

Occupational Health Hazards among Sewage Workers at Al – Qalyobia Governorate

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Abstract

Background : Sewage workers face several occupational health hazards. **Aim of the study:** The aim of the study was assessing the occupational health hazards among sewage workers at Al- Qalyobia Governorate. **Subjects& methods: Research design:** Descriptive exploratory design was used. **Setting:** The study conducted in all pumping and treatment stations affiliated to Al-Qalyobia Drinking water and Sanitation Company. **Subjects:** Stratified sample was used and 140 workers were included. **Tools of data collection:** a structured interview questionnaire, Observation sheet & Laboratory investigations. **Results:** The study results revealed that more than three quarters of studied sample reported that they exposes to psycho social hazards followed by physical hazards. And the most health problems among studied sample were skin problems, musculoskeletal, runny nose and cough, diarrhea, abdominal colic`s, nausea, vomiting and headache. Positive correlation between satisfactory knowledge and age, educational level and duration of work. **Conclusion:** It was concluded that sewage workers exposes to high levels of occupational hazards, personal protective equipment was not regularly used by a considerable number of the participants, most of sample had unsatisfactory knowledge regarding safe procedures during work stages. **Recommendations:** Health education programs should be conducted for both the workers and the relevant authorities regarding occupational diseases and hazards and its prevention, workers should be provided with protective clothes and equipment and seek medical supervision, vaccination and basic hygiene precautions are important.

Key words: Occupational, Health hazards, Sewage, Workers.

Introduction

Workers involved in sewage disposal system face several occupational health and safety hazards when they repair sewer leaks, take sewage samples, remove obstructions in sewers, and make sure raw sewage is properly treated⁽¹⁾. The physical working conditions of the sewage workers are bad; they are bending and kneeling in confined spaces and are exposed to high levels of noise, poor visibility, they may be at risk for falling while getting into the space, drowning is a threat, as well as electrocution⁽²⁾.

Sewage and wastewater contain bacteria, funguses, parasites, and viruses that can cause intestinal, lung, and other infections. Leptospirosis is an important occupational disease affecting people coming in contact with animals such as rats, skunks, opossums, raccoons,

foxes, and other vermin or their discharges⁽³⁾.

The most common way for microorganisms to enter the body is through hand to mouth contact during eating, drinking, smoking or wiping the face with contaminated hands or gloves. It is vital to follow strict hand hygiene measures (e.g. washing hands before eating, changing out of contaminated clothing before eating, drinking or smoking), microorganisms can also enter the body through cuts, scratches or from a puncture wound from a discarded hypodermic needle⁽³⁾.

Sewage workers are commonly exposed to gases like hydrogen disulfide, methane, ammonia and carbon monoxide, methane,...etc., these substances can become immediately dangerous to life or health, exposure can cause serious

permanent health effects or the worker may become dizzy or unconscious and not able to escape ⁽⁴⁾.

They also suffer from occupational lung diseases and upper respiratory tract infections, allergic problems especially of the skin like contact dermatitis, neurological problems like headache, dizziness and numbness, eye problems like burning, watering and redness, gastrointestinal problems like diarrhoea and parasitic infections and musculoskeletal problems like fatigue/weakness and backache ⁽⁵⁾.

Engineering controls and work practices are the best ways to protect workers from exposures to disease. When engineering controls are not possible, use personal protective equipment (PPE). Thus, the need arises for adequate training and education about the hazards of wastewater and sewage, a place to wash and clean up after work, the right PPE, such as gloves, goggles, a face shield, water-resistant suit, or respirator, clean areas set aside for eating and smoking and cleaning facilities or services for clothing and equipment ⁽⁶⁾.

Employees involved with sewage work should be routinely offered inoculations against Tetanus and Polio, and they should be kept up to date. Hepatitis B immunisation should be offered on the basis of a risk assessment. The risk assessment should take into account the likelihood that employees may come into contact with used syringes or needles. Some sewage workers are also offered vaccinations against Hepatitis A ⁽⁷⁾

Significance of the study:

There are about 50000 workers at Egypt works in about 600 sewage stations and more than 1800 sewage worker in Al- Qalyobia Governorate working in about 48 sewage pumping and treatment stations

Sewage workers are potentially exposed to a wide variety of physical, chemical and biological hazards by virtue of their occupation, in spite of this they have received a little attention and only a few studies have been conducted in this area. This study designed to assess these hazards, determine the factors that affect the occupational hazards and develop guidelines to improve their health and prevent illness.

Aim of the study

The study aims to assess the occupational health hazards among sewage workers at Al- Qalyobia Governorate.

