

## Effect of an Educational Program on Utilization of Personal Protective Equipment among Municipal Waste Workers at Minia City, Egypt

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### Abstract

Municipal waste workers are exposed to a variety of health hazards at work, which can be protected by wearing appropriate personal protection equipment (PPE). **Aim:** To investigate effectiveness of educational program on utilization of PPE among municipal waste workers at Minia city, Egypt. **Research design:** Quasi experimental design was utilized. **Setting:** The study was conducted at Minia city. **Sample:** A purposive sample of 168 workers. **Data collection Tools:** Four tools were utilized. 1<sup>st</sup> tool: a structured interview questionnaire sheet covered two parts (Socio-demographic characteristics - a history of occupational injuries among workers). 2<sup>nd</sup> tool: Included two parts; Availability and utilization of PPE – A scale of factors that influencing PPE uses. 3<sup>rd</sup> tool: Assessment of Municipal Waste Workers' knowledge about PPE. 4<sup>th</sup> tool: Observational Checklist for Using PPE. **Results:** Mean score of workers' knowledges about PPE was  $10.88 \pm 2.39$  in pretest, increased to  $14.33 \pm 1.97$  in posttest and mean score of their practices was  $6.41 \pm 1.79$  in pretest, increased to  $7.23 \pm 1.44$  in posttest. **Conclusion:** There were highly statistically significant increase in workers' knowledge about PPE and improvements in their utilization level after the educational program. **Recommendations:** Offering PPE more affordable and accessible by municipal authority.

**Keywords:** Educational Program, Municipal Waste Workers & Personal Protective Equipment

### Introduction

Municipal waste collection is a source of revenue for poor people with low educational levels, inadequate housing circumstances in rural locations, and large family sizes with insufficient family income. This position is mostly and formally undertaken by male employees in Egypt, and it is the same in other countries. Workers who worked in garbage collection, sorting, treatment, disposal, and were therefore directly exposed to solid waste, had a lower socioeconomic status, a lower educational level, and lived in rural locations where living conditions lag behind those in urban areas (Wankhede & Wanjari 2021).

Municipal waste workers are particularly vulnerable to chemical, biological, and physical risks, as well as injuries. Gaseous emissions such as hydrogen sulphide and significant amounts of methane, carbon monoxide, and carbon dioxide may develop from decaying garbage at dumpsites, causing nausea, respiratory problems, and headaches (Gutberlet & Uddin, 2017). Additionally, fumes emitted during the burning of lead-containing batteries, paints, and solders may cause lead poisoning. Contact with infected materials can result in biological dangers such as diarrhea, viral hepatitis, tetanus, and HIV (Rogorff & Bidderman 2015; Jerie 2016). Physical

injuries such as puncture wounds, lacerations, burns, dog and rat bites, sprains, abrasions, fractures, eye injuries, and sharp backaches are significantly more common as a result of exposure to sharp waste objects or falling heavy containers. Workers may potentially be injured by landslides, fires, or being buried by mistake. (Kasemy et al., 2021).

Personal protective equipment, or "PPE," is the material used to reduce exposure to risks that might result in significant industrial injuries and illnesses. Gloves, a uniform, respirators, hard helmets, safety glasses, high visibility clothes, and safety footwear are among the items required (Patel & Datta, 2018; Olafimihan et al., 2020).

The use of PPE<sub>s</sub> is one of the most important aspects of occupational health and safety standards for protecting workers' overall health and safety (Balkhyour et al., 2019). Non-use of PPEs exposes workers to a variety of safety and health hazards and risks, which can have serious health consequences (Ahmad et al., 2016). PPE, when available, has been described as uncomfortable and is not always formally enforced (Zolnikov et al., 2021). Employees must be instructed on how to put on and take off PPE, as well as the limitations of the PPE for the procedure at hand. When removing PPE, workers must do it safely (Poller et al., 2018).

In Egypt, waste treatment has mostly concentrated on issues of collection and disposal, with little or no consideration given to the health of garbage collectors (Ewis et al., 2013). Ignorant workers may be unaware of the critical link between infection origins and harmful health consequences. It's likely that a lack of understanding is to blame for a failure to recognize the need for safety and prevention measures like the usage of personal protective equipment (PPE) during waste management (Eassa et al., 2016).

The Occupational Safety and Health Administration (OSHA) calls for all possible measures to be adopted for the OSH of workers from workplace hazards and risks. Depending upon the type and level of hazards, OSHA recommends employing different control measures (elimination, substitution, engineering, administrative, PPEs) to eliminate or minimize hazards to the greatest extent possible (OSHA 2017). When technological and administrative control measures don't perform well in providing sufficient protection, workers should be provided with PPE and training for their use (Ahmad et al. 2016).

Workers will be put at risk when working on unsafe working platforms if PPE is not correctly utilized, stored, or maintained, according to (Goh et al 2016). As a result, it's critical to understand how to apply relevant and appropriate PPE to protect workers' general health and safety (Muema, 2017).

Workers should obtain proper training and knowledge prior to starting new assignments so that they may comprehend the hazards of the job and safeguard their health from any environmental elements that may be present. Material, equipment, and tool knowledge; identified hazards in activities and how to control these hazards; potential health risks; cleanliness standards; and wearing and using PPE must all be covered in training (Gebremedhin et al., 2016).

Professional and specialized practices that provide health and safety programs and services to workers and community groups are known as occupational health nursing. This practice focuses on health promotion and rehabilitation, disease and injury prevention, and workplace environmental hazard protection (Reitz & Scaffa 2020).

The community health nurse has a role in early case detection, management, and referral to other community resources. Also, identifying work-related accidents, occupational health and safety issues, and waste-handling safety techniques are also important (Gizaw et al, 2016; Khoshakhlagh et al, 2017).

