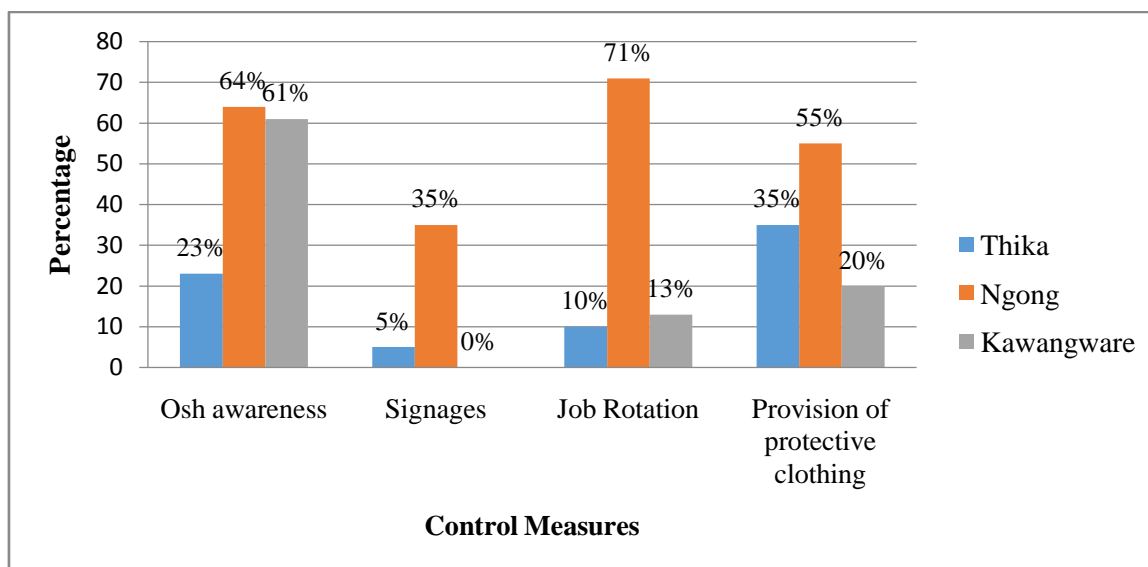


Figure 3: Control measures taken to curb injuries

Association between variables and occupational safety and health

The χ^2 test was used to analyze the level of significance between the following variables; hazards awareness, work experience, educational level and PPE use among the workers. From the study findings regarding hazard awareness versus occupational safety and health, the computed chi-square test ($\chi^2=210.995$) was greater than its corresponding critical value ($\chi^2=79.082$). Similarly the P-value (0.00) was less than the alpha level of significance (0.05). These findings showed that there was a significant association between level of awareness to hazards and occupational safety and health in the selected dumpsites. Regarding work experience in years versus occupational safety and health among the participants, the computed chi-square test value ($\chi^2=229.218$) was greater than its corresponding critical value ($\chi^2=21.026$). Similarly the P-value (0.00) was less than the alpha level of significance (0.05). Hence, there was a significant association between experience and occupational safety and health among the participants in this study (Table 3).

Educational level of the participants was also analyzed against their occupational safety and health. The computed chi-square test value ($\chi^2=17.340$) was less than its corresponding critical value ($\chi^2=21.026$). Similarly the P-value (0.137) was greater than the alpha level of significance (0.05). Therefore there was no significant association between level of education and occupational safety and health of workers in the dumpsites. Regarding PPE versus occupational safety and health of participants, the computed chi-square value was greater ($\chi^2=16.198$) than its corresponding critical value ($\chi^2=7.815$). Similarly the P-value was less (0.001) than the alpha level of significance. These findings revealed that there was a significant association between provision of protective equipment and occupational safety and health of the participants in the selected dumpsite (Table 3).

Table 3: Association between variables and occupational safety and health

Variables	Statistics of variables verse occupational health and safety				
	Computed χ^2	χ^2	f	P	α
Awareness level	210.995	79.082	57	0.00	0.05
Experience	229.218	21.026	12	0.00	0.05

Educational level	17.340	21.026	12	0.137	0.05
Protective equipment	16.198	7.815	3	0.001	0.05

Key: Computed χ^2 -Computed Chi-Square Value, χ^2 - Chi-Square Critical Value, f –Degree of freedom, P- P-Value, α - Alpha Level of Significance

IV. CONCLUSION AND RECOMMENDATION

Awareness level of waste pickers on different hazards exposed to them ranged from low to moderate based on the percentages of responses obtained. The study concludes that most participants were hindered by several factors from safe handling of wastes in the studied dumpsites. Inadequate knowledge on the dangers and health risks associated with scavenging also contributed to them being prone to illnesses hence hindering them from safe handling of waste materials. The study recommends the following; the government should sensitize dumpsite workers on different types of hazards and how to minimize the risk through training, seminars and workshops. Since hazard awareness level among the participants was low to moderate based on the percentages obtained in the study, group officials and NGOs should assist the waste pickers with proper PPE and other basic needs in order to minimize diseases, injuries and near miss.

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Conflict of interest

We the authors of this manuscript declare that there is no conflict of interest regarding publication of this manuscript whatsoever.

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