Through the following objectives:-

- Assess the prevalence of occupationally health hazards among sewage workers
- Determine the factors that affect the prevalence of occupational health hazards
- Develop guidelines to improve workers health and prevent illness

Research questions:-

1. What are the occupational health hazards among sewage workers?
2. What are the factors that affect the prevalence of occupational health hazards?
3. What are the protective measures used to improve workers health and prevent illness?

Subjects and methods

Study design:

Descriptive exploratory design was used to carry out this study

Study Setting: All pumping and treatment stations (48 stations) affiliated to Al – Qalyobia Drinking water and Sanitation Company

Study Sample: Stratified sample was used.

The first stage: Al – Qalyobia Drinking water and Sanitation Company divided to ten sectors

The second stage: Simple random sample was used to select tow stations from every sector

The third stage: All the sewage workers (140) in selected settings and having the following inclusion criteria were included in the study:-

- Work in the station at least one year
- Free from any medical problems before employment
- Accept to participate in the study

Tools of data collection

I): Interviewing questionnaire: it was developed by the researcher and composed of five parts:

Part 1: Personal data such as name, age, experience, education, salary, marital status and residence

Part 2: Assess factors that affect occupational health among sewage workers: personal factors such as smoking, eating and drinking habits and personal hygiene, health services as medical checkups, vaccination, educational sessions and protective equipment, and work related factors as source of clean water

Part 3: Medical history: current health problems related to work such as eye and nose irritation, fever, headache, back pain, traumatic injuries, asthma and abdominal colic

Part 4: Assess the prevalence of occupational health hazards among study sample: physical, biological, chemical and psycho- social

Scoring system for occupational hazards *Alberta Health Services* ⁽²⁾ & *(Centers for Disease Control and Prevention)* ⁽⁹⁾

For each type of hazards, each variable was scored as (1) for yes and (0) for no (total score = 24)

A total occupational work hazard was calculated as:-

- No risk ----- (0).
- Mild risk ----- (1-30%)
- Moderate risk ----- (>30-60%)
- High risk ---- (≥60%).

Part 5: Assess of workers knowledge about safe work practices: pre entry planning, entry procedures and at the end of the work stages

Scoring System for safe work procedure:

For each question yes answer for question was scored as (1), and no was scored as (0) total score = 25

A total knowledge score was calculated as (According to sample)

-Unsatisfactory -----<60% of total knowledge score

-Satisfactory -----≥60% of total knowledge score.

II): Assessment sheet: Include the following:-

1- Measure body mass: Worker's weight and height measurement was obtained and their Body Mass Index calculated as the following equation according to **WHO** ⁽⁴⁾:
BMI= weight is in kilograms / the height in meter.

- BMI= from 18.5 up to 25: Optimal weight
 - BMI lower than 18.5 :Underweight
 - BMI from 25 up to 30: Overweight
 - BMI from 30 upwards: Obese
- 2- Examination of worker's body general appearance such as skin, face, teeth, nails, lips and eyes, each worker was examined by the researcher to observe unhealthy signs. One point for good sign and zero point for bad, signs were categorized as healthy if ≥ 50% of maximum score (22 grade) and unhealthy if < 50%.
- 3- Measure vital signs: (temperature, blood pressure, heart beats and respiration rate).

III): Laboratory investigations: General urine & stool analysis to detect presence of any microorganisms, blood analysis (CBC – HAV – HBV – HCV) to diagnose the occupationally health hazards.

Content Validity & Reliability.

Validity of the tools was tested for content validity by Jury of five experts in the field of community health nursing and community health medicine to ascertain relevance and competences Using test – retest reliability. This method was done by administration of the same tools to the same subjects under similar condition on one or more occasions. Answers from repeated testing were compared, the correlation between scores on the first test & the scores in the re-test are used to estimate the reliability of the tool. The tool was strongly reliable in which $R = 94.6$.

Field work:

The study was conducted during the period from October 2014 to the end of March 2015 and it passed through phases:-

Phase I: (Preparatory phase):- It included reviewing of national and international related literature using journals, magazine, periodicals, textbooks, and internet to gain knowledge about the study & develop tools for data collection.

Phase II: Data were collected by the research through visiting the selected stations two day per week for each site. The aim of the study was explained to every worker before start the interview in order to get their oral approval to participate in the study. The sheet took about 20 minute to be filled in. And 10 minutes for measuring height, weight and vital signs.

Every subject of the studied sample was referred to a laboratory near his work place, after an agreement with the laboratory in order to conduct the required tests.