### Significance of the study:

The International Labor Organization (ILO) estimates that over 313 million workers in the waste management industry are exposed to non-fatal occurrences that cause work absenteeism and injuries

that could lead to death, as more serious incidents result in about half a million deaths each year. Work-related diseases, including respiratory and cardiovascular diseases, hearing loss, musculoskeletal, reproductive, mental, and neurological issues, affect an estimated 156 million individuals (Global Trends on Occupational Accidents and Diseases, 2015; Rushton, 2017). In comparison to other occupations, this one has the third highest frequency of non-fatal events (Rogorff & Bidderman, 2015).

Egyptian solid waste workers typically deal with dangerous materials by hand, putting their health at risk. Furthermore, waste management practices are typically focused on collection and disposal, with little regard for the health of solid waste collectors (Ewis et al, 2013). Workers can be safeguarded in the workplace by following safety protocols and wearing appropriate personal protective equipment (PPE) (Panthi et al., 2019).

The lack of use of personal protection equipment was validated in a study done in Menoufia (Elsayed & Abdel Malek 2021). In Egypt, most studies (Ewis et al, 2013; Abd El-Wahab et al., 2014; Awad H., 2014; Shams El-Din et al. 2017; Zaky et al. 2018 and Elsayed & Abdel Malek 2021) have focused on assessing occupational injuries caused by exposure to street sweeping and waste collection and all of their results recommended the need for urgent educational/training programs for improving workers' knowledge about occupational hazards and the utilization of PPE. In the light of these recommendations, the current study was carried out to assess the effect of an educational program on the use of PPE among municipal waste workers.

### Aim of the study:

To investigate effectiveness of educational program on utilization of PPE among municipal waste workers at Minia city, Egypt.

### Objectives:

1. To increase knowledge level about PPE among municipal waste workers at Minia city.
2. To improve practice level of PPE utilization among municipal waste workers at Minia city.
3. To assess factors that influence utilization of PPE among municipal waste workers at Minia city.

### Research Hypothesis:

Following the implementation of a health educational program, knowledge score of studied workers about PPE will be increased and their utilization level of PPE will be improved.

### Subjects and Methods:

#### Research design:

Quasi experimental design (Pretest & Post-Test) was utilized in this research study.

**Setting: -**

The study was carried out on municipal waste workers in all four districts of Minia City, which were the West, South, North, and Central districts, Minia Governorate, Egypt

**Sample and sampling:** A purposive sample consisted of 168 workers was used.

All municipal waste workers at Minia City were 300 cleaning workers; 95 at the central district; 75 at the north district; 68 at the south district; and 64 at the west district of Minia City. The required sample size was calculated based on the statistical software EPI-INFO 7.2.4.0. Assuming the maximum variability is equal to 50%, using a confidence interval of 95% and a margin of error of 5%, a minimum sample size of 168 was calculated. Participating workers were selected by using purposive sampling technique, to reach the total numbers of 168 workers, the researchers took 55% of total numbers of workers in each district (53 workers at central district, 42 at the north, 38 at the south and 35 at the west district).

**Exclusion Criteria:**

- Those who were absent, on leave and night duty during the study
- Unwilling to participate in the study
- Have speech disorders, or deaf and damp
- Have previous training program on PPE.

**Tools of Data Collection:**

Data was collected using four tools:

**The 1<sup>st</sup> tool (pretest):** An Arabic structured interview questionnaire that was designed by the researchers to collect the required data. It consisted of the following two parts:

**Part I: Socio-demographic characteristics:** It included six questions (age, residence, education, marital status, job, work experience, and work status).

**Part II: A History of Occupational Injuries and Health Hazards among Municipal Waste Workers:** It included five questions (injury during work in the past year; number of occurrences; types; causes of these injuries; and health care/referral).

**The 2<sup>nd</sup> tool (pretest):** it consisted of the following two parts:

**Part I: Availability and utilization of PPE among Municipal Waste Workers:** It was designed by the researcher and written in Arabic. It included 7 (seven) question related to the availability of PPE, such as using PPE during work, types of PPE used, sources from which workers can get the PPE, ...etc.

**Part II: A Scale of Factors that Influence the Use of PPE among Municipal Waste Workers:** It was developed by Kyalo (2016) and modified by the researchers (to be more relevant to our study population) to collect data related to factors that influence the participants' use of PPE. it consisted of 10 items such as feeling uncomforted in using PPE,

lack of coworker/supervisor, unavailability of PPE, negligence...etc. It was translated into the Arabic language. Its responses are rated by using a 3-point Likert scale by each participant, with 1 = disagree, 2 = neutral, 3 = agree.

**The 3<sup>rd</sup> tool: Assessment of Municipal Waste Workers' knowledge about PPE (pre/post):**

An Arabic structured interview questionnaire that was designed by the researcher after reviewing the relevant literatures, to collect data related to a participant's knowledge about the utilization of PPE. It consisted of 8 (eight) questions about the types of occupational hazards and injuries that can be prevented by using PPE. Meaning of PPE, indications, types that should be used, how to use it properly, repair and replacement, and storage of PPE.

**In scoring system of knowledge,** one (1) grade was given for correct responses, and zero grades were given for incorrect responses. The grades of each correct item are summed up and converted into percent scores. The total knowledge score was divided into three categories: **poor (< 60%), average (60-70%), and good (> 70%)** (Awad H., (2014) & Zaky et al. (2018).

