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# ERGONOMIC RISK ASSESSMENT FOR REFUSE COLLECTORS AT CHITUNGWIZA MUNICIPALITY IN ZIMBABWE

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**Background:** Waste-related activities such as collecting and segregating mixed waste are associated with a number of health hazards. These hazards include microbiological exposure associated with the collection of putrefying material, chemicals from the waste itself and from its decomposition, as well as exhaust fumes from trucks, noise, extreme temperatures, ultraviolet radiation, and more. Occupational risks for waste collection workers include increased environmental and workload-related injuries (sprains and fractures associated with lifting, carrying, pushing/dragging heavy objects and awkward positions), what causes diseases of the musculoskeletal system. **Objectives:** The main objective of current study was to assess the risk of activity among waste collectors at Chitungwiza Municipality (Zimbabwe), identify musculoskeletal disorders (MSD) using the REBA worksheet and examine the level of knowledge of safe work practices among employees. **Methods:** A descriptive cross-sectional study design was developed. The study was conducted from January to December 2022. The sample frame was all Refuse collectors in the Municipality which comprised 230 workers. For inclusion, participants were supposed to have worked for a period of one month or more in the Refuse Section, who were at work on the day of sampling. A sample of 57 respondents which approximates to 25% of the sample frame were randomly selected using convenience sampling. A self-administered questionnaire comprising both open- and close-ended questions was used to collect data. The REBA assessment tool was used as observational guide in rating different body parts to exertion of different forces and postures that lead to MSDs. Analysis of data was manipulated through Ms Excel 2010 version. Cleaned and pre-coded data from questionnaires was analysed through SPSS version 20.0. REBA assessment tool matrix was also used to score the level of MSD risk in respondents. **Results:** It was found that 45.6% of workers did not undergo a medical examination upon hiring and 80.7% of workers received a formal induction. The study shows that 35% of workers do not report incidents because they consider the injuries to be minor and, as a result, do not receive medical care. Careful handling of garbage bins and wearing protective clothing were recognized by 40.9% of workers as key safety practices. The most common ailments were lower back pain, hip pain, knee pain, and sometimes shoulder stiffness. It was found that 21 workers worked in medium-risk conditions and 36 workers in high-risk conditions, which is 36.8% and 63.2% of all respondents, respectively. **Conclusion:** Only 2/3 of the workers were trained in safe working practices, and most importantly, they were not trained in lifting techniques. About 1/3 of the workers were subject to frequent stress due to lack of payment of wages, a situation that is aggravated by the fact that workers are forced to continue other manual work after completing the main work. The employer has a duty to ensure the safety of its employees and stakeholders, failure to do so will lead to lawsuits from employees or safety officials, such as trade unions or labour unions. The organizational image is damaged, thereby negatively affecting the brand of the organization. Recruitment of experienced workers will be jeopardized, as these workers will view the organization as an unsafe place to work.

**Keywords**: occupational safety; environment; musculoskeletal system; lumbar pain; manual loading; stressful state; training in safe working practices.

## INTRODUCTION

The alarming rate of growth of municipal solid waste (MSW) due to population growth has raised serious concerns worldwide. According to the World Bank, waste generation is expected to increase to 2.2 billion tonnes by 2025 (Hoornweg & Bhada-Tata, 2012). Although MSW collection from the population accounts for 5 – 25% of government expenditure, due to the need to ensure cleanliness and sanitation, and to prevent the spread of various dangerous diseases and infections, an important task for city authorities is the high-quality collection of MSW from the population and its timely removal to special sites for recycling, processing or safe disposal. Waste collectors usually belong to the socially and economically backward class of the society (Sapkota et al., 2020). Most often, this service is provided by informal waste pickers, including women and children (ILO, 2012). Some studies have found that informal waste collection supplements municipal collection, generates income for low-income urban residents, generates profits for the country, and helps clean up cities (Medina, 2008). This approach is beneficial to city authorities, which can lead to significant growth in the number of people whose income depends on waste collection.

Waste-related activities such as collecting and segregating mixed waste are associated with a number of health hazards. These hazards include microbiological exposure associated with the collection of putrefying material, chemicals from the waste itself and from its decomposition, as well as exhaust fumes from trucks, noise, extreme temperatures, ultraviolet radiation, and more (Nielsen et al., 2000; Lavoie et al., 2006). If these are ignored and safe working conditions are not provided, then as the number of informal waste pickers increases, there will be a rapid increase in injuries and illnesses among this category of workers.

According to the International Labour Organization (ILO), more than 2.3 million women and men die at work every year from work-related injuries or diseases. More than 350,000 deaths were due to fatal accidents and almost 2 million due to fatal occupational diseases. Recent reports have shown that the global incidence of fatal occupational injuries is 71 per 100,000 workers per year. Waste collection workers are exposed to occupational risks and injuries more frequently than other industrial occupations (UN-Habitat, 2010). The severity of accidents and other health consequences of workers associated with waste collection and landfills varies significantly with the age of workers and their level of education, income and number of working days. In developing countries, one of the problems is the occupational health of waste collection workers (Kandasamy et al., 2013). Other occupational risks for waste collection workers include the following.

1. Increased environmental and workload-related injuries. Non-fatal injuries include insect and animal bites, eye injuries, ankle sprains, fractures, and musculoskeletal disorders (Poole &

Basu, 2017; Battini et al., 2018). Sprains and fractures are caused by careless exits from machines, as this usually involves the worker jumping from a height. Activities involving lifting, carrying, pushing/pulling heavy objects, and awkward postures contribute to spinal problems of varying severity. Some studies have found that kerbside waste collection is the most environmentally friendly (Mora et al. 2013). However, from an ergonomic point of view, such a collection system is also characterized by a large number of manual operations, namely, moving containers/trolleys or plastic bags with waste, lifting and lowering them, pushing and pulling. Performing such work is closely associated with the risk of developing occupational musculoskeletal diseases. Lack of education of waste collectors, ignorance of obvious health hazards, and excessive working hours contribute to the development of many disorders, such as physical disability or even death (Ravindra et al., 2016).

