

Adverse Health Effects among Solid Waste Collectors in Alexandria Governorate

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Abstract

Solid waste management has arisen as a vigorous human and environmental health issue. Waste collectors are doubtless exposed to a spread of activity biohazards and safety risks. Aim of the study was directed to assess adverse health effects among solid waste collectors in Alexandria governorate. A cross section descriptive study design was utilized. Randomly selected of 4 zones out of 8 zones namely; El-Montaza, East, Middle and El-Gomrok Zones in Alexandria governorate. The target population of this study was solid waste collectors in previous mentioned zones (n=100). One tool was used, it consists of four parts; socio-demographic characteristics of solid waste collectors, work related characteristics and different health problems among waste workers. Study findings revealed that vast majority (94%) of the collectors suffering from health problems and 76% of them experienced work-related accidents. It can be noted that, there was high propagation of occupational health morbidities among waste collectors as gastrointestinal complaints, eye problems, skin problems, work related injury, respiratory and musculoskeletal pain. Risk factors of the adverse health effects among solid waste collectors namely age, level of education, duration of employment, type of work, use of personal protective equipment, awareness about adverse health effects, job stress, and job satisfaction; this shed the light on the urgent need for application of awareness programs to increase their knowledge about occupational health hazards also routine medical examination of waste collectors must be carried out by health officers.

Keywords: solid waste collectors, health problems, adverse health effects, Alexandria governorate

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1 Introduction

Solid waste includes materials that are thrown away by people and regarded as trash or garbage. It comprises waste resulting from public activities and facilities such as dead animals, street waste, and abandoned vehicles [1, 2]. Poor waste management practices are found to be one of the main contributing factors for most of diseases in developing countries [3- 5]. Solid waste collectors play an honorable role in preserving health and hygiene in any country. This job requires much effort to be accomplished, given the nature of the work, workplace conditions, plus predictable and unpredictable variables that track their routine [6]. These collectors are exposed to physical, chemical and biological hazards in addition to multiple risk-factors and every day they face job related dangers thus they sustain high rates of occupational health-problems [7,8].

Annually, they constitute average of 90 deaths per 100.000 collectors; this makes waste collection and handling riskier occupation compared with other jobs. Hazards occur at any step in the process of waste management started from collection at homes, during transportation and ended at the sites of recycling or disposal [9, 10]. Solid waste collectors in developing countries as paralleled to general residents has been found to have approximately three times more relative risk for chronic bronchitis, six times more relative risk for infectious diseases, about three and a half times more risk for respiratory disease, almost two times increased risk for hepatitis, ten times more relative risk for acute diarrhea and three times more relative risk for parasites [11]. The riskiness and complexity of this problem are initiated from restricted technologies, resources, low socioeconomic status and low educational level [12]. One of the major challenges facing both developing and developed countries is the protection of environment and human health [13, 14]. However, in developing countries the situation is more sophisticated owing to the nominal stress on safety measures or regulatory frameworks for collectors compared to strict implementation of occupational safety agencies and environmental safeguard laws in the developed countries [15]. Community health nursing play a critical role in prevention of waste related hazards among waste collectors and appropriate management techniques. Moreover, increasing awareness about the health hazard of community waste, methods of handling, safe disposal of hazardous waste and increase their alertness regarding the significance of personnel protective equipment (PPE) [16,17].

Significance of the study

Solid waste collectors have the seventh most dangerous job in the world. As a result of insufficient consideration of magnitude of the problem and poor financial resources; the threat is still mostly unmanaged in greatest of developing countries similar Egypt. The estimated population of Alexandria governorate is five million and eight million in the summer due to the massive summer visitors and the community solid waste generation is 4200 tons per day [18-19]. Moreover, in Egypt there has been little study of the health and injury incidence of solid waste collectors. Hence this study was aimed to assess adverse health effects among solid waste collectors in Alexandria governorate. The research question underpinning this study was:

1. What are the adverse health effects among solid waste collectors in Alexandria governorate?

2 Material and Methods**2.1 Material****2.1.1 Study design:**

A cross-sectional descriptive design was utilized for the existing study.

2.1.2 Study setting:

The study data was gained from Alexandria City which composed of eight zones; out of them four zones were randomly selected namely, El-Montaza, East, Middle and El-Gomrok zones.

2.1.3 Study subjects:

The target population of this study was solid waste collectors in the previous mentioned zones.

2.1.4 Inclusion criteria

- 1- Contact with the solid waste for at least one year.
- 2- Workers who willing to join the study.

2.1.5. Sampling technique

By using multistage sampling techniques, the following steps were done;

1. Alexandria Governorate is classified into 8 zones, namely: East, Al-Montazah, Borg Al-Arab, West, Al-Gomrouk, Al-Ajami, Al-Amiriyah, and Middle.

2. Four zones randomly selected out of eight zones to be included in the study namely, El-Montaza, East, Middle and El-Gomrok zones.
3. No available records or data base for the total population of the solid waste collectors even in each of the previously selected zones or in the private company that contracted with the administrative zones, for that reason the researchers had to use snowball sample method. Snowball sampling was conducted to recruit participants, the researcher identified some wasted collectors and after explaining the purpose of the study and obtaining oral consent, they were asked to introduce some other collectors to recruit a large sample size. Accordingly, the reached sample size was 100 (25 from El-Montaza, 25 from East, 30 from Middle and 20 from El-Gomrok Zones).