**The 4<sup>th</sup> tool: Observational Checklist for Using PPE among Municipal Waste Workers (pre/post):**

It was designed by Bogale et al. (2014) to collect data related to participants' practices regarding the utilization of PPE for those who have PPE only. It consisted of 20 items related to observed status of different types of PPE that used by workers such as if the used gloves were new, perforated /not well maintained, worn correctly/ well-dressed, fitting correctly or not used ...etc. It was translated into the Arabic language.

**Practice scoring system:**

One (1) grade was given for correct responses, and zero grades were given for incorrect responses. The grades of each correct item are summed up and converted into percent scores. **Satisfactory (compliance with PPE) if the score was  $\geq$  50 %. Unsatisfactory (non-compliance) score was < 50%,** (Zaky et al., 2018).

**Content Validity:** The tools were tested for content validity by a jury panel of five experts in the field of community and public health medicine, who reviewed the tools for clarity, relevance, comprehensiveness, understanding, applicability, and easiness.

**Reliability:** The internal consistency of the interview questionnaire was assessed with the Cronbach's alpha coefficient after the pilot study was completed. Cronbach's alpha coefficient of the 2<sup>nd</sup> tool (part I and II), 3<sup>rd</sup> tool, and 4<sup>th</sup> tool was (0.718, 0.867), 0.753, and 0.706 respectively.

**Pilot Study:**

A pilot study was conducted on 10% of the sample (17 workers) before conducting a pre-test to assess the clarity, reliability, and applicability of the study tools; that were excluded from the study due to major modifications.

**Methodology:****Administrative phase:**

An official letter of the study's approval was obtained from the director of Solid Waste Management in Minia city council to perform the study. The data was collected at the beginning of May 2021 and was completed by the end of October 2021, a six-month period. The current study was accomplished through the following phases:

**Assessment phase (pre-test)**

The researchers conducted the first meeting with participants at their actual work places in streets and household garbage collection areas in all the previously mentioned Minia city districts. Oral informed consent was obtained from participants. A detailed explanation of study objectives was given, including the purpose of the study, the right to privacy, confidentiality and the right to withdraw at any time.

To test the workers' knowledge about PPE and their utilization of it, pretest sheets were distributed and filled in by the researchers. The researchers started a face-to-face individual interview; each interview took about 50-60 minutes (about 4-5 sheets per day). This phase took about two months to fill pretest sheets.

**Planning (preparatory phase):**

Based on the base line data in the assessment phase, the arrangements for conducting the program were made. These included the teaching place, program content and time, number of sessions, teaching methods, and media used. Teaching places: The educational program was conducted at the presidency building in the south, north, west, and central districts of Minia City.

Program duration and content: The total number of sessions was 20. One session for each group, duration of each session was one hour. These sessions discussed occupational hazards and work-related injuries that workers were exposed to; the meaning of PPE, its purpose and indication of PPE; types of PPE that should be used; how to use it properly; repair, replacement, and storage of PPE. Types of occupational hazards and injuries that can be prevented by using PPE and importance of training program about occupational safety and PPE. The teaching methods included group discussion and teaching videos.

The total participants were divided into 20 groups. Each group consisted of 8-10 workers, and the

researchers applied the program to each group at a separate time (two groups per day).

**Implementation phase (carrying out the education program)**

In this phase, the developed educational program was actually conducted and implemented.

The program started at the beginning of July, 2021, and was completed by the mid of August, 2021, it was implemented to workers in terms of sessions at the presidency building in their districts of Minia City. The total number of sessions was 20. One session for each group, duration of each session was one hour. The studied workers were divided into 20 groups. Each group consisted of 8-10 workers, and the researchers applied the program to each group at a separate time (two groups per day). The researchers attended in the study settings two days per week; Saturday and Thursday from 10.00 Am to 1.00 Pm. Sessions were given in the form of group discussion by using audio-visual aids (Power point and videos). Leaflets about the topic that were prepared, written in simple Arabic language and supported by illustrative pictures, were given to participants at the end of the session.

**Evaluation phase (post-test):**

The post-test (the 3<sup>rd</sup> and 4<sup>th</sup> tool of the data collection tools) was done after one month of completing the program to evaluate the effectiveness of the program. The posttest was evaluated the same knowledge and practice as the pretest.

**Ethical Consideration**

Approval to conduct the study was obtained from the director of Solid Waste Management in Minia City Council to perform the study. The purpose of this study was discussed with the participants. Oral informed consent was obtained from participants. A detailed explanation of study objectives was given, including the purpose of the study, the right to privacy and confidentiality, and the right to withdraw at any time.

**Statistical Design**

The collected data was computerized, tabulated, analyzed, and summarized by using statistical tests such as an independent t-test and a Chi-square to test research hypotheses by using SPSS version 26. The level of significance was accepted at  $P < 0.05$  and was considered highly significant when the P-value was less than or equal to 0.01.

## Results

Table (1): Socio-demographic characteristics of studied workers at Minia city (n = 168).

Socio-demographic data of studied workers	No.	%
<b>Age (years)</b>		
< 40 years.	36	21.4
40 < 50.	60	35.7
50 more	72	42.9
Mean $\pm$ SD	43.37 $\pm$ 0.58 years	
<b>Residence</b>		
Urban	104	61.9
Rural	64	38.1
<b>Marital Status</b>		
Single	11	6.5
Married	153	91.1
Divorced	4	2.4
<b>Job</b>		
Street sweepers	141	83.9
Garbage collectors	27	16.1
<b>Education</b>		
Illiterate	114	67.9
Read and write	33	19.6
Basic education	12	7.1
Secondary or university	9	5.4
<b>Work status</b>		
Fixed	160	95.2
Contract	8	4.8
<b>Work experiences</b>		
< 5yrs.	27	16.1
5-10 yrs.	60	35.7
> 10yrs.	81	48.2

Table (2): Distribution of studied workers according to their history of occupational injuries / health hazards at Minia city, Egypt (n = 168).