2. Respiratory diseases due to chronic exposure to bioaerosols and heavy metals (Poole & Basu, 2017). Ambient air pollution near garbage trucks and waste dumps is a major cause of morbidity and mortality, contributing to respiratory and other diseases. Particulate matter PM 2.5 released from waste masses can enter the alveoli and cause acute respiratory infections. Inhalation of air containing PM2.5 particles causes 3% of deaths from respiratory and cardiovascular diseases such as heart attacks, heart failure and strokes, and 5% of deaths from lung cancer. Asthma attacks associated with inhalation of air containing PM2.5 particles are aggravated by symptoms such as sneezing, wheezing, and shortness of breath (US-EPA, 2023).

3. Diseases of the internal organs of the digestive system. As a rule, liver damage is often observed under the influence of hepatitis A, B, and C viruses, which are transmitted by airborne droplets and through blood as a result of cuts with sharp objects and needle pricks. Gastrointestinal problems, and as a result, skin diseases, occur under the influence of bioaerosols and volatile compounds.

The incidence of the disease has been gradually decreasing in many countries in parallel with the implementation of effective safety and prevention measures (Degavi et al., 2021). For example, the safety of workers involved in waste collection and segregation is constantly at risk and they face high health risks, mainly when proper protective equipment and safe work habits are not used (Bogale et al., 2014). Training in safe work practices and ergonomic interventions in the form of education/training and administrative control can be useful in preventing occupational risks. For example, Samani et al. (2012) found a decrease in muscle and cardiovascular load in workers engaged in solid waste collection following the implementation of ergonomic procedures such as regular exercise. Such exercise can be considered as a preventive intervention for the prevention of musculoskeletal, back and neck diseases.

Waste collection, including recycling, is a growing sector and this area requires further research efforts.

The main objective of current study was to assess the risk of activity among waste collectors at Chitungwiza Municipality (Zimbabwe), identify musculoskeletal disorders (MSD) using the REBA worksheet and examine the level of knowledge of safe work practices among employees. The results of the study contribute to reducing insurance costs through the payment of treatment and workers' compensation, as well as reducing morbidity, mortality and years of life with disability (YLD) among workers. The study was conducted from January to December 2022.

## MATERIALS AND METHODS

### Research area

The study was conducted in one of the largest cities in Zimbabwe. The City's area is 42 km$^2$ with population density of 354 472 with projected growth rate of 2.93% per annum as per 2022 census. The main economic activities include formal and informal sole trading. The majority of those who are formerly employed work in the capital, and a smaller portion of these are employed in government institutions, Municipality and retail shops. Most of the residents are into informal activities such as brick moulding, welding, and motor mechanics and vending. The city is adequately serviced in terms of shopping centres and these are evenly distributed. The town has good road network which links with other cities. The study area map is shown if Figure 1.

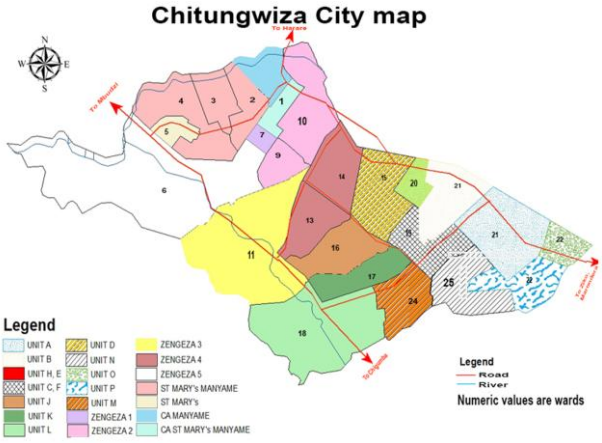


Figure 1. Study area map

### Research design

A descriptive cross-sectional study design was instituted to assess ergonomic risks for refuse collectors in the selected Municipality.

### Sampling

The sample frame was all Refuse collectors in the Municipality which comprised 230 workers. Convenience sampling was done to select participants. For inclusion, participants were supposed to have worked for a period of one month or more in the Refuse Section, who were at work on the day of sampling. A sample of 57 respondents which approximates to 25% of the sample frame were randomly selected using convenience sampling.

### Data capture tools

A self-administered questionnaire comprising both open- and close-ended questions was used to collect data. The REBA assessment tool was used as observational guide in rating different body parts to exertion of different forces and postures that lead to MSDs.

REBA (Rapid Entire Body Assessment) is one of the four most popular low-cost rapid methods for assessing the risk of occupational Musculo-skeletal disorders (MSD). This is justified by satisfactory inter- and intra-observer reliability, ease of learning and scoring using this method (Hignett & McAtamney, 2000; Erginel & Toptanci, 2019; Ghasemi & Mahdavi, 2020). According to REBA, the body is divided into two main parts: (i) neck, trunk, legs and (ii) shoulders, forearms and wrists. To obtain a single value, the indicators are combined using scoring tables separately for the first and second parts

(Ghasemi & Mahdavi, 2020). And after the points obtained are added to the points related to grip and strength, as well as the type of activity, the final score is assessed, which takes values in the range from one to more than eleven. The higher the final score, the higher the risk of Musculo-skeletal disorders is considered.