2.1.6. Tool for data collection:

In order to collect the necessary information one tool was used in this study:-

Solid waste collectors' structured interview schedule:-

It was developed by the researchers after a thorough review of relevant literature and consists of four parts:-

Part I:

Socio-demographic information such as age, gender, educational level, marital status, place of residence, monthly income, presence of chronic diseases and smoking.

Part II:

- Work related characteristics information such as duration of employment, hours spend in work, presence of license, methods of collecting & sorting waste, using of personal protective equipment, job satisfaction, job related stress, and awareness regarding how to avoid adverse health effects.
- Types of personal protective equipment used by waste collectors.
- Frequency of hand washing practice among waste collectors.
- Risky exposure among waste collectors.

Part III:

- Different health problems stated by waste collectors such as respiratory diseases, eye troubles, skin harms, nail infection, gastrointestinal illnesses and frequency of musculoskeletal problems.
- Reported work related accidents.

Part IV:

Anthropometric measurements:

Anthropometric measurements were estimated using standardized procedures and calibrated equipment. Height was measured using a non-stretching measuring tape in centimeters to the nearest 0.1 cm. Weight was measured using a standardized weighing scale in kilograms to the nearest 0.5 kg and Body Mass Index (Kg/m^2) was estimated using standardized weighting and height equation.

The calculated Body Mass Index (BMI) was compared with the reference value and interpreted as following:-

Less than 18.5 kg/cm ²	(underweight)	18.5 – 24.9 kg/cm ²	(normal weight)
25.0 – 29.9kg/cm ²	(overweight)	30.0 – 34.9 kg/cm ²	(obesity) [20]

2.2 Methods

2.2.1 Development of study tool

1. The tool of data collection was established by the researchers after a comprehensive analysis of pertinent literature.
2. The tool was verified for its content validity by a jury entailed of 3 academic staff in community health Nursing at Mansoura, and Damanhur University. The essential modifications were accomplished.
3. Test of reliability was conducted using Cronbach's Alpha ($=0.781$).

2.2.2 Pilot study was conducted on 10 of waste collectors in Alexandria Governorate out of the sample to ascertain the clarity and applicability of the tool and to estimate the time required to fill the study tool. Reforms done based on the result.

2.2.3 Data collection

- The data was collected individually from the workers using one tool after a brief explanation of the purpose and the nature of the research for full cooperation. The workers were requested for an oral consent for sharing in the study.
- At the beginning of the interview with each worker, the researchers were introduced themselves, clarify the purpose of interview and established a trust relationship with waste workers.
- The researchers were able to interview about 1 – 2 workers daily about 2-4 per week and nearly from 10-12 collectors every month.

- The structured Interview time took approximately from 45 to 60 minutes for each worker.
- Data was collected by the researchers over a period of 9 months (October 2017 – June 2018).
- 2.2.4 Statistical analysis:
 - After data collection, the reported data was coded and transferred into especially intended format to be appropriate for computer feeding.
 - Data was entered into and analyzed using the statistical package of social science (SPSS) version 20.
 - After data entry, data was checked and revised through frequency analysis, cross tabulation, and manual revision to discover any error during data entry.
 - Variables were analyzed using the descriptive statistics which included: percentages, frequencies, range (minimum and maximum), arithmetic mean, and standard deviation (SD).
 - The level of significance selected for this study was $p \leq 0.05$.
 - Multivariate analysis logistic regression model was used to indicate the predictors of adverse health effects, the model was statistically significant ($p \leq 0.05$).
 - Graphs were done for data visualization by using Microsoft Excel program.
- 2.2.5 Ethical considerations:
 - Ethical consideration, each worker was interviewed individually after establishing trustful relationship with him to gain his cooperation and confidence. This was attained through explaining the purpose of the study, promising that the collected data will be used only for the purpose of the study and informs them about their unpaid sharing in the study.
 - Oral informed consent was obtained from every worker included in the study after explanation of the purpose of the study.
 - Confidentiality and anonymity of individual response was guaranteed through using a code numbers instead of names.
 - Those waste collectors who were hesitant to participate were omitted from the study.

3 Results

Table (1) reveals the socio demographic characteristics of the solid waste collectors. Regarding their age, it ranged from 20 to 56 years with a mean of 30.48 ± 8.5 years. More than one third (36%) of the solid waste collectors aged 30 to less than 40 years old and less than one fifth (19%) of them aged 50 years and more. The majority (94.0%) of the collectors was males and only 6% were

females. Half (50%) of them were illiterate and only 8% of them had secondary and technical education. Furthermore, less than two thirds (63.0%) of them were from rural areas and 55% of them were married. Additionally, less than three quarters (71.0%) of them earned less than 800L.E every month and the vast majority (97%) of them reported smoking.

Table (2) Spectacles that the majority (88%) of the collectors were employed for more than five years and spent eight hours per shift in the day. Furthermore, more than one fifth (22%) of the collectors have a work license. Less than two thirds (62%) of the collectors declared that they collect wastes manually and use of personal protective equipment on work reported by 65% of them. While more than three quarters (79%) of the collectors sort wastes. Alternatively, the majority (80%) of collectors who did not use personal protective equipment informed absence of such equipment. Moreover, only (13%) of the collectors reported job satisfaction and more than two thirds (67%) of them experienced job stress. Additionally, the majority (92%) of the collectors stated that they have no knowledge about how to avoid adverse health effects of their work.