History of occupational injuries / health hazards	No.	%
<b>Occupational injuries in the past 12 months (n = 168)</b>		
Yes	102	60.7
No	66	39.3
<b>Number of occurrences of work-related injuries (n = 102)</b>		
Once	48	47.1
Twice	44	43.1
More than twice	10	9.8
<b>Types of work-related injuries (n = 102)</b>		
Cuts	59	57.8
Puncture	20	19.7
Fall	4	3.9
Abrasion	7	6.9
Strain or dislocation	9	8.8
Others	3	2.9
<b>Causes of those occupational injuries (n = 102)</b>		
Non-compliance with PPE	39	38.7
Old equipment's	37	36.8
Absence of periodic maintenance	15	14.7
Un availability of work tools	10	9.8
<b>Health care / referral (n = 102)</b>		
Yes	31	30.4
No	71	69.6
<b>Routine medical check-up (n = 168)</b>		
Yes	165	98.2
No	3	1.78

Table (3): Availability and utilization of PPE among studied workers at Minia city, Egypt (n = 168).

Variables	No.	%
<b>Use PPE during work shift (n = 168)</b>		
Yes	69	41.1
No	99	58.9
<b>Use PPE during work shift all the time (n = 69)</b>		
Yes	11	15.9
No	58	84.1
<b>Reasons for not using PPE all the time (n = 58)</b>		
Feeling discomfort	32	55.2
No access	11	18.9
Perceived work to be less risky	10	17.3
To safe time	5	8.6
<b>Sources of getting PPE (n = 168)</b>		
Municipality	22	13.1
Purchase by self	146	86.9
<b>Municipality provide PPE regularly (n = 22)</b>		
Yes	18	81.9
No	4	18.1
<b>PPE training program provided by municipality regularly (n = 168)</b>		
Yes	17	10.1
No	151	89.9

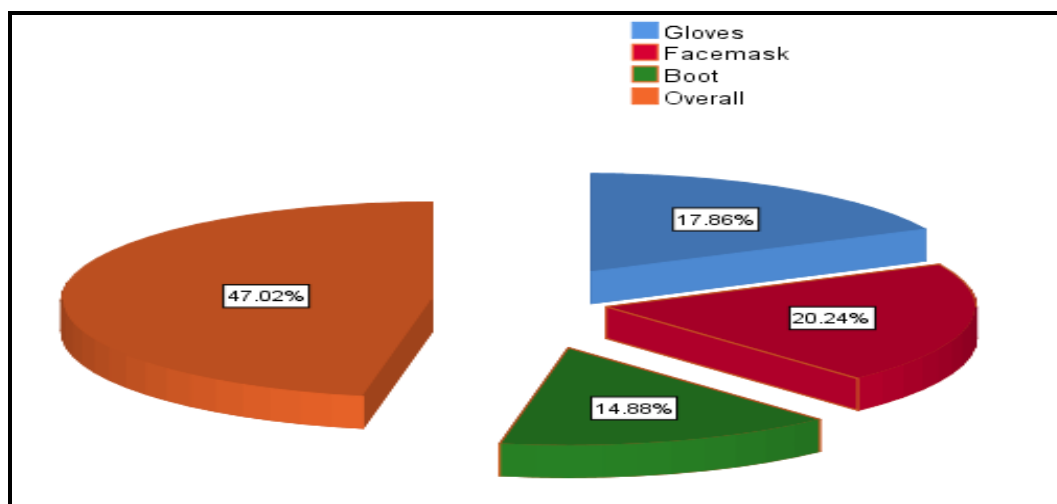


Figure (1): Types of personal protective equipment used by studied workers at Minia city, Egypt

Table (4): Factors influencing the use of PPE among studied workers at Minia city, Egypt. (n = 168).

Factor	Agree		Neutral		Disagree	
	No.	%	No.	%	No.	%
Feeling uncomfortable in using PPE	71	42.3	15	8.9	82	48.8
Feeling hot when wearing PPE	16	9.5	39	23.2	113	67.3
Feeling not fit	75	44.6	41	24.4	52	31.0
Perceived tasks to be less risky / hazardous	112	66.7	36	21.4	20	11.9
Lack of training about occupational health hazards	103	61.3	28	16.7	37	22.0
Lack of awareness about indications of PPE	113	67.3	19	11.3	36	21.4
Lack of coworker/supervisor	118	70.2	17	10.1	33	19.6
Unavailability of PPE	111	66.0	25	14.5	32	18.5
Inaccessibility of PPE	69	41.1	92	54.8	7	4.2
Negligence	57	33.9	37	22.0	74	44.0

**Table (5): Distribution of studied workers according to their utilization of PPE in pretest and posttest, (n = 168).**

PPE	Observed status		Pretest		Posttest		X <sup>2</sup>	P-value
			No.	%	No.	%		
1. Glove	Used		84	50.0	129	76.9	7.816	0.001 **
	Used	New	8	9.0	18	13.4		
		Perforated /not well maintained	35	41.0	50	38.5		
		Worn correctly/ well dressed	55	65.0	93	71.6		
		Fitting correctly	52	61.2	97	74.9		
Not used		84	50.0	39	22.8			
2. Face mask	Used (pre n=107) (Post n=127)	New	88	82.0	110	87.4	4.751	0.001**
		Perforated /not well maintained	15	14.2	16	12.7		
		Worn correctly	72	66.8	119	93.8		
		Fitting correctly	75	69.7	94	74.0		
	Not used		61	36.3	41	24.3		
3. Overall clothing	Used (pre n=116) (Post n=146)	New	20	17.09	29	20.1	6.025	0.001 **
		Perforated /not well maintained	34	29.4	40	27.7		
		Worn correctly	78	66.2	119	81.4		
		Fitting correctly	83	71.0	116	79.5		
	Not used		52	31.0	22	12.9		
4. Shoe cover/boot	Used (pre n=99) (Post n=141)	New	5	3.9	80	5.7	7.461	0.001 **
		Perforated /not well maintained	59	59.6	54	38.6		
		Worn correctly	90	91.0	135	95.7		
		Fitting correctly	87	88.2	133	94.2		
	Not used		69	41.1	27	15.7		

Test used: paired sample T test.