### Data analysis

Analysis of data was manipulated through Microsoft Excel, version 2010. Cleaned and pre-coded data from questionnaires was analysed through SPSS version 20.0. REBA assessment tool matrix was also used to score the level of Musculo-skeletal disorders risk in respondents.

## RESULTS

Table 1 shows the demographics of the 57 respondents who took part in the study.

### Employment duration

Figure 2 depicts the employment duration of respondents employed by the selected municipality from a minimum of 10 months to a maximum of 21 years.

Table 1. Socio-demographic characteristics

| Variables | Response label | Frequency | Percentage | Variables | Response label | Frequency | Percentage |
|---|---|---|---|---|---|---|---|
| Age | 18 – 25 years | 10 | 17.5 | Education | Secondary | 40 | 70.2 |
| | 26 – 35 years | 11 | 19.3 | | Tertiary | 4 | 7.0 |
| | 36 – 45 years | 19 | 33.3 | Height | 1.40 – 1.59 m | 10 | 17.5 |
| | 46 – 55 years | 11 | 19.3 | | 1.60 – 1.69 m | 31 | 54.4 |
| | > 56 years | 5 | 8.8 | | 1.70 – 1.79 m | 10 | 17.5 |
| | Missing | 1 | 1.8 | | 1.80 – 1.89 m | 4 | 7.0 |
| Gender | Male | 43 | 75.4 | | > 1.9 m | 2 | 3.5 |
| | Female | 14 | 24.6 | Weight | > 50 kgs | 2 | 3.5 |
| Marital Status | Single | 13 | 22.8 | | 51 – 60kgs | 13 | 22.8 |
| | Married | 30 | 52.6 | | 61 – 70kgs | 26 | 45.6 |
| | Divorced | 7 | 12.3 | | 71 – 80 kgs | 10 | 17.5 |
| | Widow/Widower | 7 | 12.3 | | 81 – 90 kgs | 3 | 5.3 |
| Education | None | 5 | 8.8 | | 91 – 100 kgs | 2 | 3.5 |
| | Primary | 8 | 14.0 | | Missing | 1 | 1.8 |

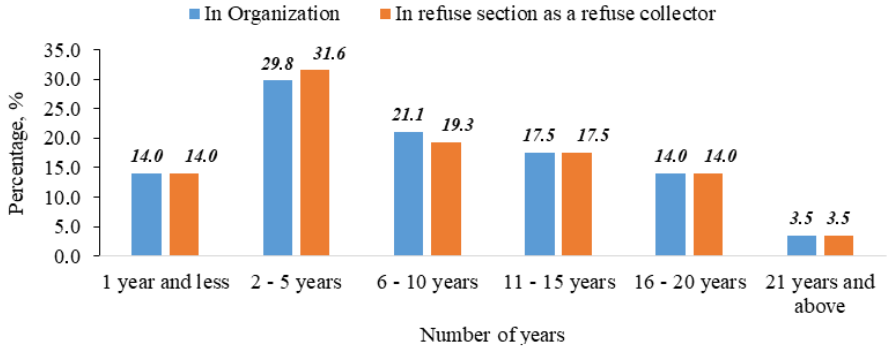


Figure 2. Employment duration

### Periodic examinations and formal induction

Figure 3 shows the periodic examinations and formal inductions at the municipality. A higher percentage (54.4%) indicated that pre-placement medical examination had been done on recruitment compared to 45.6% who had not been examined. From Figure 3, 91.2% said they did not receive periodic medical examinations. However, about 80.7% received formal induction.