Table (3) reveals the distribution of waste collectors in relation to reported health problems. It was observed that the vast majority (94%) of the collectors had health problems or complaints. The most frequent complaints encountered among waste collectors were gastrointestinal complaints that stated by whole collectors (100%), worm infestations as mentioned by (68.1%) of those. Furthermore, (95.7%) of the collectors had eye problems mainly redness as reported by less than three quarters (73.3%) of the collectors, while, collectors who complained of skin problems constituted (83%) including itching and nail infection (57.7 %&46.2% respectively) and scabies (14.1%) of them. Among the respiratory complaints, less than half (49.3% and 41.1%) of the collectors mentioned cough and dyspnea respectively. On the other hand, musculoskeletal pain was stated by less than three quarters (74.5%) of the collectors mainly, neck and low back pain (54.3% and 44.3% respectively).

Table (4) shows the distribution of waste collectors according to work related accidents. It was noticed that more than three quarters (76%) of the collectors experienced work-related accidents. The main accidents were needle stick injury as mentioned by 100.0% of the collectors, followed by falls (86.8%), fissure feet (71.1%), and contusions (57.9%) of them. Furthermore, more than two fifths of the collectors complained of puncture wounds and lacerations (43.4% and 42.1% respectively), while fracture was reported by (27.6%) of the collectors. On the other hand, animal bites and chemical injury were stated by (15.8% and 11.8%

respectively) of the collectors. Additionally, around half (49%) of the collectors were previously hospitalized because of work related hazards.

Table (5) illustrates multivariate analysis logistic regression for risk factors of adverse health effects among solid waste collectors. The table announce that eight variables had a significant association to the adverse health effects among participants namely age (OR = 1.64), level of education (OR = 1.93), duration of employment (OR = 2.8), type of work (OR = 1.92), use of personal protective equipment (OR = 2.51), awareness about adverse health effects (OR = 4.25), job stress (OR = 0.57), and job satisfaction (OR = 1.71). Additionally, the table displays that those collectors aged more than thirty years, non-educated, hired for more than five years, working in sorting of wastes, not using personal protective equipment are at greater risk for adverse health effects of waste collection. As well, those collectors with low awareness about adverse effects of waste collection and those with higher job stress and lower job satisfaction are at greater risk for adverse health effects of waste collection.

Figure (1) confirms the personal protective equipment used by waste collectors. Safety boots were used by less than three quarters (73.8%) of the collectors, while gowns were used by 12.3% of them. Moreover, less than one tenth (7.7% and 6.2%) of the collectors used heavy utility gloves and head covers respectively. On the other hand, none of the collectors reported use of safety goggles and face mask on work.

Figure (2) displays the frequency of hand washing practice among waste collectors. The majority (81%) of collectors used to wash their hands before eating, while, more than half (55 %) of them wash their hands before taking medications. Moreover, Hand washing was also emphasized by waste collectors before and after using the toilets as stated by 40% of them. Besides, 30% of collectors stated that they wash their hands before drinking. On the other hand, lesser percentages of collectors wash their hands upon using cellular phone or before smoking (6% and 2% respectively).

Figure (3) gives a picture of the risky exposure among waste collectors. The first risky exposure reported by 62% of the collectors were domestic waste including papers, cardboard, plastics, canes and rage, followed by women's sanitary pads (57%), broken glass and other sharp items (52%), animal and domestic pets' excreta (49%) and dead animals and rodent carcasses (46%). Furthermore, less than half (41.0%) of collectors stated that they were exposed daily to dust compared to (38%) of them who stated food waste. Syringe and needles were reported by 29% of collectors, while sludge, tan and dead new born were mentioned by (15%, 12% and 3% respectively) of the collectors.

Figure (4) exhibits body mass index among waste collectors. It was noticed that more than one tenth (11%) of the collectors was obese and about one fifth (19%) of them were overweight. While the collectors who had normal body weight and underweight constituted (44% and 26%, respectively).

Table 1: Distribution of solid waste collectors consistent with their socio demographic characteristics

Waste collectors	Total N=100	
	No	%
Age (years)		
20-	18	18.0
30-	36	36.0
40-	27	27.0
50+	19	19.0
Min-Max	20.0-56.0	
Mean ± SD	30.48 ±8.523	
Gender		
Male	94	94.0
Female	6	6.0
Level of education		
Illiterate	50	50.0
Literate certificate	13	13.0
Primary education	17	17.0
Preparatory education	12	12.0
Secondary /technical education	8	8.0
Marital status		
Single	36	36.0
Married	55	55.0
Divorced / Widowed	9	9.0
Place of residence		
Rural	63	63.0
Urban	37	37.0
Monthly income		
< 800 LE	71	71.0
≥ 800 LE	29	29.0
Presence of chronic diseases		
Yes	28	28.0
No	72	72.0
Smoking		
Yes [≠]	97	97.0
No	3	3.0

[≠] There are 3 females' workers reported smoking

Table 2: Distribution of solid waste collectors consistent with their work-related characteristics

Items	Total N= 100	
	No	%
Duration of employment		
≤ 5 years	12	12.0
> 5 years	88	88.0
Duration of work shift per day		
12 hours	12	12.0
8 hours	88	88.0
Have a work license		
Yes	22	22.0
No	78	78.0
Method of waste collection		
Manual (by hand)	62	62.0
By use of equipment	38	38.0
Sorting of waste		
Yes	79	79.0
No	21	21.0
Using of personal protective equipment in work		
Yes	65	65.0
No	35	35.0
Causes of non-use of personal protective equipment		
N=35		
Not available	28	80.0
Hinder work / not comfortable	7	20.0
Experience of job satisfaction		
N=100		
Yes	13	13.0
No	87	87.0
Experience of job related stress		
Yes	67	67.0
No	33	33.0
Awareness about avoidance of adverse health effects caused by waste collection		
Yes	8	8.0
No	92	92.0