Phase III: Develop guidelines about occupational health hazards among sewage workers for workers and employers

The guideline aims to improve sewage workers health and prevent illness and include the following:-

- Definition of occupational health hazard
- Factors that affect occupational health

- Types of occupational health hazards among sewage workers
- Current health problems among sewage workers
- Control of hazards

Pilot study:

A pilot study conducted for 10% of the study subjects after the development and modification of the tool and before starting data collection to test the feasibility, clarity and objectivity of the tool. It also helped to estimate the time needed to complete the data collection forms. The workers who have participated in pilot study were excluded from the main study sample.

Administrative and Ethical considerations:

A written permission for data collection was obtained by submission of official letters issued from the faculty of nursing Zagazig University to the chairman of Al-Qalyobia Drinking water and Sanitation Company, who gave a written permission to the manager of each station, then took permission to conduct the study in the station, oral informed consent of the workers was obtained to agree to participate in the study .At interview, each subject was informed about the purpose of the study, and they were informed that their participation is voluntary and they have right to withdraw from the study at any time without giving any reason. In addition, confidentiality and anonymity of the subjects were assured through coding of all data.

Statistical design:

Data analysis was performed using IBM SPSS statistical software version 13. The data were explored. Descriptive statistics with mean and standard deviation (SD) for continuous variables and frequency for categorical variables were analyzed. Chi-square test was used to detect the relation between the variables, statistical significance was considered at p -value < 0.05 .

Results

Table (1) reveals that about the third of the studied sample aged 40 to less than 50 years (31.4%). 41.4% of studied sample were illiterate. They worked in sewage 10 < 15 years (31.4%), more than one quarter works more than 8 hours daily (27.1%). Also, 30% of subjects have no week end. 52.9% of the studied sample was married. 37.1% of them come from rural residence. Also 73.6% of the sample reported the monthly income was insufficient.

Table (2) indicates that 30.7% of the studied sample had leukocytosis and more than one fifth were anemic (22.9%). 30% of studied sample were positive HAV followed by positive HCV (22.1%), then positive HBV (15%). Also 15.7% of studied sample had G. lambylia and Ascaris in 34.3%. Pus cells was fined in urine of 44.3% of studied sample

Table (3) illustrates that 77.9% conducting medical examination before placement and no one performed any laboratory tests, X rays or US. Also none of the study subjects take vaccinations or performed periodical medical examinations and only 12.1% & 14.3% respectively attended first aid & safety and health sessions.

Table (4) indicates 33.6% used safety boots & 31.4% lighter, 11.4% used overall but no one used goggles.

Table (5) illustrated the workers aged 40 to less than 50 years they exposed to moderate to high occupational hazards (33.3%, 29.2% respectively), also illiterate group were more liable to exposed to moderate and high risk of occupational hazards (38.7% & 44.7% respectively). The moderate and high exposure to occupational hazards among those worked from 10 to 15 years (33.3%, 44.6% respectively).

Table (6) indicates the worker who had satisfactory level of

knowledge about safety measures were belong to age group 40< 50 year (46.7%), with intermediate education (40.4%), and their duration in the work > 15 years (46.7%)

Figure (1) porterys that 61.4% of studies sample had unhealthy appearance.

Figure (2) showed 77% of workers had inadequate protective equipment

Figure (3) showed 76.6% expose to psycho social hazards followed by physical hazards (65.6%), then biological and chemical hazards

Figure (4) portrays no one expose to low level of sewage hazards

Figure (5) show that the majority of studied sample had unsatisfied knowledge about safe work procedures (89.3%).

As shown in **figure 6**, 87.9% of studied sample wash their hand before eating and after toilet (60.7%), while the minority of the studied sample mentioned the importance of hand washing before smoking, dressing wounds and using phone (10%, 3.6%, and 5.7% respectively).

Discussion

Sewage workers universally expose to many work related health hazards and safety risks, notably allergic and other diseases of the respiratory system. Health impacts could also entail musculoskeletal, gastro-intestinal and infectious diseases as well as injuries caused by work-related accidents Kuijjer ⁽⁸⁾.

Workers can be protected by employing safety procedures in the workplace and ensuring the use of adequate personal protective clothes and equipment, basic hygiene precautions and health education is needed for sewage workers especially about hazards, its causes and

prevention(Centers for Disease Control and Prevention)⁽⁹⁾

Health impact and morbidity data about occupational exposure among sewage workers is scarce. The present study was conducted to assess the occupational health hazards among sewage workers at Al-Qalyobia Governorate through: - assess the prevalence of occupationally health hazards among sewage workers, determine the factors that affect the prevalence of occupational health hazards, develop guidelines to improve workers health and prevent illness.