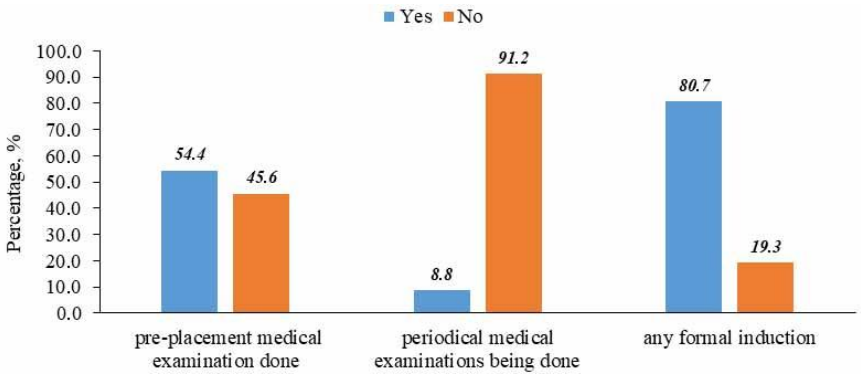


Figure 3. Medical examination and formal induction

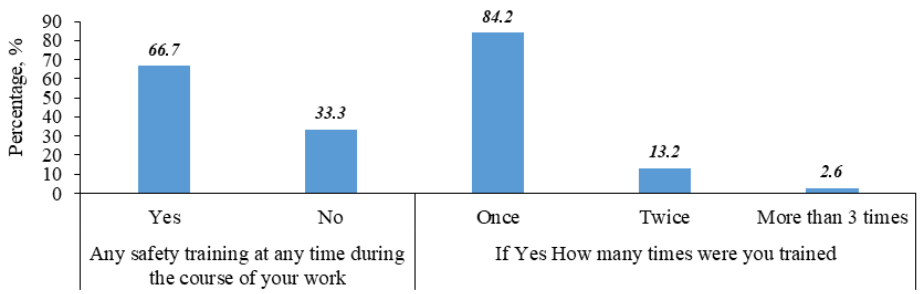


Figure 4. Safety training

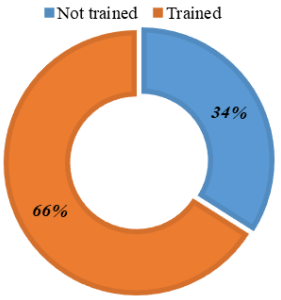


Figure 5. Lifting techniques


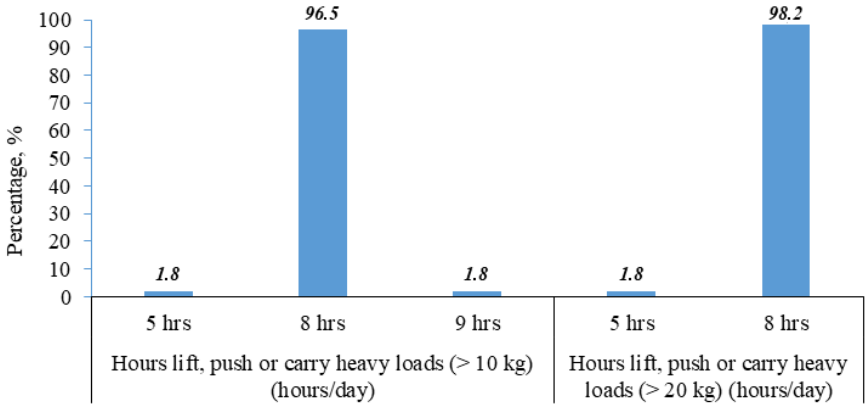


Figure 6. Lifting posture, duration and loads lifted

**Lifting Techniques**

Figure 5 below shows information pertaining to training with regards to lifting techniques.

Figure 6 & Plate 1 – lifting posture as well as the duration of lifting or pushing and the weights lifted or pushed by refuse collectors as they load the refuse into the rear compactor. It can be noted that for the 8 hours worked, a greater percentage (96.5% and 98.2%) lifted or pushed loads greater than 10 kg or greater than 20 kg, respectively.

**Waste collection sites**

However, workers collect waste not only at the facility.All the respondents indicated that they collect waste from locations outside a facility. The most common sites where waste was collected from were households, streets, commercial, industrial and health centres (Table 2). Related to the refuse collection sites were the distances covered and time taken travelling from collection point to the disposal site. Figure 7 shows the distance covered from the collection point to disposal site and the time taken for the trips.

**Type of waste collected**

Table 3 and Figure 8 show the type of waste collected.

**Waste transportation**

Table 4 depicts the various modes of transport instituted by the municipality for refuse collection.

Table 2. Refuse collection sites

| Area | Frequency | Percentage |
|---|---|---|
| Household, streets | 11 | 19.3 |
| Household, commercial, industries, health centres, streets | 8 | 14.0 |
| Household, industries, streets | 8 | 14.0 |
| Household, health centres, streets | 8 | 14.0 |
| Household, industries, health centres, streets | 6 | 10.5 |
| Household, commercial, streets | 5 | 8.8 |
| Household, commercial, industries, streets | 3 | 5.3 |
| Household, commercial, health centres | 2 | 3.5 |
| Household, commercial, health centres, streets | 2 | 3.5 |
| Household, commercial, industries | 1 | 1.8 |
| Household, health centres | 1 | 1.8 |
| Household | 1 | 1.8 |
| Health centres | 1 | 1.8 |
| ***Total*** | ***57*** | ***100.0*** |

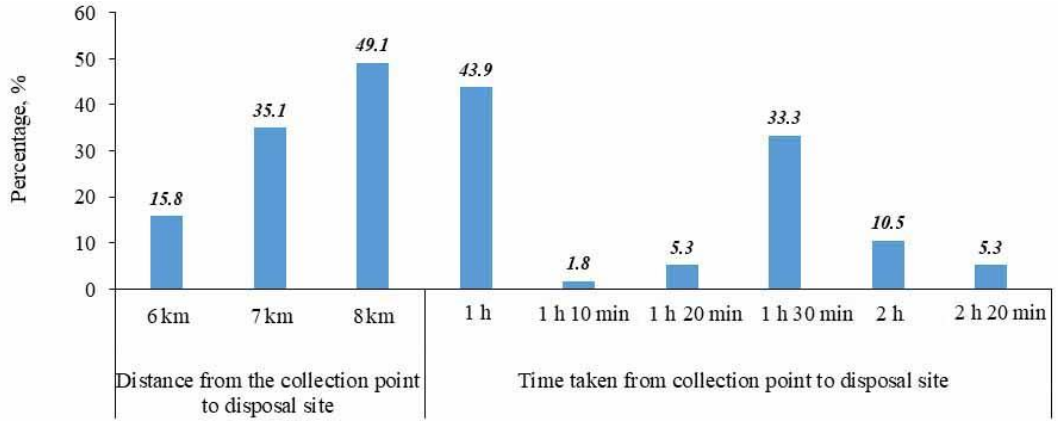


Figure 7. Distance covered and Time taken from the collection point to disposal site

Table 3. Type of waste collected

| Type of waste | Frequency | Percentage |
|---|---|---|
| Bottles, plastic waste, electronic waste, glass materials, organic materials, cans and metals, soil | 11 | 19.3 |
| Bottles, plastic waste, electronic waste, glass materials, organic materials, cans and metals, soil, pampers, pads | 9 | 15.8 |
| Bottles, plastic waste, electronic waste, glass materials, organic materials, cans and metals | 8 | 14.0 |
| Bottles, plastic waste, electronic waste, glass materials, cans and metals | 7 | 12.3 |
| Bottles, plastic waste, electronic waste, glass materials, organic materials, cans and metals, soil, sharps | 6 | 10.5 |
| Bottles, plastic waste, glass materials, cans and metals | 4 | 7.0 |
| Bottles, plastic waste, electronic waste, cans and metals | 4 | 7.0 |
| Bottles, plastic waste, electronic waste, glass materials, cans and metals | 4 | 7.0 |
| Bottles, plastic waste, glass materials, cans and metals | 3 | 5.3 |
| Bottles, plastic waste | 1 | 1.8 |
| ***Total*** | ***57*** | ***100.0*** |