Table 3: Distribution of solid waste collectors consistent with reported current health complaints and problems

Items	Total N= 100	
	No	%
Presence of current health complaints		
No	6	6.0
Yes	94	94.0
Gastro intestinal problems	94	100.0
Eye problems	90	95.7
Skin problems	78	83.0
Respiratory problems	73	77.7
Musculoskeletal problems	70	74.5
Gastrointestinal problems*		
N=94		
Worm infestation	64	68.1
Anorexia	33	35.1
Abdominal colic	28	30.4
Diarrhea/dysentery	23	24.5
Dyspepsia	21	22.3
Nausea/ vomiting	12	12.8
Eye problems*		
N= 90		
Redness	66	73.3
Irritation	55	61.1
Watering	34	37.8
Skin problems*		
N=78		
Itching	45	57.7
Nail infection	36	46.2
Tineaasis	28	35.9
Rash	21	26.9
Dermatitis	14	17.9
Scabies	11	14.1
Respiratory problems*		
N=73		
Cough	36	49.3
Dyspnea	30	41.1
Bronchitis	28	38.4
Tightness	21	28.8
Musculoskeletal pain*		
N=70		
Knee pain	38	54.3
Low back pain	31	44.3
Shoulder pain	28	40.0
Elbow pain	26	37.1
Ankle pain	22	31.4
Wrist pain	19	27.1
Neck pain	12	17.1

* More than one answer was allowed

Table 4: Distribution of solid waste collectors consistent with work related accidents

Items	Total N= 100	
	No	%
Experience of work related accidents		
Yes	76	76.0
No	24	24.0
Types of accidents*		
N=76		
Needle stick injury	76	100
Falls	66	86.8
Fissure feet	54	71.1
Contusions	44	57.9
Puncture wounds	33	43.4
Lacerations	32	42.1
Road accidents	24	31.6
Fractures	21	27.6
Burn	19	25
Sprains	13	17.1
Animal bites	12	15.8
Chemical injury	9	11.8
Previous hospitalization due to work related hazards		
N= 100		
Yes	49	49.0
No	51	51.0

* More than one answer was allowed

Table 5: Multivariate analysis logistic regression for risk factors of adverse health effects among solid waste collectors

Characteristics	P	OR	95% CI	
			LL	UL
Gender (male/ female)	0.628	1.14	0.67	1.94
Age (less than 30 years/ more than 30 years)	0.027*	1.64	1.06	2.54
Marital status (married / not married)	0.490	0.64	0.18	2.31
Residence place (rural/ urban)	0.068	1.51	0.97	2.35
Level of education (non-educated /educated)	0.002*	1.93	1.29	2.89
Monthly Income (less than 800 LE/ more than 800 LE)	0.223	0.77	0.51	1.17
Duration of employment (less than 5 yrs. / more than 5 yrs.)	0.043*	2.8	1.84	4.26
Working hours (12 hrs./ 8 hrs.)	0.387	0.83	0.53	1.28
Presence of work license (no /yes)	0.519	0.88	0.61	1.29
Type of work (collection/ sorting)	0.012*	1.92	1.19	2.79
Use of personal protective equipment (no /yes)	0.046*	2.51	1.51	6.31
Awareness about avoidance of adverse health effects (no/ yes)	0.020*	4.25	3.07	8.89
Job stress (yes/ no)	0.006*	0.57	0.44	0.74
Job satisfaction (no/ yes)	0.053*	1.71	0.91	5.25

OR: Odds ratio
Interval

UL: Upper Limit LL: lower Limit

CI: Confidence

* Statistically significant at $P \leq 0.05$

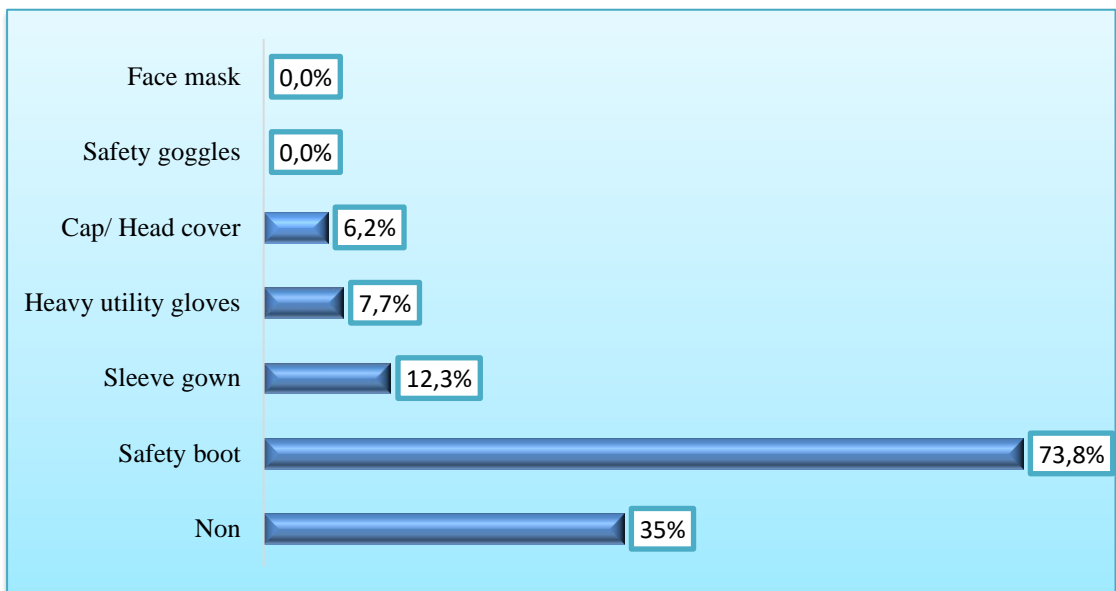


Figure (1): Available personal protective equipment used by solid waste collectors.