\*\* Statistically significant at P – value ≤ .01

**Table (6): Distribution of studied workers according to their total levels of knowledge about PPE and their utilization of PPE (n= 168)**

Total score	Pretest		Posttest		T	P- Value
	No	%	No	%		
<b>Knowledge levels (total score of knowledge)</b>						
Poor < (50%)	78	46.4	30	17.9	21.507	0.001**
Average (50- 75%)	49	29.2	55	32.7		
Good > (75%)	41	24.4	83	49.4		
<b>Mean ± SD</b>	10.88± 2.39		14.33 ± 1.97			
<b>Utilization of PPE</b>						
Unsatisfactory	90	53.6	37	22.1	8.418	0.001**
Satisfactory	78	46.4	131	77.9		
<b>Mean ± SD</b>	6.41 ± 1.79		7.23 ± 1.44			

Test used: paired sample T test.

\*\* Statistically significant at P – value ≤ .01

Table (7): Relation between studied workers' knowledge about occupational injuries and PPE and their demographic data in pretest and posttest, (n = 168).

Demographic data of workers	Workers Knowledge					
	Pretest			Posttest		
	Poor (n = 78)	Average (n= 49)	Good (n = 41)	Poor (n = 30)	Average (n= 55)	Good (n= 83)
<b>Age/year</b>						
20<40 yrs.	24	9	3	2	6	27
40<50 yrs.	50	10	0	24	39	18
50-60 yrs.	4	30	38	4	10	38
X <sup>2</sup> (P – value)	96.173 (0.001)**			1360.001 (0.001)**		
<b>Residence</b>						
Urban	24	39	41	3	39	62
Rural	54	10	0	27	16	21
X <sup>2</sup> (P – value)	63.794 (0.001)**			97.024 (0.001)**		
<b>Marital Status</b>						
Single	6	2	3	3	2	15
Married	68	47	38	26	42	61
Divorced	4	0	0	1	11	7
X <sup>2</sup> (P – value)	5.531 (.237) <sup>NS</sup>			15.320 (0.001)**		
<b>Education</b>						
Illiterate	30	46	35	4	25	64
Read and write	32	1	4	14	8	9
Basic education	12	0	1	12	20	3
Secondary or university	4	2	1	0	2	7
X <sup>2</sup> (P – value)	66.781 (0.001)**			65.368 (0.001)**		
<b>Work experiences</b>						
< 5yrs.	20	7	0	6	11	22
5-10 yrs.	50	10	0	20	10	16
> 10yrs.	8	32	41	4	34	45
X <sup>2</sup> (P – value)	95.672 (0.001)**			157.333 (0.001)**		
<b>Work status</b>						
Fixed	70	49	37	28	50	66
Contract	8	0	4	2	5	17
X <sup>2</sup> (P – value)	9.692 (.008)**			14.305 (0.001)**		
<b>Job</b>						
Street sweepers	51	47	36	16	49	71
Garbage (solid waste) collectors	27	2	5	14	6	12
X <sup>2</sup> (P – value)	37.119 (0.001)**			32.170 (0.001)**		

NS= Not statistically significance

\*\* Statistically significant at P – value ≤ .01.



**Table (8): Relation between studied workers' utilization of PPE and their demographic data in pretest and posttest, (n = 168).**

Demographic data of workers	Workers utilization of PPE			
	Pretest		Posttest	
	Unsatisfactory (n = 90)	Satisfactory (n = 78)	Unsatisfactory (n = 37)	Satisfactory (n = 131)
<b>Age/year</b>				
20<40 yrs.	24	10	7	36
40<50 yrs.	60	2	28	23
50-60 yrs.	6	66	2	72
X <sup>2</sup> (P – value)	113.723 (0.001)**		85.411 (0.001)**	
<b>Residence</b>				
Urban	26	78	0	104
Rural	64	0	37	27
X <sup>2</sup> (P – value)	89.600 (0.001)**		77.107 (0.001)**	
<b>Marital Status</b>				
Single	0	11	4	11
Married	86	67	33	116
Divorced	4	0	0	4
X <sup>2</sup> (P – value)	6.587 (.082) <sup>NS</sup>		4.652 (.098) <sup>NS</sup>	
<b>Education</b>				
Illiterate	45	69	0	114
Read and write	33	0	25	8
Basic education	12	0	12	0
Secondary or university	0	9	0	9
X <sup>2</sup> (P – value)	58.494 (0.001)**		132.709 (0.001)**	
<b>Work experiences</b>				
< 5yrs.	24	3	10	27
5-10 yrs.	60	1	25	23
> 10yrs.	6	74	2	81
X <sup>2</sup> (P – value)	134.942 (0.001)**		85.411 (0.001)**	
<b>Work status</b>				
Fixed	85	75	35	123
Contract	5	3	2	8
X <sup>2</sup> (P – value)	.269 (.604) <sup>NS</sup>		2.373 (.123) <sup>NS</sup>	
<b>Job</b>				
Street sweepers	63	78	12	129
Garbage (solid waste) collectors	27	0	25	2
X <sup>2</sup> (P – value)	27.881 (0.001)**		93.288 (0.001)**	

NS= Not statistically significance

\* Statistically significant at P – value ≤ .05

\*\* Statistically significant at P – value ≤ .01.