Figure 8. Plate 2 – type of waste collected by refuse workers

Table 4. Waste transportation

| Type of transport | Frequency | Percentage |
|---|---|---|
| Tipper truck | 12 | 21.1 |
| Compactor truck | 10 | 17.5 |
| Skip truck, tipper truck, lorries | 9 | 15.8 |
| Compactor truck, skip truck, tractors, lorries | 7 | 12.3 |
| Lorries | 6 | 10.5 |
| Skip truck | 6 | 10.5 |
| Compactor truck, skip truck, lorries | 4 | 7.0 |
| Compactor truck, tipper truck, lorries | 3 | 5.3 |
| ***Total*** | ***57*** | ***100.0*** |

**Waste loading**

Figure 9 shows how garbage collectors load waste collected from a designated area and the length of service (calculated in years) directly in this particular job. The majority of the respondents (98.2%) do loading of waste, and lowest percentage (14%) have been in the waste loading position for 6 – 10 years. As shown in Figure 10, waste is loaded manually into the refuse trucks. Besides the official municipal job, the respondents were also engaged in other tasks/jobs as shown in Table 5. As shown in Table 5, the majority of the participants had at least one extra job outside the formal employment.

**Accidents at work and reporting**

Figure 11 shows the accidents that occurred at work and how the respondents reported the them. It can be noted that the respondents have been variedly involved in an accident: once (82.5%), while an equal number (16.1%) has been involved in an accident either four times or more than five times. Paradoxically, fewer respondents have reported per each category. Various reasons were cited for not reporting the accidents, as in Table 6.

The dominant reasons cited for not reporting were that respondent thought the accidents were minor (35%) or no action was taken or assistance given after reporting (35%).

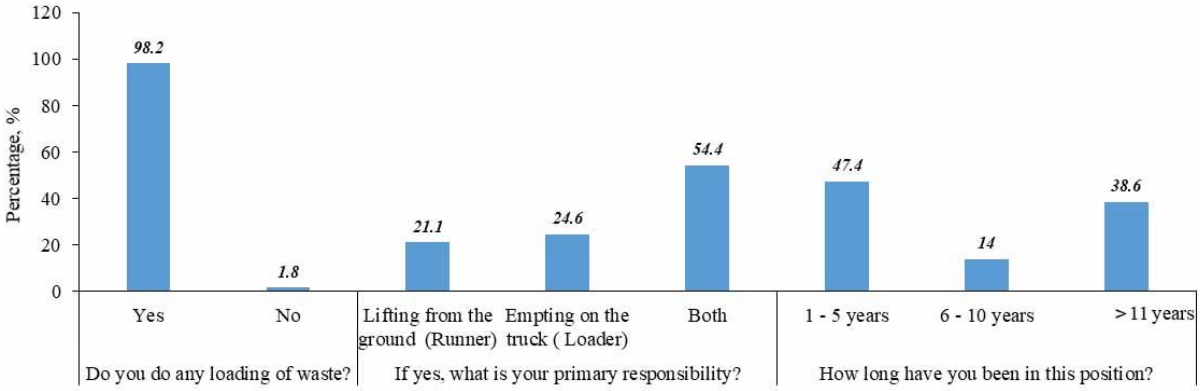


Figure 9. Waste loading


Figure 10. Plate 4 – Manual loading of waste

Table 5. Extra/other jobs done by refuse collectors

| Job | Frequency | Percentage | Job | Frequency | Percentage |
|---|---|---|---|---|---|
| Builder | 3 | 15.0 | Push cart vendor | 1 | 5.0 |
| Security guard | 2 | 10.0 | Radio technician | 1 | 5.0 |
| Gas vendor | 2 | 10.0 | Shoe vendor | 1 | 5.0 |
| Airtime vendor | 1 | 5.0 | Shop assistant | 1 | 5.0 |
| Bicycle repairs | 1 | 5.0 | Tailor | 1 | 5.0 |
| Builder assistant | 1 | 5.0 | Taxi driver | 1 | 5.0 |
| Carpentry | 1 | 5.0 | Waste recycling | 1 | 5.0 |
| Poultry farmer | 1 | 5.0 | Welder | 1 | 5.0 |
| ***Total*** | | | | ***20*** | ***100.0*** |

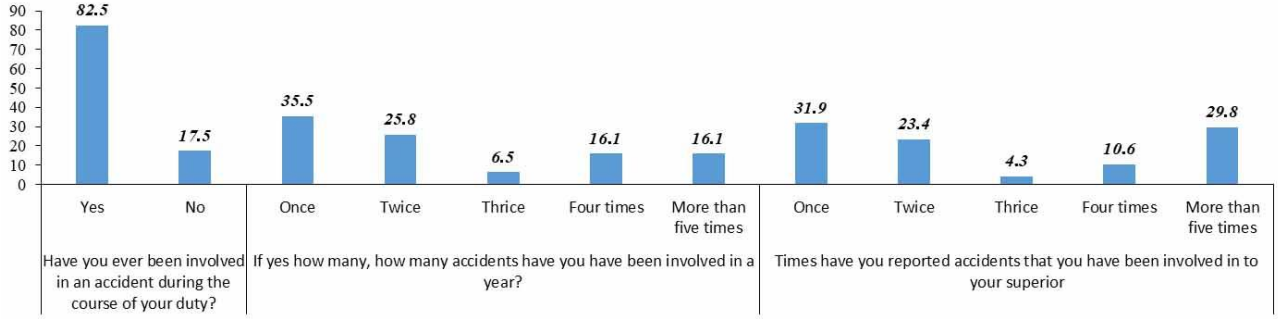


Figure 11. Accidents at work and reporting

Table 6. Reason for not reporting

| Reason for not reporting | Frequency | Percentage |
|---|---|---|
| I thought it was minor | 7 | 35.0 |
| Have been reporting to superior but no action taken/ No assistance is given even if you report/ no action taken | 7 | 35.0 |
| Because there is no assistance given to seek medication or treatment/ It is a waste of time you are just referred to clinic where there is no medication | 5 | 25.0 |
| Not reported because the supervisor saw me falling | 1 | 5.0 |
| ***Total*** | ***20*** | ***100.0*** |