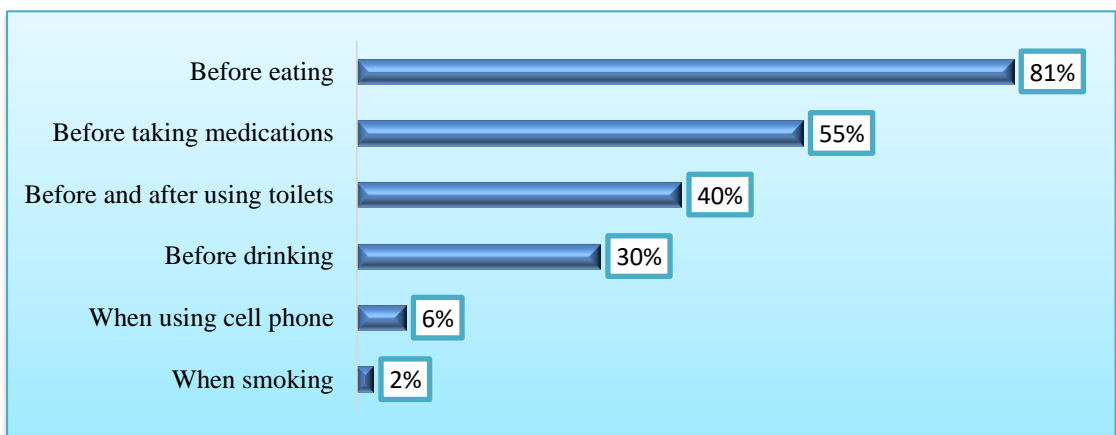


Figure (2): Frequency of hand washing practice among solid waste collectors

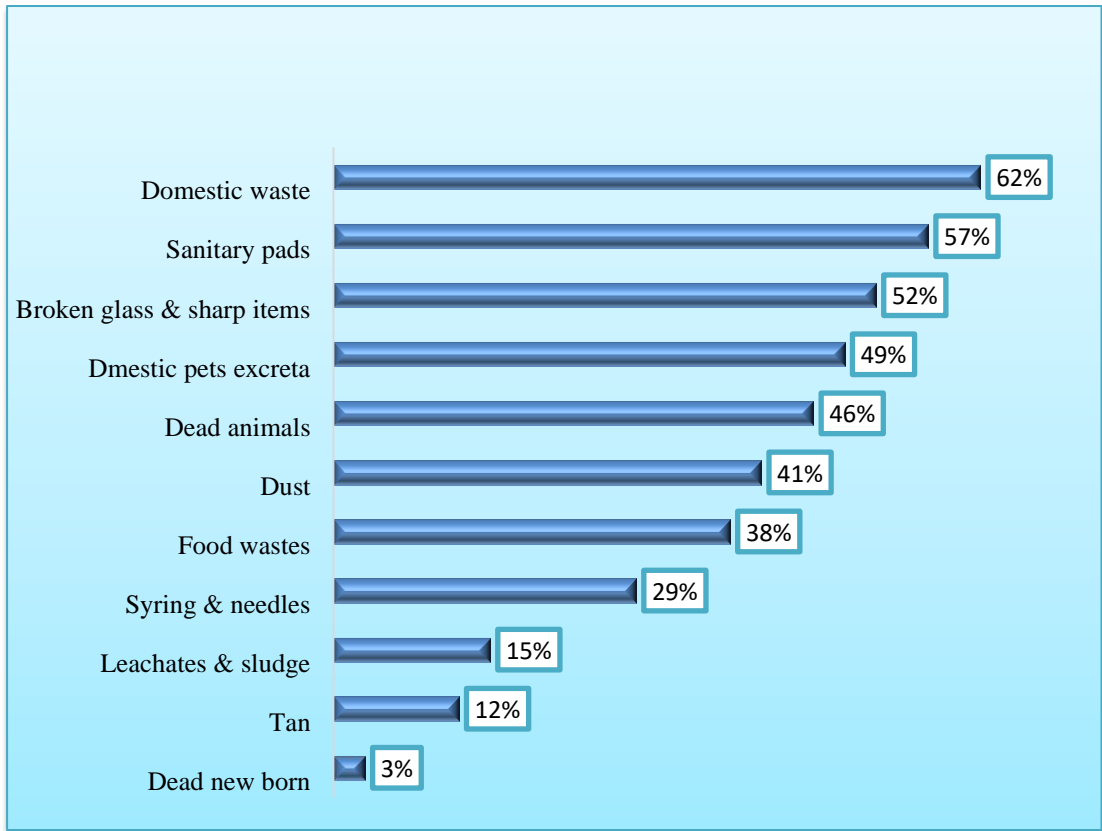


Figure (3): Risky exposure among solid waste collectors

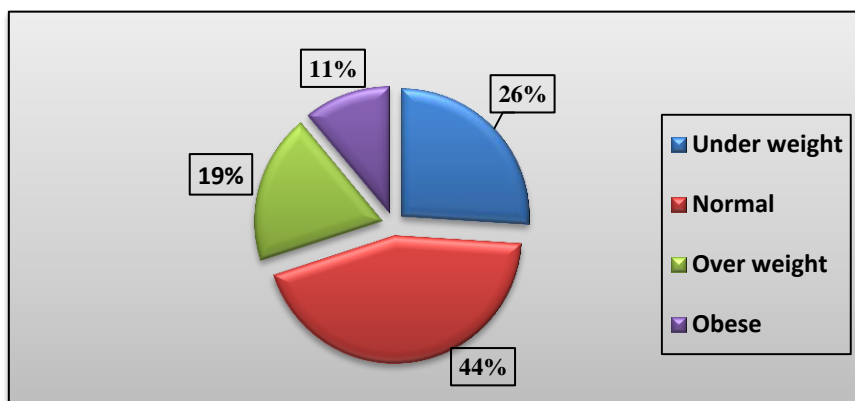


Figure (4): Solid waste collectors according to their body mass index

4 Discussion

Municipal solid waste are produced and discarded every day and it can lead to pollution if it is not collected and treated accordingly. It includes product packaging, food waste, plastics, furniture, clothing and electrical appliances [21]. Waste collectors refer to a group of workers responsible for waste collection from different locations to the designated waste disposal area. Municipal solid waste worker plays an important role towards the effectiveness of the waste management strategy planned by the local authority to ensure cleanliness of the country [22]. The International Labor Organization (ILO) estimates that 270 million occupational accidents and diseases occur each year, around 2.3 million workers die as a result of it. Estimates from member States of the European Union specified that the economic cost of all work-related ill health ranges from 2.6 to 3.8 % of the GDP [23,24]

Subsequently, the present study was conducted to highlight those neglected category of community population. The present study exhibited that, the mean age of waste collectors was 30.48 ± 8.5 . Also, it was noted that waste collectors aged > 30 years were (1.64) times more likely to had adverse health effects. Comparable study performed in Kentucky USA at (2011) [25] to evaluate injury among solid waste workers in public sectors reported that 35 – 44 years old group had the highest frequency of work related injury. Other study conducted in Amsterdam, Netherland (2004) [26] reported that older age collectors are subjected to fall injury than the younger. This can be attributed to the age associated decreased ability among older age collectors who work equal amount of time as young age ones and the absence of chance to do work proportional to their abilities owing to the nature of the job.

Municipal waste management is a source of revenue among poor people with insufficient housing conditions in rural dwelling and large family size .In Egypt, this job is chiefly and formally achieved by male employees and the same applies in other countries [27]. These coincide with the current results, in which a majority of study sample were male and about two thirds of them lived in rural. Furthermore, this is in line with study done in Thailand (2012) [28] which specified that, most of the collectors were male and the majority of them were rural residents with inadequate housing. Contrary to another study done in Nepal (2017) [29] the majority of female (61%) were found to be involved in this sector than male (39%).The reason might be due to the sectors being an emerging and leveled as one of small scale enterprises in their country Nepal where the females are actively involved in this sector as well the low level of education demand in this field for employment.

Regarding education level of the waste collectors, the current study discovered that majority of them had poor education either illiterate or had literate certificate or just