The current study reveals that more than the half of studied sample reported that they exposes to high levels of occupational hazards this result may due to low level of health services which provided to workers, whereas; no one of studied sample had conducted any laboratory tests, X rays or Ultra Sonography. Also no one of them reported that they had not take any vaccinations or periodic checkups after employment, the minority of studied sample received sessions in first aid, safety and health.

Regarding types of occupational health hazards among the studied sample. The results of the present study revealed that more than three quarters of studied sample reported that they exposes to psycho social hazards followed by physical hazards, then biological hazards among less than half of the participants, and at the last chemical hazards. This result may be due to this type of works as low status in addition the workers had no idea about the hazards of this work. This result agree with Abdou⁽¹⁰⁾, in Jeddah who found that the most common health hazards among waste water workers was psychological problems as they formed 84.4%. This result collides with Sheha⁽¹¹⁾, in Egypt who reported that more than three quarters of studied sample reported that they exposed to mechanical hazards and expose to work related stress.

Regarding laboratory investigations among studied sample the present study revealed various infections affected the studied sample such as hepatitis A, B & C viruses, G. lamblia, Ascaris in stool and pus cells in their urine. This risk might be due to the endemic presence of pathogens organisms including bacteria, fungi, parasites, worms, protozoa, viruses in raw sewage and infection can occur both through sewage contact and aerosols.

In the present study showed nearly one third of studied sample were positive HAV This result supported by the study of Al. Batanony⁽¹²⁾, in Egypt who found that the antibody level against both HAV and HEV was significantly higher among sewage workers.

Also, Helal et al.⁽¹³⁾, in Egypt they found that there were statistically significant differences between the exposed sewage population (58.82%) and the control groups (20 %), as regards the presence of chronic infection with HAV. This result coincides with the result of Weldon et al.⁽¹⁴⁾, in Texas, who found an increased risk of acquiring Hepatitis A infection, which was 2.15 times higher in wastewater workers than in those not occupationally exposed. On contrary, Glass et al.⁽¹⁵⁾, after analyzing 17 published papers concerning Hepatitis A risk, did not confirm an increased risk of symptomatic HA among sewage workers.

Concerning HBV, the present study revealed 15% of studied sample were positive HB. On the same line Helal et al., they found that there were statistically significant differences between the exposed (38.23 %) and the control groups (17.14 %), as regards the presence of HBsAg. According to Arvanitidou, et al.⁽¹⁶⁾, (France) HBV infection was observed in 32.4% of the exposed to sewage population and in 5.8% of the controls.

Giardia Lamblia was found in stool analysis of studied sample (15.7%). It is well known that G.

Lambliia is transmitted by fecal – oral rout, this result agree with Foad & Awadalla ⁽¹⁷⁾, in Egypt, reported that Giardia Lambliia was slightly more frequent in sewage group (20%) than referent group (10%). Ascaris was found in stool of 34.3% of subjects. More than fifth of studied sample suffering from anemia. This result may be due to poor nutrition or low income.

Regarding relationship between personnel characteristics among studied sample and exposure to occupational hazards. The present study revealed the level of occupational hazard increased with increased years of work, the moderate and high levels of exposure was among illiterate group of studied sample, while the level of exposure increased with age (40 < 50 years) this result may be due to this age group accounted for one third of the studied sample also their work duration was more than ten years, this mean they exposed more to occupational hazards. This result agree with Abdou, who reported presence of statistically significant difference regarding having psychological problems ($p=0.007$), and duration of work. This indicates that psychological problems increased with the increased exposure or long duration in sewage work.

Relation ship between personnel characteristics among studied sample and exposure to Hepatitis, the present study revealed the prevalence of hepatitis A increased with increased duration (years) of work, while it was negative relation with educational level. These results coincides with Arvanitidou, et al, who reported the prevalence of anti-HAV was significantly higher in less educated persons and was increasing with age ($p < 0.001$), also Divizia, et al ⁽¹⁸⁾, stated that the increasing risk of antibody presence among the oldest subjects (45.4 years).

The current study also showed presence of positive correlation between prevalence of HBV and

increase duration of work, with lower educational level (illiterate) and at age of 40 years. This result confirm with the finding of Arvanitidou, et al, who showed HBV infection was observed in 32.4% of the exposed to sewage population and in 5.8% of the controls. Multivariate analysis showed that variables significantly and independently related to previous HBV infection was occupational exposure to sewage and age over 40 years old.

Regarding using of personal protective equipment, the current study revealed that personal protective equipment was not regularly used by a considerable number of the participants. Some workers reasoned that for the shortage in its supply that they can receive pair of thick heavy duty gloves every some months, if they are torn during work, not replaced. This holds true for safety boots and gowns supplied every 1 year. Others claimed that they prefer working without wearing gloves as they limit their free movement during work or cause skin irritation and dryness.

