

# The Assessment of Chemical Hazards Among Industry Workers in Iraqi Kurdistan Region: A Cross-Sectional Study

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## ABSTRACT

A chemical hazard is an occupational risk brought on by exposure to chemicals at work. Long-term or short-term health effects could result from chemical exposure at work. The study attempts to assess exposed workers to chemical hazards in the workplace. A worker-based cross-sectional study was conducted among ten large-scale factories. The factories have over 900-line workers. 300 of them were selected by using Epi Info™ software. The right number of employees per factory was determined using a proportionate method, and then the employees were selected on purpose. The workers were interviewed using a developed questionnaire. The study observed that out of 300 participating workers in 10 industries, 116 were exposed to chemical hazards, accounting for slightly more than half, representing 50.9%. It is necessary to awareness raising among industry workers regarding chemical substance and their health hazards in addition, at the national and workplace levels, a preventative safety and health culture should be formed, with different stakeholders involved at all levels.

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## 1. Introduction

A chemical hazard is an occupational danger produced by chemical exposure in the workplace. Chemical exposure at work might have short- or long-term health consequences. Dangerous chemicals include neurotoxins, immunological agents, dermatological agents, carcinogens, reproductive toxins, systemic toxins, asthma genes, pneumoconiosis agents, and sensitizers [3].

In the workplace, inhalation is the most common method for chemical compounds to enter the body, followed by skin contact and then epidermal absorption. Despite the fact that the gastrointestinal tract is a possible absorption route, considerable amounts of chemicals are rarely consumed in the workplace [8]. Acute health effects occur shortly after exposure, while exposed for a long time, several years after the beginning exposure, chronic toxic effects gradually develop [15]. There are four main ways by which harmful chemicals reach the body; inhalation, absorption of the skin or eye, ingestion, and injection.

It is necessary to recognize chemical hazards and employ preventive measures to manage them in order to protect individuals from their effects. For any major hazard control system, this is an important starting point. Alerting workers and visitors to the existing of a dangerous chemical by means of hazard pictograms. Pictograms allow to understand that the chemicals we use will harm human health and the environment [7].

As a section of environmental hazards, workplace hazards have a role in developing various of medical problems and injuries [12]. An inadequate and risky workplace environment, fast development of new factories, innovations and use of new instruments for large scale production as well as other operations all have the potential to expose employees to significant dangers they were not expecting." As a result, workers are considered as a high group. Injuries, illnesses, work disruptions, and tragic accidents are all possibilities. In the industrial operating fields, these potentially dangerous. In the industrial operating areas, these potentially adverse influences with them [6]. This research tries to assess the exposed workers to chemical hazards at Slemani industries, in Iraqi Kurdistan Region (KRG).

## **2. Methods**

Worker based a cross-sectional study was carried out among large-scale industries in the Slemani province in KRG. the large-scale factories are registered at Board of Investment (BI) in KRG. The participated factories were revolved: oil and gas, petrochemicals and chemicals, construction materials, food processing, services, and metal fabrication/processing. Of the thirty large-scale factories listed with the Board of Investment and approached to participate in this study, 20 factories refused due to two main reasons. Firstly because of Covid-19 issues, the industries administration managers declared lockdown for visitors including researchers, as a precautionary procedure to protect the workers from exposed to coronavirus. Secondly, most of the factories had issues relating to being involved in the research study and they refused to be a part of the study. They attribute the reason to the policy of the industries. Of the 900 workers in these factories, 300 were selected including workers rotational shift work, as well as the workers who had worked at the firm for several months by using Epi Info™ software. Based on the assumptions of a 95 percent confidence interval, a 5 percent margin of error, and a design effect of 0.1, a minimum sample size of 270 respondents is required. The sample was increased to account for a chance of non-response 10%. The resulting final sample size was 300 participants.

For selecting the worker from each factory, the proportionate sampling technique was used, with workers chosen from every factory in proportionate to the total number of employees [1]. The workers selected according to the inclusion criteria of the study which include every formal worker in the industries, both sexes, all age groups while every pregnant worker, the managers, executives, administration staff and everyone who are not willing to be part of the study are excluded according to exclusion criteria.