completed primary education. It was observed from this current result that, collectors had low education were (1.93) times more likely to had health problems. This may be explained that education is likely to enhance collectors' health and safety practice through increasing their awareness about the potential hazards and the health impacts related to wastes collecting methods.

The occurrence of any type of occupational injuries or diseases is meaningfully associated with monthly income of the waste workers. This may be attributed to the fact that better salaries mean well chances of treatment and well protection from work related accidents which helps them to have less exposure to waste dust and less contact with waste material [30]. The current study publicized that majority of workers in this study had health problems and slightly less than three quarters of them earned less than 800L.E. per month. Correspondingly, it was perceived from the current study that collectors who reported higher working years (above 5years) were (2.8) times more likely to had health problems. This may be explained that lethal accidents usually occur to collectors who could still have had a long working career ahead of them; the routine type of daily work may not require special experience or expertise and those engaged in such routine activities for long period of time with poor working environment may sustain job dissatisfaction ; the work is insecure so that collectors stayed for long period of time in this insecure job had increased vulnerability of different injuries; once the worker provided personal protective equipment's they did not provide extra for a year and the past injury might be the cause for the next year injury/chronic effect. In similar to this result, other studies conducted globally showed that more experienced waste collectors are more vulnerable to occupational accidents [31]. Conversely, this explain the greater level of job dissatisfaction and social stigma in waste collectors owing to the nature of job in the existing study in which only a petite more than one tenth of waste collectors reported job satisfaction and those with a job dissatisfaction had (1.71) times more likely to had adverse health problems .

The current study displayed that, solid waste collectors had job related stress showed (0.57) times more likely to had adverse health problems. This finding is harmonized with other studies done among industrial collectors [32]. The probable explanation for this results could be collectors who had stress might be anxious by extra thinking which originated from physical symptoms (which includes headache and abdominal pain) and trouble of psychological and family relationships related to stress.

The work of solid waste loading is highly associated with the smoking. This habit is found to be more common and they work as anesthesia during the working hours. Due to the exposure of waste loading work, collectors were vulnerable to the development of communicable as well as non-communicable diseases/disorders [33,

34]. This congruent with the results of current study in which the majority of waste collectors were smoking. In conflicting to this result, another study done in India (2017) [35] about factors associated with chronic bronchitis among municipal sanitary collectors indicated that one third of the workers reported smoking. The discrepancy between results of two studies may be due the nature of current study that include majority of male participants while in the another study the females displayed a larger prevalence as compared to males.