**Table (9): Correlation between studied workers' knowledge about occupational injuries. and their utilization of PPE in pretest and posttest, (n = 168).**

Variables	Pretest		Posttest	
	Knowledge	Practices	Knowledge	Practices
<b>Knowledge</b>				
r. value	1	.752	1	.630
P. value	-	0.001**	-	0.001**
<b>Utilization of PPE</b>				
r. value	.752	1	.630	1
P. value	0.001**	-	0.001**	-

\*\* Correlation is significant at the 0.01 level (2- tailed). \* Correlation is significant at the 0.05 level (2- tailed).

**Table (1):** Illustrates distribution of the studied workers according to their socio-demographic characteristics. It shows that 42.9% of them were aged more than 50 years, with a mean age of  $43.37 \pm 0.58$  years, 91.1% of them were married, 61.9% were from urban areas and 67.9% of them were illiterate. In terms of work status, 95.2% have a fixed (permanent) job, and nearly half of them (48.2%) have more than ten years of experience. The majority of them (83.9%) were street sweepers.

**Table (2):** Reveals that 60.7% of studied workers were exposed to occupational injuries. 57.8% of them reported cut wounds followed by puncture wounds (19.7%) and 38.7% of them reported that non-compliance with PPE was the cause of those injuries. Only 30.4% of injured workers have been referred to health care. The majority of workers (98.2%) did not have routine medical checkup.

**Table (3):** Reveals that 41.1% of participants were using PPE during work shift, while 84.1% said they did not use it all of the time. The main reasons mentioned by workers for the none use of PPE were; feeling discomfort while using (55.2%); no access (18.9%); perception of work to be less risky / hazardous and therefore there is no need to use PPE (17.3%); and to save time (8.6%).

Concerning sources from which they can get PPE, the majority of participating workers (86.9%) purchase it for themselves. The majority of studied workers (89.9%) reported that their municipality doesn't provide them with regular training programs about occupational safety.

**Figure (1):** Illustrates types of PPE used by studied workers at Minia city, Egypt. It revealed that 47.0% of workers reported that they used overall, followed by face masks (20.2%), gloves (17.9%) and boots (14.9%).

**Table (4):** Represents factors that influenced the use of PPE among studied workers. It reveals that lack of supervisors (70.2%), lack of awareness about indications of PPE (67.3%), perceived tasks to be less risky / hazardous (66.7%), and unavailability of PPE

(66.0%) were the most common factors influencing workers' uses of PPE.

**Table (5):** Illustrates the distribution of studied workers according to their observed practices of PPE utilization in the pretest and posttest. It indicates that there were highly statistically significant differences among workers' usage of PPE in both pre and post educational intervention (where p-value was 0.001). The percentage of workers who don't use gloves, face masks, overall clothing, and shoe covers/boots decreased from 50.0%, 36.3%, 31.0% and 41.1% respectively in pre-educational intervention to 22.8%, 24.3%, 12.9% and 15.7% respectively after educational intervention.

There were highly statistically significant differences among the observed status of different types of PPE that used by workers such as if it was new, perforated /not well maintained, worn correctly/ well-dressed and fitting correctly in both pretest and posttest where p-value were 0.001 for each type of PPE.

**Table (6):** Describes the distribution of studied workers according to their total knowledge and practice levels about utilization of PPE. It revealed that the mean score of their knowledge was  $10.88 \pm 2.39$  in pretest and increased to  $14.33 \pm 1.97$  in posttest with highly statistically significant increase in their knowledge level. Additionally, the mean score of their practices was  $6.41 \pm 1.79$  in the pretest and increased to  $7.23 \pm 1.44$  in the posttest with highly statistically significant improvements in their practices level.

**Table (7):** Illustrates that there was a highly statistically significant relation between workers' total knowledge about PPE and their demographic data related to their age, residence, education, job, work experience, and work status in both the pretest and posttest where P-values were 0.001, 0.001, 0.001 and 0.001 respectively.

**Table (8):** Illustrates that there was a highly statistically significant relationship between workers' utilization of PPE and their demographic data related to their age, residence, education, job, and work experience in both the pretest and posttest where P-

values were 0.001, 0.001, 0.001, 0.001, 0.001, 0.001, 0.001, 0.001, and 0.001 respectively.

**Table (9):** Illustrates the correlation between studied workers' knowledge about occupational injuries and PPE and their utilization of PPE in pretest and posttest. It showed that there was positive correlation between workers' knowledge and their practices in the pretest where  $r\_value$  was 0.752 with highly statistically significant differences where  $p\_value$  was 00.001.

Furthermore, there were positive correlations between participant workers' knowledge about occupational injuries and PPE and their utilization of PPE after implementation of the educational program where  $r\_value$  was 0.630 with highly statistically significant differences where  $p\_value$  was 0.001.

### Discussion:

Street sweepers and garbage collectors are exposed to different health hazards (Adekiya et al., 2022) that lead to significant morbidities because of their work environment. They are vulnerable and susceptible to a wide range of occupational diseases as they are frequently exposed to dust, biodegradable trash, bio-aerosols, volatile organic matters, and mechanical stress (Habybabady et al., 2018; Olafimihan et al., 2020). They can be protected by using adequate PPE (Panthi et al., 2019).

Effective protective equipment should be provided and maintained by the employer for the use of workers. By wearing appropriate PPE, workers can help reduce some of the hazards that are inherent to their jobs and prevent occupational injuries and illnesses (Johnson & John, 2020). Non-compliant use of PPE or lack of its provision at the workplace has been reported in studies across many countries (Lissah et al., 2020 & Adekiya et al., 2022).