The present study indicates that the majority of workers were washing their hands before eating and after toilet, but don't emphasize hand washing before drinking, smoking, dressing wounds or before using phone. Most of the workers were not aware of the importance and timing of hand washing and hygienic practices. Also, no convenient washing facilities (with warm water and soap) were available near the collection points or for those working in the street. All the above mentioned careless to wash hand might be the cause of many risky hazard affected the sewage workers.

Concerning the level of knowledge of studied sample, the most of sample had unsatisfactory knowledge regarding safe procedures during work stages. This may be due to more than the third of studied sample were illiterate. This result contrasts with Kumari & Reddy ⁽¹⁹⁾, in

India, who reported that most of the agricultural workers in the study area had sufficient level of knowledge regarding safe use of pesticide.

Regarding the correlation between personal characteristics of the studied sample and their knowledge regarding safe procedures during work. The current study shows positive correlation between satisfactory knowledge and age (>40 years), educational level and duration of work. This might be more than half of the study sample older than 40 years and the work duration more than 10 years so they can gain knowledge from previous experiences.

In the current study there was statistical negative correlation between exposure to occupational health hazards and using protective equipment, total healthy score, total hand washing score and total knowledge practices score. This result were expected because insufficient personal equipment provided, plus bad hygiene habits regarding no wash hand before smoking or eating and this bad habit increased with increase years of work. In sewage care, also most of them illiterate so cannot read about important of personal hygiene

and balance diet so they had unhealthy appearance.

Conclusion

The results of the current study concluded that, sewage workers expose to high levels of occupational hazards, studied sample reported that they expose to psycho social hazards followed by physical hazards. The main risk factors that affect sewage workers health and safety were age, educational level, work duration, personal hygiene and personal habits. Most of workers had unsatisfactory knowledge regarding safe procedures throughout work stages.

Recommendations:

- Health guidance programs should be conducted for both the workers and the relevant authorities regarding occupational health hazards and its prevention.
- Workers should be provided with and encouraged to use protective clothes and equipment and seek medical supervision
- Vaccination and basic hygiene precautions are important to prevent illness

Table (1): Distribution of the studied sample regarding to their personnel characteristics (n= 140)

Variable	Frequency	%
Age in years:		
20-	27	19.3
30-	33	23.6
40-	44	31.4
50 – 59	36	25.7
Mean ±SD	34.06±9.23	
Educational level:		
Illiterate	58	41.4
Basic education	43	30.7
Intermediate education	39	27.9
Duration of work (years):		
1-	25	17.9
5-	23	16.4
10-	44	31.4
15+	48	34.3
Mean ±SD	12.82±8.19	
Marital status:		
Single	44	31.4
Married	74	52.9
Divorced	9	6.4
Widowed	13	9.3
Family size:		
3	25	17.9
5 -	71	50.7
7+	44	31.4
Daily working hours:		
8	102	72.9
12	30	21.4
24	8	5.7
Weekly rest days:		
1 day	98	70.0
Non	42	30.0
Residence:		
Urban	88	62.9
Rural	52	37.1
Monthly income:		
Enough	37	26.4
Not enough	103	73.6

Table (2): Distribution of the studied sample regarding to laboratory investigation findings (n=140)

Variable	Normal		Abnormal	
	No	%	No	%
Blood:				
Leukocytosis	97	69.3	43	30.7
Anemia	108	77.1	32	22.9
HAV	98	70.0	42	30.0
HBV	119	85.0	21	15.0
HCV	109	77.9	31	22.1
Stool:				
G. lambylia	118	84.3	22	15.7
Ascaris	92	65.7	48	34.3
Urine:				
Pus cells	78	55.7	62	44.3

Table (3): Health services provided for studied sample (n=140)

Variable	Frequency	%
Medical checkup before employment:		
Medical examination	109	77.9
Laboratory tests	0	.0
X rays	0	.0
U S	0	.0
Non	31	22.1
Vaccination before working:		
Non	140	100.0
Periodic checks:		
Non	140	100.0
Educational sessions after employment:		
First aid	17	12.1
Health and safety	20	14.3
Non	103	73.6

Table (4): Distribution of studied sample regarding to using the protective equipment (n=140)