While solid waste management incorporates a wide range of activities, the dangers occur at every phase in the process, from the point of collection at homes, during transportation and at the sites of recycling or disposal [36]. The current study revealed that waste collectors who stated that their work includes both collecting and sorting had (1.92) times more possible to had health problems than those who collected only.

Analysis of health hazards in present study that may be encountered in waste management revealed that less than two thirds (62%) of collectors were exposed daily to domestic waste including papers, cardboard, plastics, canes, rage and food waste. More than half (57%) of them exposed to broken glass and other sharp items. Moreover, slightly less than half (49%) exposed to animal and domestic pets excreta and (41%; 29% respectively) reported exposure to dust and used syringe/needles. These results coincide with results of study done in Egypt (2014) [37] aimed to describe health practices and safety measures adopted by collectors in the main municipal company in Egypt.

Most of the participants were awake to the importance and temporal order of washing hands and healthful practices. Yet, no appropriate washing facilities (with heat water and soap) were accessible close to the gathering points or for those operating within the street. Likewise, lay individuals of low socio-economic customary don't forever follow hand or mouth washing. Though, majority of respondents in this study had hand washing habit with soap before eating, 55 % of them wash their hands before taking medication and 40% of them wash their hands before entering toilet. This result goes in line with study done in Adidas Ababa (2016) [38] in which the hand washing practices performed frequently by 78.6% of solid waste collectors.

In developing countries, solid waste collectors habitually touch the waste while collecting and sorting without wearing gloves. They are also bare to a number of pathogens (bacteria, fungi, viruses, parasites and cysts), toxic substances, chemicals that derive from the waste itself and its decomposition. These collectors do not frequently put their personal protective clothes and therefore tend to handle waste with bared hands and without making use of any tool [39]. Even though somewhat less than two thirds (62%) of solid waste collectors in current study collected waste

manually but about two thirds of them using personal protective equipment , the highest percent of them used safety boots. In opposing to these results, a study done in Hebron and Bethlehem reveals that most of the solid waste collectors did not use PPE [40]. The common reported causes for irregular use of PPE were its not available and it hinder their work these reasons also stated in study done in Nairobi, Kenya (2016) [10] in which personal protective equipment was not regularly used by a considerable number of the participants. Some rational for the shortage in its supply that they can receive pair of thick heavy duty gloves every 4 month, if they are torn during work, not replaced. Later they put only one pair for minimal protection. This holds true for safety boots and gowns supplied every 1 year. Others stated that they prefer working without wearing gloves as they limit their free movement during work or cause skin inflammation and dryness. In addition, a study done in Addis Ababa (2012) [41] revealed that only 43.6% of the waste workers were using PPE while they are on duty and of these, only fifth of them reported as not using it regularly while they are on duty. Not having access (84%), discomfort (26%) and to save time (13%) were the core reasons declared by them for not using the PPE. Furthermore, it was observed from this current result that collectors who did not use of PPE were (2.51) times more likely to had adverse health problems.

In developing countries due to poor working conditions and lack of protection gear accident rates among solid waste collectors are generally high and a major health effect associated with the job has been shown to be injuries caused by work-related accidents [42, 43]. This is consistent with this study wherever more than three quarters (76%) of collectors experienced work related accidents. These resemble to another study, 80% of waste collectors reported wounds in Katmandu, Nepal. [29] Compared to general collectors, the reported relative risk of injuries were 1.3 in Nigeria (2015) [44] and 5.6 in United Arab Emirates (2010) [45]. At this juncture of this study also the most common injury experienced by whole waste collectors were needle stick injury followed by falls, fissure feet and contusions (86.8%, 71.1%, and 57.9% respectively). Additionally, this result reliable with study done in Ethiopia (2016) [46] wherever among the 90 respondents majority of the collectors reported that they were suffering from injuries like cut by sharp instruments on their hand or leg and fracture of hand due to falling. This might be due to the reasons that collectors used their feet to push spade into the pile of garbage and sometimes they wiped waste to put it in spade using feet or hand.

Hospitalization may be a non-fatal health out return that's thought of to be comparatively free from errors related to coverage ill health and may be used as proxy indicator of severe morbidity. The hospitalization rate among waste collectors in study done in India (2013) [47] was 13.1%, but this disparate with present study which shown that about half of collectors experienced hospitalization due to work

related hazards. This discrepancy may be explained by performing routine activities for long period of time with poor working environment by waste collectors had increased vulnerability of different injuries and increase need for hospitalization, additionally this study done in large governorate with available health services and governmental hospitals.

Spending longer durations to handle waste leads to the serious gastrointestinal problems because of their exposure to a number of diseases, vectors and direct skin contact of those material full of flora spores, bacteria, viruses and parasitic ova which will cause the gastro-intestinal discomfort [48]. The results of current study revealed that, the most frequent complaints encountered among waste collectors were gastrointestinal complaints that stated by entire collectors (100%). Similar as in the study conducted among the waste collectors of Kathmandu Metropolitan City (KMC) (2004) [49]. It revealed that a majority of sweepers and loaders were found suffering from such type of gastrointestinal problems as gastric, dysentery, worm infection and vomiting. Contrary to the reported high prevalence of gastrointestinal complaints, only 2% of the participants from other Asian country Taiwan (2001) [50] reported diarrheal diseases. It may be attributed to good awareness and respectable food hygiene practices in conjunction with the use of sanitary latrine by the community making the probabilities of feces contamination less. Contrariwise, Nielsen et al. did not find any excess of GIT symptoms among the waste collectors possibly due to lower concentration of bacteria they appraised in the waste [51].