**Safe practices/ conditions during work**

Table 7 shows safe practises or conditions observed when respondents were carrying out their work. The dominant safe act/condition cited was handling bins with care and wearing protective clothing (40.9%).

**Pain and Stiffness in lower back, Pain in hips**

The respondents also cited varied degrees of pain and stiffness in the lower back and hips. These were indications of Musculo-skeletal disorder (MSDs) due to the respondents' type of work. Figure 12 depicts the experiences of the different MSDs.

Table 7. Safe acts/conditions

| Safe acts/conditions | Frequency | Percentage |
|---|---|---|
| Handling bins with care, Wearing protective clothing | 18 | 40.9 |
| Handling bins with care | 7 | 15.9 |
| Handling bins with care, wearing protective clothing, Washing of hands after work | 2 | 4.5 |
| Handling waste with caution | 2 | 4.5 |
| Not coming to work drunk, Not getting close to a moving vehicle, Making use of protective clothing | 2 | 4.5 |
| Wearing protective clothing, Not getting close to a moving vehicle | 2 | 4.5 |
| Good communication among team members | 1 | 2.3 |
| Handling bins with care, no to use defective machinery | 1 | 2.3 |
| Making use of protective clothing | 2 | 4.5 |
| Making use of protective clothes, avoid catching falling bins, Good communication between drivers and loaders, Report when not feeling well | 1 | 2.3 |
| Making use of protective clothes, Handling bins with care, Not coming to work drunk | 1 | 2.3 |
| Making use of protective clothing, Use an appropriate refuse vehicle like a compactor | 1 | 2.3 |
| No loading while the vehicle is in motion, avoid running to close the vehicle | 1 | 2.3 |
| Not loading moving vehicle, Not attempt loading heavy loads beyond my capacity | 1 | 2.3 |
| Not to move to close to the vehicle, not to work in the dish of the compactor | 1 | 2.3 |
| Not to work when not feeling well, Handling bins with care | 1 | 2.3 |
| ***Total*** | ***44*** | ***100.0*** |

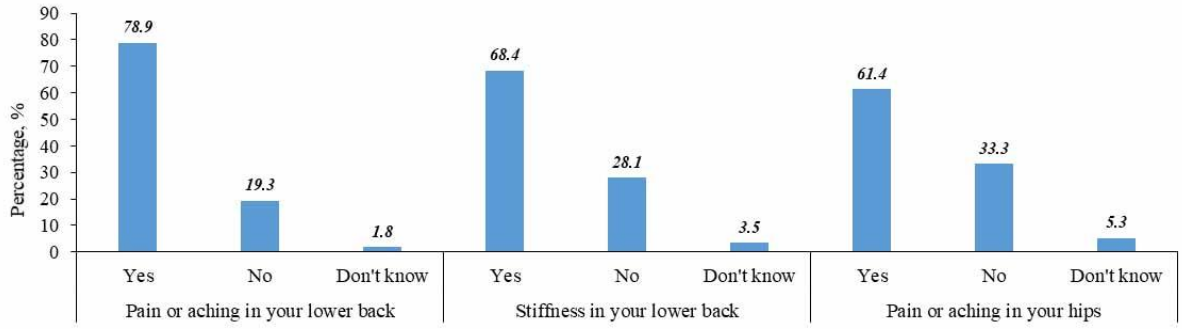


Figure 12. Pain and stiffness in lower back and pain in hips

On average, 69.6% cited have experienced pain and stiffness in lower back and/or pain in hips, while a smaller percentage (average 3.5%) were not aware about experiencing either pain and stiffness in the lower back or pain in the hips (Figure 12).

The respondents also cited having experienced other types of MSDs such as stiffness in hip joints or muscles, knees and foot (Figure 13), pain and stiffness in shoulder and hands (Figure 14), as well as pain and stiffness in hands (Figure 15).