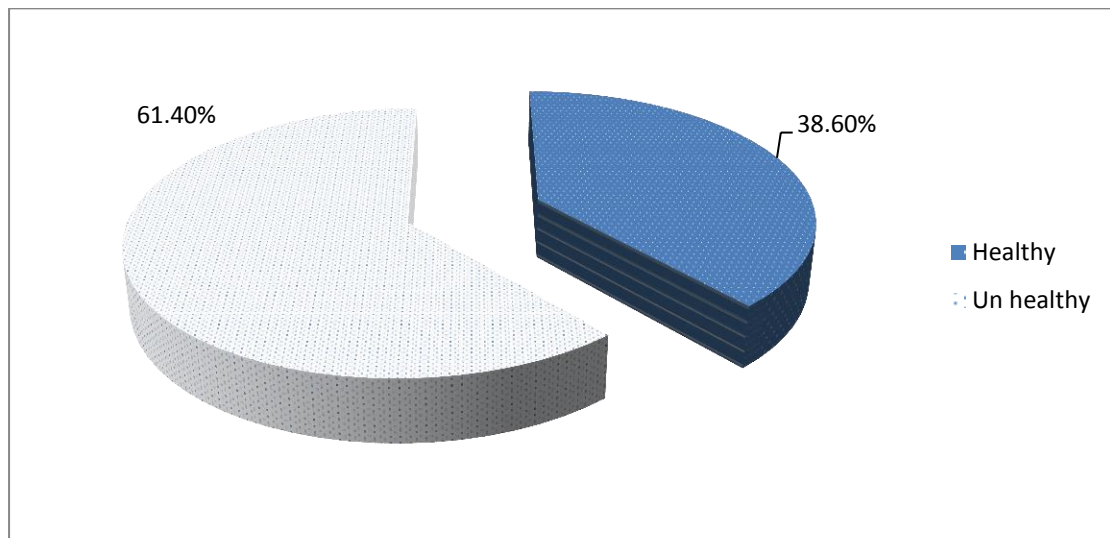
Variable	No		Yes	
	No	%	No	%
Overall	124	88.6	16	11.4
Safety boot	93	66.4	47	33.6
Thick (heavy duty) gloves	120	85.7	20	14.3
Face mask	121	86.4	19	13.6
Safety goggles	140	100.0	0	0.0
Disinfectant for hands	111	79.3	29	20.7
First Aid Bag	128	91.4	12	8.6
Device for measuring oxygen ratio	122	87.1	18	12.9
Helmet	132	94.3	8	5.7
Respirator	131	93.6	9	6.4
Lighter	96	68.6	44	31.4
Rescue equipment as hoisting device	118	84.3	22	15.7
Traffic warning devices	122	87.1	18	12.9

Table (5): Relation between personnel characteristics among studied participants and exposure to occupational hazards

Personnel characteristics	Moderate exposure N=75		High exposure N=65		X ²	p-value
	No	%	No	%		
Age in years						
20-	14	18.7	13	20.0	.416	>0.05
30-	18	24.0	15	23.1		
40-	25	33.3	19	29.2		
50 – 59	18	24.0	18	27.7		
Educational level						
Illiterate	29	38.7	29	44.6	3.46	>0.05
Basic education	28	37.3	15	23.1		
Intermediate education	18	24.0	21	32.3		
Duration of work (years):						
<5	13	17.3	12	18.5	1.32	>0.05
5-	11	14.7	12	18.5		
10-	25	33.3	19	29.2		
15-	26	34.7	22	33.8		

Table (6): Relation between personnel characteristics of the studied sample and their knowledge regarding safe procedures during work

Personnel characteristics	Unsatisfactory N=125		Satisfactory N=15		X ²	p-value
	No	%	No	%		
Age in years						
20-	25	20.0	2	13.3	2.30	>0.05
30-	31	24.8	2	13.3		
40-	37	29.6	7	46.7		
50 – 59	32	25.6	4	26.7		
Educational level						
Illiterate	53	42.4	5	33.3	2.67	>0.05
Basic education	39	31.2	4	26.7		
Intermediate education	33	26.4	6	40.0		
Duration of work (years):						
<5	23	18.4	2	13.3	2.41	>0.05
5-	22	17.6	1	6.7		
10-	39	31.2	5	33.3		
15-	41	32.8	7	46.7		