Regarding eyes problems, current study revealed that vast majority of the collectors had eye problems mainly redness as reported by less than three quarters (73.3%) of the collectors. On the contrary to these results study done in India (2010) [52] showed that 89% of waste collectors from Bombay city had eye problems. Peak of the eye problems were burning sensation, watering redness and itching of the eyes plus 1.7 relative risk of this occupation with eye disease was observed.

In present study, collectors who complained of skin problems constituted (83%) including tineasis (35.9%) and scabies (14.1%) of them which can ensue to allergic or infectious causes and infected ulcers directly caused by organic or chemical wastes and injuries. This was dissimilarly reported from India (2016) [6] which stated that 36.4% of waste collectors had skin lesion. The reasons of this discrepancy may be attributed to un-training and lack of awareness among collectors in which they did not use the personal protective equipment frequently and correctly at work. This explained the result of this study regarding collectors awareness about avoidance of adverse health problems in which the majority (92%) of the collectors stated that they have no knowledge about avoidance of adverse health effects of work and also they had (4.25) times more likely to had health problems.

It is the first time any study reported rumored incidence of nail infection among waste handlers. Nearby less than half of them had nail infection of either fingers or toes of which may be due to fungal infection and lesions with secondary bacterial infection which was worsened by recurrent wetting due to direct contact with waste as reported by them [53].

Greater prevalence of respiratory symptoms mainly cough (dry or productive) were found amongst collectors and street cleaners who are unprotected from both chemical and biological sensitizers in the workplace. Similarly some collectors experienced breathlessness probably due to air way obstruction and inflammation as stated earlier [54-56]. The results of the current study made known that more than three quarters of collectors suffering from respiratory problems mainly cough followed by dyspnea. Previous studies have according the next prevalence of respiratory problems among waste collectors than within the general population like Greece [57]. This may well be explained through the exposure against allergens and toxins contained in waste, seasonal allergens, and infectious agents. Even with the higher prevalence of smokers and ex-smokers as in the Egyptian population.

Among all ergonomic issues, musculoskeletal problems are shared among waste collectors in the form of nonfatal injuries because waste collection is a task which requires recurrent dense physical activity such as heavy lifting, carrying, pulling/pushing of bins and containers that involve static muscle contraction and in future increases the risk of musculoskeletal disorders [58, 59]. The results of the current study publicized that marginally three quarters (74.5%) of collectors suffering from musculoskeletal problems. The joints affected in the order are knee, low back, shoulder and elbow (54.3%, 44.3%, 40% and 35.7%, respectively). This might be attributed to the large bulk of refuse they have to pack manually and hold above shoulder level. Besides, in Egypt collectors tend to use old and traditional equipment and depend mainly on the physical power, likewise around less than two thirds (62%) of collectors in the current study work manual by using their hands. In accord with this result, Abou-Elwafa *et al*, (2012) [27] indicated in a latest study conducted in Egypt higher percentage of musculoskeletal complaints (61%) among municipal solid waste collectors where low back pain was the greatest regularly notified (23%). Moreover, study done in German (2015) [60] stated that the majority of respondents (90%) were found suffering from muscular-skeletal problems like in current study and consider musculoskeletal disorders as major occupational health problem among the waste collectors. This is not surprising since handling waste containers denotes a considerable strain for the musculoskeletal system particularly of the back [61].

As a final point, the high prevalence of adverse health problems and work related accidents revealed in the present study calls for new standardized guidelines and

measures to improve work safety in hazardous waste collection, transport and handling. Protection against personal injury is crucial for all waste workers. All risks ought to be recognized and acceptable protection from those risks should be provided [62]. Though medical waste is collected and disposed in several settings, observation of medical waste (disposable needles, syringes, blades, IV lines, bandages and blood bags) in the general waste stream was mutual. This indicates the need for suitable handling, containment or destruction of these dangerous materials by users prior to disposal [37].

5 Conclusion & Recommendation

The results of this study concluded that, the prevalence of gastrointestinal complaints, eye problems, skin problems, work related injury, respiratory and musculoskeletal problems were stated to be great among solid waste collectors. Predictors of the adverse health effects among solid waste collectors namely age , level of education , duration of employment , type of work , use of personal protective equipment , awareness about adverse health effects , job stress , and job satisfaction . So based on this study, it is recommended that;

- ✚ Awareness programs for waste workers need to be focused to increase their knowledge on occupational health hazards and ergonomic principles.
- ✚ Periodic training regarding wearing of internationally recommended personal protective dressing should be enforced for making the protection of skin, eyes and respiratory airway.
- ✚ Measures are required to enhance the work setting of waste handlers by guaranteeing accessibility protecting gears, clean drinkable and sanitation facilities throughout operating hours.
- ✚ Effective personal hygiene should be maintained by provision of adequate as well as delicate soap, towels or perhaps cleansing wipes on assortment vehicles.
- ✚ The routine medical examination of solid waste collectors must be carried by health officers.
- ✚ Campaign must be planned through mass media to educate residents about the significance of sorting waste before disposal.
- ✚ A system of health recording and routine surveillance among solid waste collectors should be implemented.

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CONFLICTS OF INTEREST

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