The workers were interviewed using a questionnaire. Ther questionnaire was developed and build from literature review and previous study. The questionnaire consisted of two sections. The first section contains the respondents' socio-demographic information, and the second section was related to chemical hazards.

Question relating to chemical hazards were tested by the respondent self-reporting through the five levels of the Likert scales and rating: Strongly Agree (SA), Agree (A), Neither Agree nor Disagree (ND), Disagree (D), and Strongly Disagree (SD). Ratings of 5, 4, 3, 2 and 1 were used to score the scale of the hazard. Workers gave a score of 5 if they were exposed to or at risk of being exposed to highly chemical substances hazards at workplace., 4 for hazard, 3 for neither agree nor disagree (moderate hazard), 2 for a little hazard and 1 for no hazard, this implies that the workers were not exposed or at risk of exposure to physical hazards. The mean of the score from 5-3.67 was considered high hazard, 3.66-2.34 was considered

moderate hazard, and less than 2.34 was considered low hazard. The data was collected from June 14th, 2020 to December 16th, 2020. The data was analyzed using SPSS version 25. Twenty experts assessed the questionnaire for content and relevancy of the questions, as well as the study's purpose. Minor changes to the content's language were required as a result of the experts' feedback. A pilot study was performed to examine the internal consistency of items. The sample was comprised of 30 workers who worked in ten factories and were selected according to the proportionate sampling technique, and the samples were excluded from the original sample size. The reliability was determined using the Cronbach's alpha technique. The questionnaire had an alpha score of 0.77. This indicating that the questions are internally consistent.

### 3. Results

Of the 300 participant workers, 53.7% were aged between 21-30 years old. The majority of the study sample were male (87.7%) and 32% were college graduates. More than half (52.3%) of the workers had a rotation shift and less than half (47.3%) of the workers worked for a total of 48 hours every week. As well the result observed that about (53.7%) of workers had worked for a duration between 1 to 5 years. In addition, 18.3% of the participants had occupational health charts, as shown in [Table 1].

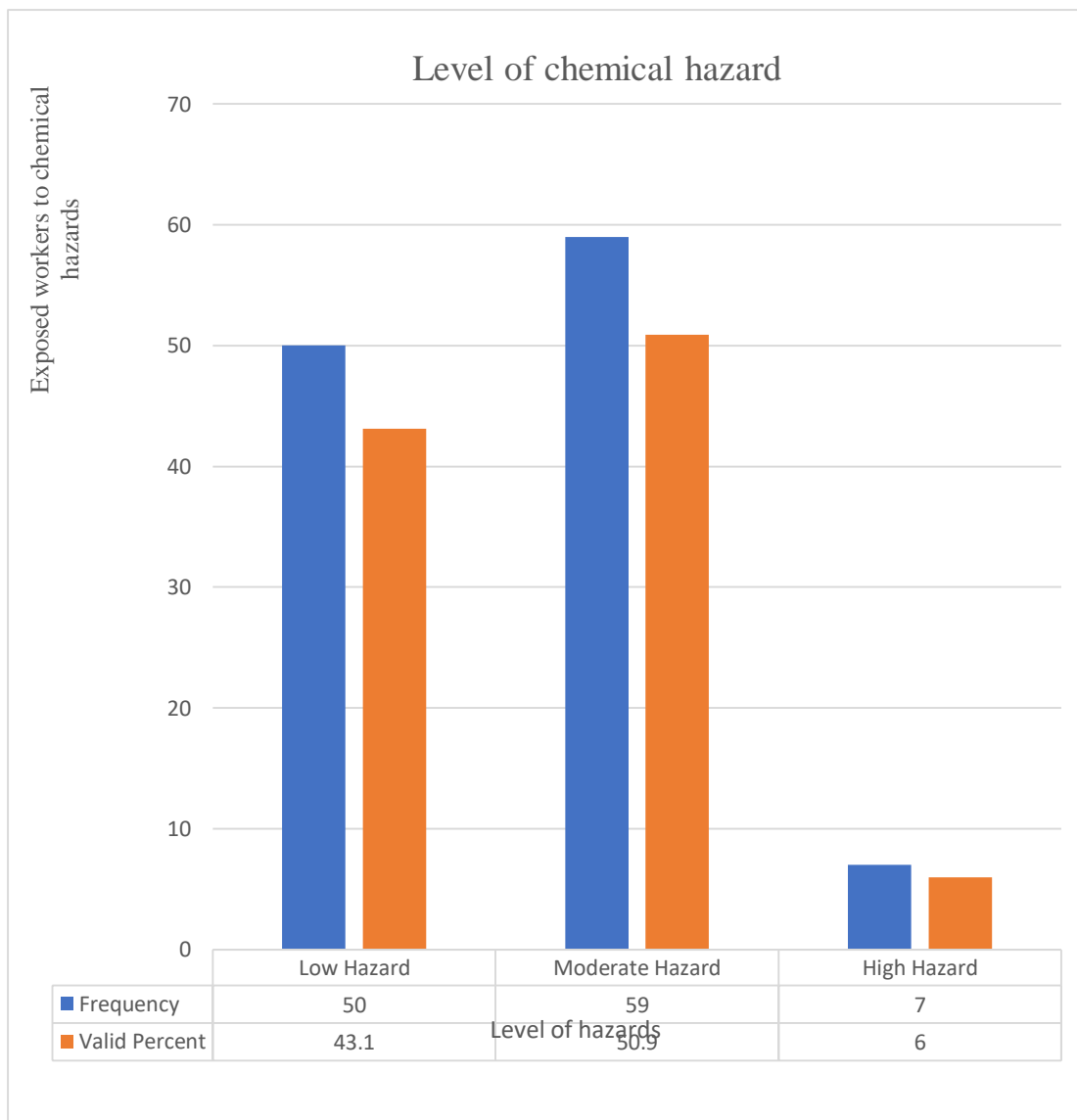
**Table 1.** Sociodemographic characteristics of 300 workers among 10 participated industries