**Figure (1): General appearance of studied sample**

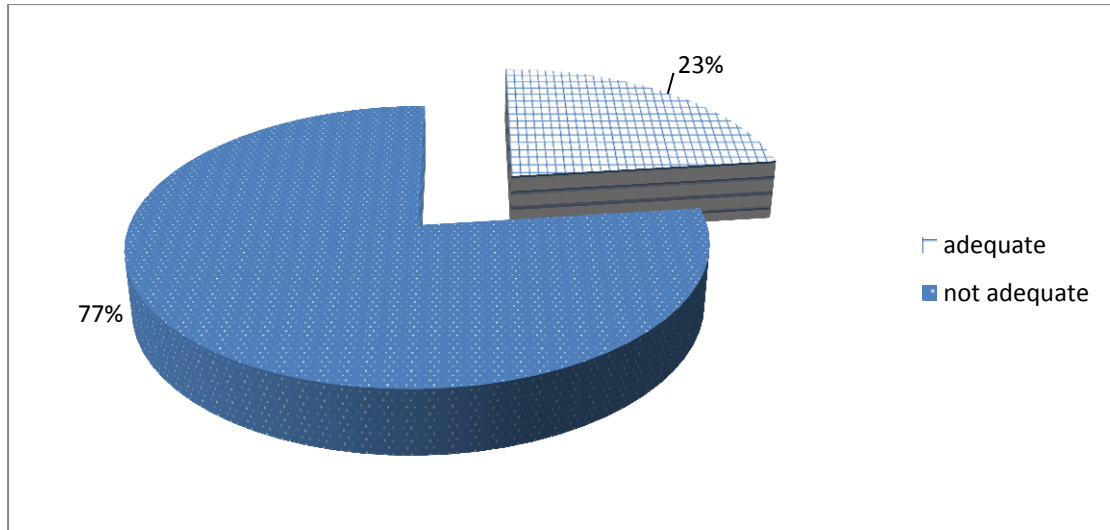


Figure (2): Availability of protective equipment (n=140)