The present study showed that the mean age of workers was  $43.37 \pm 0.58$  years., the vast majority of them were married, and nearly two thirds of them were illiterate. From the researchers' points of view, street sweeping and collecting waste is work that is carried out by very poor individuals that have no or low educational and socioeconomic levels and who are married and responsible for a large family. It was in the same line with a study conducted by Zaky et al., (2018) in Assiut city, Egypt, which revealed that around two fifths of the workers aged more than 50 years, more than two thirds of the studied workers were illiterate. Also, it agrees with a study by Mostafa et al., (2015) in Cairo, Egypt, which found that the participants of the study group were above or equal to 40 years old and two-thirds of them were sweepers. The majority of them were married and not educated.

Regarding their work status, the vast majority of workers have a permanent job, and nearly half of them have work experience of more than 10 years. Because about half of them were over the age of 50 years. It comes in compliance with a study conducted by Rungsoongnoen et al., (2019) in Mueang Sisaket District, which revealed that most workers in both experimental and comparison groups have working experience of more than ten years or more. It also contradicted a study conducted by Johnson & John (2020) in Uyo, Nigeria, which revealed that all of the participants were temporary workers with an average tenure of  $2.89 \pm 1.20$  years

The current study highlighted that the vast majority of workers did not have routine medical checkups. From the researchers' points of view, it might be attributed to the lack of provision of such health services by the government to this low-social-class job, a lack of medical insurance and a lack of attention paid by the authorities to ensure their protection. In addition, street sweepers and waste collectors are usually socially and economically deprived and have no access to medical checkups. Similar findings were demonstrated by a study of Adekiya et al., (2022) in Abuja Municipal Area Council, which revealed that the majority of domestic waste collector/sweepers did not have routine medical checks, and a study conducted by Adeyi & Adeyemi (2019) in Nigeria, which reported that the majority of workers don't have routine medical check-ups due to a lack of medical insurance.

The current findings revealed that about two thirds of workers were exposed to occupational injuries in the last 12 months. This could be attributed to a lack of awareness about occupational safety and poor compliance with using PPE, in addition to the variety of hazards in their workplace that are associated with eye, nose, throat, and respiratory symptoms. Similar findings were demonstrated by Byonanebyea et al., (2022), in Kampala, Uganda, where nearly two-thirds of workers reported occupational injuries in the previous twelve months, and Miwano et al., (2018) in Obio/Akpor Local Government Area of Rivers State, where the majority of workers exposed to various hazards during work. It also agreed with Zaky et al., (2018), which presented that more than two thirds of the studied workers were exposed to injury during work.

Regarding to the most frequent types of work-related injuries, more than half of workers reported cut wounds, followed by puncture wounds, which could be explained by workers' direct contact with injurious substances at work, such as sharp-pointed objects pressing into and slicing the skin tissue and sharp-edged objects piercing the skin tissue (as broken glasses, needles, sharp-edged cans, etc.) as they

collect produced wastes manually with no protection. It was consistent with the findings of **Byonanebyea et al., (2022)** in Kampala, Uganda, who reported that the most common injuries were backpain, cuts, and skin wounds, and a study conducted by **Rungsoongnoen et al., 2019**, in Mueang Sisaket District, which revealed that being cut by a sharp object was the most common type of accident in the majority of both trial and comparison groups. It also agreed with **Shams El-Din et al. (2017)**, which reported that about two thirds of studied workers experienced one or more injuries, and the most frequent ones were cut wounds and punctured wounds.

The findings of the current study revealed that less than one third of injured workers have been referred to health care. It might be explained that since street sweeping and garbage collecting are negligible jobs and are done by people of lower socioeconomic class and those with lower educational levels, less attention is paid to their health. These findings agree with a study by **Olafimihan et al., (2020)** in Ilorin Metropolis, Nigeria, which reported that nearly one third of workers were referred for medical examination.

More than half of workers didn't use PPE during work. The main reasons mentioned by them were: feeling discomfort while using; no access (unavailability); perception of work to be less risky/hazardous, and therefore there is no need to use PPE; and to save time. The researchers viewed that lack of regular provision of occupational safety training and PPE training by municipal authorities might lead to a lack of workers' awareness about the usefulness of PPE in protection against different occupational hazards. In addition, the lack of regular provision of PPE by the municipality might hinder them from utilizing it. This reflects the necessity/need of providing educational and training programs regarding occupational safety and the uses of PPE. Similar results were revealed by **Byonanebyea et al., (2022)**, which reported that the main reasons for not using PPE were not possessing it, reluctance to utilize it, and thinking that the PPE was not useful; also by **Alemu et al., (2020)** in Addis Ababa, Ethiopia, which studied building construction worker and demonstrated that the unavailability of PPE and the absence of workers orientation on using it were the main reasons for not using it.

Concerning sources from which they can get PPE, the vast minority of workers reported that the municipality provide them with it regularly. Also, the majority of workers reported that the municipality doesn't provide them with regular training programs about occupational safety. From the researchers' point of view, as mentioned above, little or no attention was

paid to their safety and protection due to the traditional cultures that label their job as a negligible occupation. These findings came in agreement with **Olafimihan et al., (2020)**, which stated that more than three quarters of the respondents reported that PPE was sourced for by themselves and not by the municipality, and also with **Johnson & John, (2020)**, which revealed that none of the workers received any safety training due to a lack of provision of training by employers; and with **Abrha et al., (2021)**, in Northern Ethiopia, which reported that no safety training was given during employment time as mentioned by workers. Similar findings were reported by **Byonanebyea et al., (2022)**, which indicated that most of the respondents' daily income was below the poverty level. This may explain why most waste workers are using improvised PPE. Therefore, the informal sector should be prioritized for PPE accessibility.