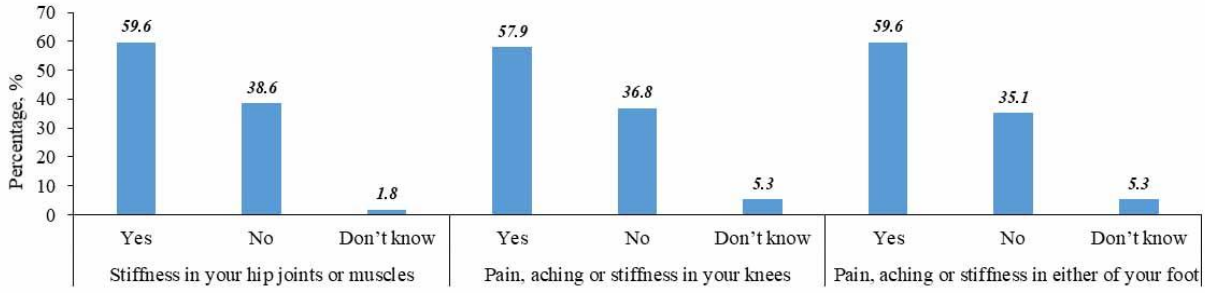


Figure 13. Stiffness in hip joints or muscles, knees and foot

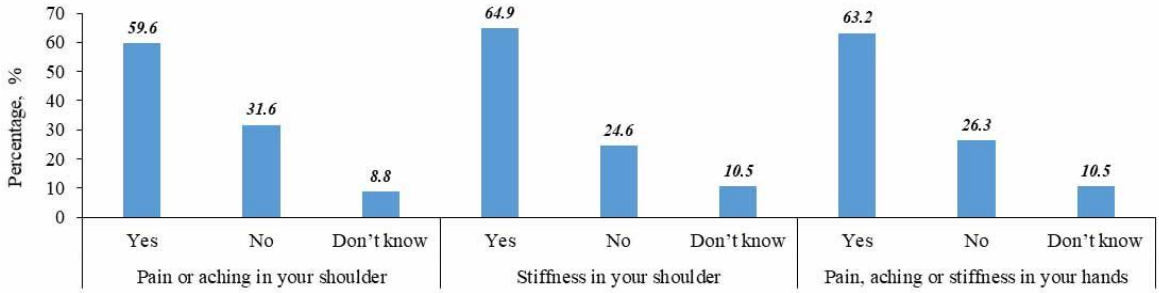


Figure 14. Pain, stiffness in shoulder and hands

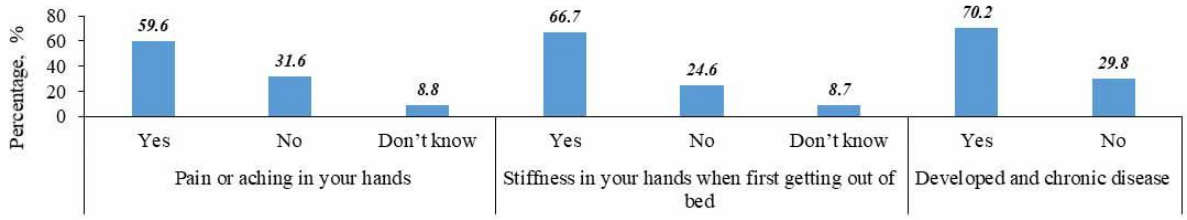


Figure 15. Pain and stiffness in hands, chronic condition

An almost equal percentage of participants experienced stiffness in hip joints (59.6%), pain or stiffness in knees (57.9%) and pain or stiffness in foot (59.6%), (Figure 13). From Figure 14 the greatest percentage (64.9%) experienced stiffness in the shoulder, while as few as 8.8% were not aware of whether they experienced pain or aching in the shoulder. From Figure 15, a very high percentage (70.2%) developed a certain chronic disease.

**REBA employee assessment**

The SDs evaluation of employees was carried out in accordance with the criteria presented below:

1 – Negligible risk;
2–3 – Low risk change may be needed;
4–7 – Medium risk - further investigation and rapid changes in working conditions are required;
8–10 – High risk – urgent investigation and implementation of improved working conditions are required;
>11 – Very high risk – urgent changes to working conditions are required.

The evaluation results are presented in Table 8.

Table 8. Depicts the REBA employee assessment scoring

| Risk | | | | |
|---|---|---|---|---|
| Negligible | Low | Medium | High | Very high |
| 0 (0%) | 0 (0%) | 21 (36.8%) | 36 (63.2%) | 0 (0%) |

## DISCUSSION

**Assessment of risk jobs or risk activities among refuse collectors**

This study unearthed that manual lifting was the most significant cause of lower back pain. About 33.3% of the workers were not trained in lifting techniques which put them at risk of developing lower back pain. This outcome was in line with the findings from a study which found a correlation between lower back pain and manual lifting among warehouse workers in Saudi Arabia (Basahel, 2015). The findings also substantiate the conventional knowledge in medical literature whereby it is widely believed that awkward posture, manual lifting and lack of resting cycles grossly affect lower back (Ziaei et al., 2018). Distance travelled to the disposal site increased the risk of lower back pain because of the awkward posture for a long distance and time. Majority of the respondents travelled an average of 8 km. It has been postulated that there is a correlation between frequency and time taken to do manual work (Lamprecht & Padayachy. 2019). At the Municipality waste segregation is not practiced hence all types of waste is mixed. All waste collected by refuse collector contain bottles, plastic, electronic waste, glass material, organic, cans, metals and soil hence putting the collectors at high risk of getting injured. The scenario was supported by (Jayakrishnan et al., 2013).

The study also found out that 12.4% of the Refuse collectors at the Municipality had other manual jobs that they perform after work, which could also contribute or can be implicated in the development of MSDs. Refuse collection was classified as a Risk activity as agreed by many authors that the results showed that lifting task highly significantly impacted low back pain among all participants. This was also consistent with the findings of (Ziaei et al., 2018) who unearthed that MSDs, which are problems of Musculo-skeletal system, are significant and costly workplace problems affecting occupational health, productivity and the careers of the working population. The study also exposed that 33.3% of workers were stressed because of none payment of their salaries. Goetsch (2015) pointed out that stress was a major contributor to unsafe acts. The same can be applicable to the Refuse collectors at the Municipality who are demotivated because they cannot meet their basis requirements at the same time working in a risky environment.