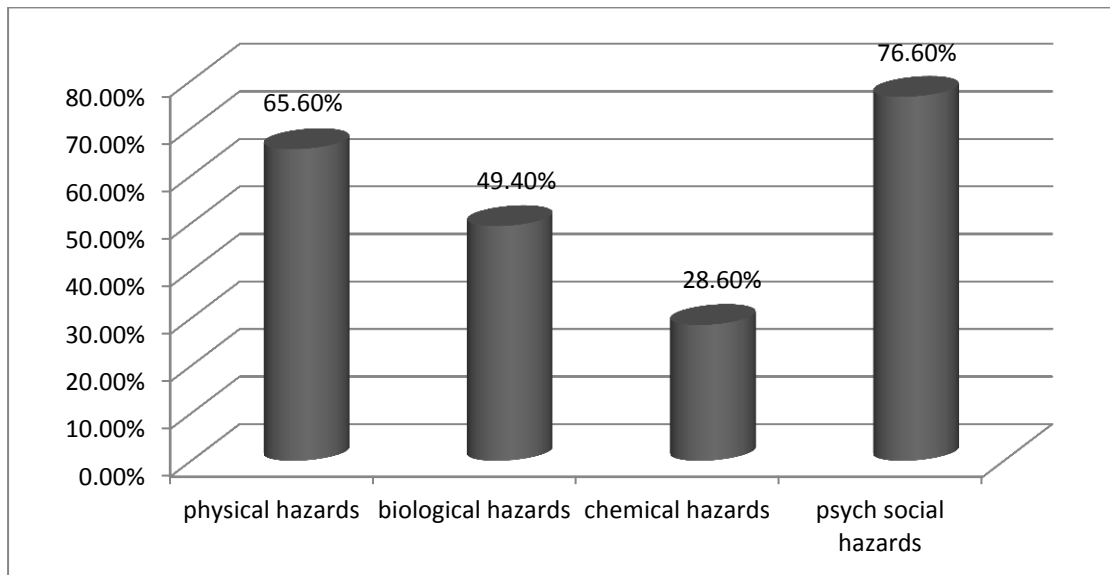


Figure (3): Prevalence of occupational health hazards among studied sample

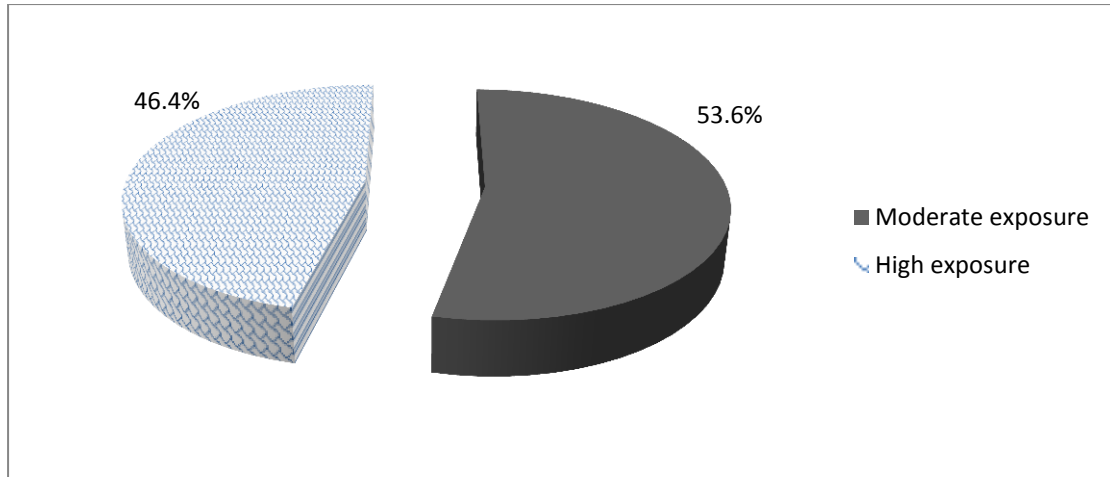


Figure (4): Total level of risk among studied sample

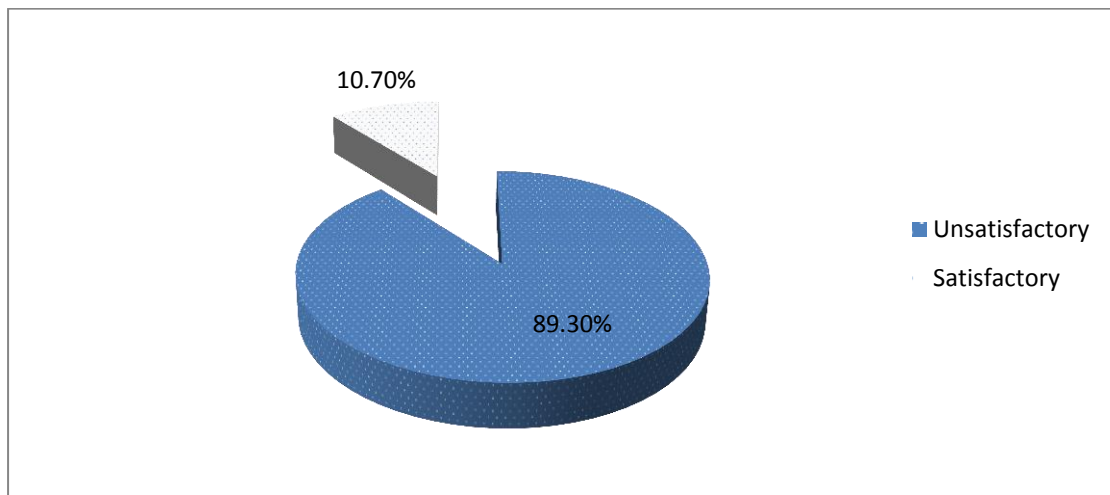


Figure (5): Total level of knowledge of the studied sample regarding safe procedures throughout the work process

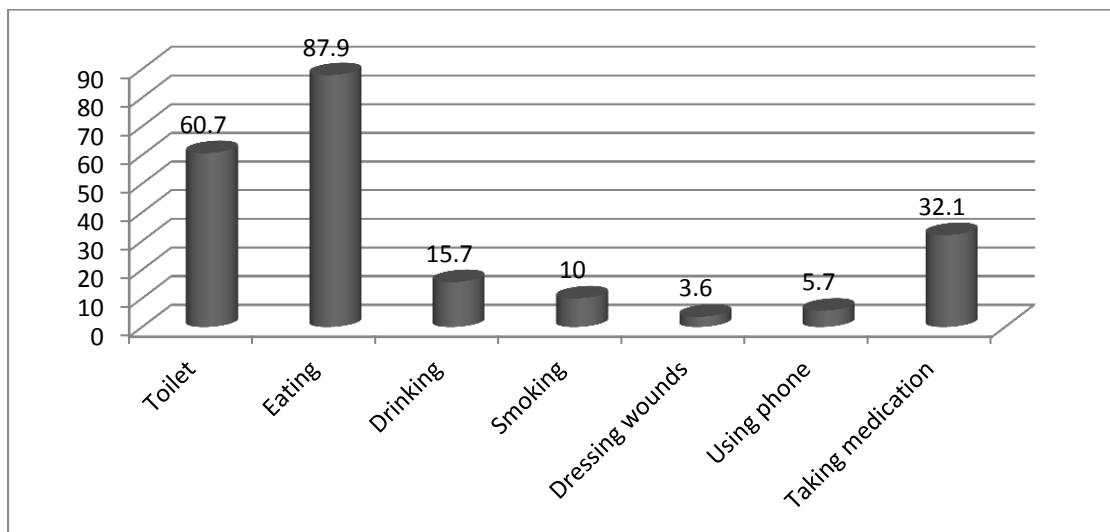


Figure (6): Hand washing practice among studied sample

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