The overall (apron) was the type of PPE that was most frequently used by workers, followed by face masks, gloves, and boots. It might be attributed to the fact that the apron was an obligatory uniform for each worker to wear as it was a compulsory requirement for sweeping and waste collecting jobs, while other types were less used. This might be due to lack of awareness about its benefits or absence of managerial supervision that enforces and reminds workers to use these types. It was consistent with **Adekiya et al., (2022)**, which revealed that the apron was the most commonly used PPE among the domestic waste collectors/sweepers, followed by face masks, boots, and hand gloves. It also agreed with **Johnson & John (2020)**, which reported that the apron was the most commonly used by workers, and with the results of **Patel & Datta (2018)**, in Delhi, India, which showed that eighty-six percent of workers used aprons and reflectors. Additionally, it wasn't in agreement with **Erah et al., (2018)** in Edo state, Nigeria, which stated that the apron was the least used PPE among workers and the findings of **Byonanebyea et al., (2022)**, which reported that the most common PPE used by the respondents were gloves and boots.

The current study highlighted that the most common factors influencing utilization of PPE among workers were lack of manager supervision, followed by lack of awareness about the indication of PPE, lack of safety training programs, perceived tasks to be less risky / hazardous, and finally unavailability of PPE. It can be explained that workers who are supervised might be reminded and enforced to use PPE with a fear of being fired from the job (**Ayu et al., 2018; Alemu et al., 2020**).

It was supported by the findings of **Alemu et al. (2020)** in Addis Abeba, Ethiopia, who found that the presence of training on PPE use and safety training,

safety orientation before starting work, and the presence of supervision were the most frequently influencing PPE use among workers. These findings come in disagreement with **Byonanebyea et al., (2022)** in Kampala, Uganda, which reported that age, work experience, prior training, and high daily income were factors influencing utilization of PPE among workers; also with **Abrha et al., (2021)**, in Northern Ethiopia, which revealed that unavailability of PPE was the main reason for not using it.

Furthermore, the current study highlighted that there were highly statistically significant differences with increase and improvement in workers' total score of knowledge (about occupational injuries and PPE) before and after the educational intervention and their utilization of PPE before and after the educational intervention. It might be attributed to the positive effectiveness of the educational intervention in changing knowledge and skills/practices of workers for using PPE at work places. These findings are supported by **Rungsoongnoen, et al., 2019**, in Mueang Sisaket District, which revealed that knowledge of the experimental group (related to occupational threats and PPE) and their wearing behavior of PPE after intervention is better than before, with statistically significant differences.

Additionally, the current study illustrated that there was a highly statistically significant relationship between workers' utilization of PPE and their demographic data related to their age, residence, education, job, and work experience in both the pretest and posttest. From the researchers' point of view, this correlation may be explained because older workers are more aware of and familiar with PPE, as well as their fear of contracting diseases. Place of residence; both in rural and urban areas can also affect the use of PPE, as the ease of access of urban residents to the workplace encourages them to bring PPE compared to rural residents. On the other hand, because of the illiteracy of the workers, they were more willing to learn more about the usage of personal protective equipment. As well, because street sweepers are more likely to meet with the local municipal authorities because they are afraid of being penalized or receiving discounts if they do not use PPE.

This finding was supported by **Byonanebyea et al., (2022)**, who showed that prior training in PPE use and older age were associated with higher odds of PPE use. Also, it was consistent with findings of **Panthi et al., (2019)**, which revealed that education was found statistically significant related to the use of PPE. It was also similar to a study of **Diwe et al., (2016)**, in the South Eastern State of Nigeria, which indicated that age, sex, and recipient of pre-employment were found statistically significant with

the use and awareness of PPE, and **Laor et al. (2018)**, which highlighted that age and education level were statistically significant with the KAP level on medical solid waste management. This finding contrasts with the findings of **Asgedom et al. (2019)**, who discovered no correlation between knowledge score, years of experience, and workers' age.

Based on the results of this study, implementing an educational program on the proper use of personal protective equipment (PPE) assists municipal waste workers (MWW) in gaining necessary knowledge and improving their practices of PPE utilization. As a result, the educational program benefited municipal waste workers. Given the findings, the hypothesis that "Following the implementation of a health educational intervention, the use of personal protective equipment by municipal waste workers will improve" was supported

### Conclusion:

The present research concluded that, two-thirds of the studied workers were exposed to occupational injuries and the majority of them did not use PPE all of the time. As regards to the types of PPE that are mostly used by workers, nearly half of them wore an overall. The most common factors influencing utilization of PPE among workers were lack of manager supervision, followed by lack of awareness about the indication of PPE, lack of safety training programs, perceived tasks to be less risky / hazardous, and finally unavailability of PPE. The vast majority of workers reported that the municipality doesn't provide them with PPE regularly.

Additionally, there were highly statistically significant differences among workers' usage of PPE as well as improvements in their knowledge and practice level after the application of educational program.

### Recommendations:

- Offering PPE more affordable and accessible by municipal authority.
- Assertive managerial supervision that enforces workers to use all types of PPE should be started.
- Regular checkup for PPE along with proper maintenance for it during the work.
- A periodic training program about PPE and workplace hazards should be provided and offered regularly by municipal authority.
- Applying health education about PPE for municipal waste workers to a large sample in different settings to confirm the current results.

**Limitation of the study:** The main obstacle which encountered the researchers during carrying out this study is that some participants who were included in

the post test were absent, or on leave or on night duty during carrying out the posttest.

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