**Identification of muscular skeletal disorders**

The REBA assessment tool indicated that 63.2% of the refuse workers were at high risk while 36.8% were at medium risk. The study concluded that all the Refuse collectors were between medium to high risk. This was consistent with (Emmatty et al., 2019)`s findings that 92.5% of waste collectors reported MSDs symptom at least in one body region during the last 12 months. This proved that refuse collection is a very risky activity. It is also indicated in the findings that majority of the workers suffered MSDs in one part of the body or the other as a result of Awkward posture during waste collection. The finding was in line with the findings of (Zakaria et al., 2017), which indicated that the highest prevalence of MSDs symptoms during last 12 months is low back pain (54.50%) followed by upper back pain (27.30%) and at shoulder region (22.70%). REBA analysis of the observed results showed that 43.20% of the waste collectors have scored 7, indicating that postural changes must be done immediately. Meanwhile 45.5% of waste collectors scored 5 an indication of postural changes must be carried out soon. At the Municipality the workers awkward postures were a result of improper equipment's used to collect refuse see Plate 2, the type of the vehicles is far too high for workers to empty the bins hence exertion of force on muscles which may lead to repetitive strain injuries in body muscles. Lamprecht & Padayachy (2019) concurred that Work-related musculoskeletal injuries (WRMSI) are a group of painful complaints involving the muscles, tendons and nerves which occurs in an occupational setting due to physical tasks carried out in normal work activities. Therefore, like all other Refuse collectors were study have been carried out, municipality Refuse Collector are not spared from the development of MSDs, since vehicles are inappropriate hence refuse collectors are exposed to infections conditions as no waste segregation is practiced in communities. In a study by (Jerie, 2014) on profile of composition of waste in Gweru, Zimbawe highlighted all sorts of waste ranging from metals, garbage, plastics, which are hazardous substances can have physical, chemical, or biological characteristics that can place human health at risk or adversely affect the natural environment. This is the same scenario at the municipality placing refuse collectors at risk of occupational hazards.

**Examination of knowledge levels on work practices among employees**

The study showed that Refuse workers were aware of safe work practises 78.9% indicated they had information on safe work, practices. About 21.1% of the workers were not knowledgeable of safe work practices which was a key driver to risk in refuse collectors. ILO (2019) concluded that these facets of knowledge bring different insights into how safe work practices are achieved at an individual and team level in operations, thus adding to the existing understanding of the nature of knowledge in safe work practices, hence the same scenario exist at the Municipality where one group is aware of safe practices and the other is not aware of safe practices. Using the Likert scale to measure the Refuse collector's knowledge on safe practice based on at least five correct safe practice with a rating of (Poor, Fair, Good, Very Good and Excellent) 60% of the Refuse collectors were between good and very good, which also indicated that majority of workers were knowledgeable. The study also showed that although the respondents were knowledgeable of safe work practice 85.5% had been involved in an accident during the course of their work. The same notion was highlighted by (Blewusi, 2019) in his study of Waste collectors in the Adentan Municipality in Accra, Ghana, where he found out that Collectors are aware of the occupational health hazards associated with waste collection in the city of Accra but their behaviour and attitudes is contrary to their knowledge, but according to (Shukriah et al., 2017) there was also initial evidence suggesting that the group process-unsafe behaviour relationship was mediated by intentions to approach other team members engaged in unsafe acts. One of the key drivers purported was the issue of engaging in unsafe acts in order to meet work targets. During observations it was noted that Refuse collectors were engaging in unsafe acts, like working in a compactor loading dish, getting in contact with contaminated waste form various collection sites, or being trapped by compactor hydraulic system. The study found out that the number of accident/injuries reported was underestimated as 38% of the respondents who were involved in accidents did not report. According to (Goetsch, 2015) workers fail to report accidents because of fear of being victimized, demoted or reprimanded for non-compliance to the company safety rules, while in actual fact reporting pave way for intervention measure to remove the hazards.

## CONCLUSION

Based on the results of the study, it was found that all municipal waste collectors did not avoid developing MSD. Only 2/3 of workers were trained in safe methods of performing work, most importantly they were not trained in lifting techniques. This factor is the most significant hazard and contributes to the risk of developing lower back pain. It was also found that about 1/3 of workers were subject to frequent stress due to lack of salary payment. As is known, stress conditions contribute to a multiple increase in the risk of errors in professional activities, which subsequently negatively affects the health of workers. The situation is aggravated by the fact that workers are forced to continue other manual work after completing their main work. Thus, 2/3 of the studied workers were classified as a high-risk group and 1/3 of workers as a medium-risk group.

It is the duty of the employer to take care of its employees and stakeholders' occupational safety, failure of which will result in the litigation from employees or custodian of safety for example Labour Unions, or Workers Unions. Workers injuries also contribute to the loss of revenue in the organisation through compensation of injured workers. Occupational injuries cause low productivity, thereby having a negative impact on organisational targets due to lost man hours. Demotivation of workers' as a consequence of unsafe acts and practices more often than not affects morale leading to increase in more unsafe acts. Organisational image gets tarnished thereby negatively impacting the brand of the organisation. Recruitment of expert workers will be compromised as those workers will view the organisation as an unsafe place to work.

The injuries will cause loss of income to individual and their families due to absence from work. Employee affected will meet medical bills for treatment of injuries, thereby impacting on his/her disposal income. Unsafe practise will be increased as other employees will try to avoid correct procedures and will resort to keeping themselves safe. The rate of productivity will be affected negatively, hence reducing his or her social status as a result of injury or disability.

The current research can be summarized in the following lessons learnt:

– Pre-placement medical examination on recruited workers is essential;
– Safety training including proper lifting techniques should be cascaded to new and old workers;
– Non -segregation of waste exposes workers to infection an injury;
– Manual loading is the root cause for MSDs;
– Workers do not report accidents for fear of victimisation.

**Author's statements**

***Contributions***

The authors contributed equally to all aspects of the current study and preparation of the manuscript.

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