Sociodemographic characteristics	F	%
Age	≤ 20	5.7
	21 - 30	53.7
	31 - 40	31.3
	> 40	9.3
	Total	100%
Sex	Male	87.7
	Female	12.3
	Total	100%
Level of Education	Illiterate	3.3
	Able to read and write	7.0
	Primary school graduated	14.3
	Secondary school graduated	11.0
	Intermediate school graduated	13.7
	Institute graduated	18.7
	College graduated	32.0
Running shifts	Total	100%
	Morning shift	45.7
	Night shift	2.0
	Rotation-shift	52.3
	Total	100%
Number of working hours/weeks	< 48	31.0
	48	47.3
	> 48	21.7

	Total	300	100%
Duration of working /years	< 1	24	8.0
	1 to 5	161	53.7
	5 to 10	63	21.0
	11 to 15	39	13.0
	≥16	13	4.3
	Total	300	100%
Industry health charts	Yes	55	18.3
	No	245	81.67
	Total	300	100%

F=Frequency    %=Percentage

As shown in [Figure 1]. Shows the number of exposed workers to chemical hazards at workplace; among 300 participated workers in 10 industries, 116 workers have to deal with chemical hazards. Slightly more than half of them exposed to moderate level chemical health hazards 59 workers (50.9%).



**Figure 1.** Exposed workers to chemical hazards

Mean > 2.34 Low Hazard    Mean > 2.34-3.66 Moderate Hazard    Mean > 3.66-5 High Hazard

The finding of the [Table 2]. reveals a high percentage of factory workers use some form of personal protective equipment. 76.7% of workers wear gloves and (73.7%) wear masks. While uses of Industry uniforms or work apron, safety helmets, Safety boots or shoes, Safety glasses or goggles, and earmuffs and earpieces among workers were (54.7%), (56,3%), (63.7%), (45.3), and (34.7%) respectively. In addition, non-availability of PPE, not being comfortable using PPE, and ignorance were the main reasons for not wearing or using PPE (37.7%) (16%) (15%) respectively among participants.

**Table 2.** Uses of personal protective equipment and the causes of not using it by the workers (n=300).

Use of Personal Protective Equipment PPE	F	P
Industry uniforms or work apron	164	54.7
Gloves	230	76.7
Masks	221	73.7
Safety helmets	169	56.3
Safety boots or shoes	191	63.7
Safety glasses or goggles	136	45.3
Earmuffs and earpieces	104	34.7
Reason for not use of PPE		
Non-Available PPE	113	37.7
Not comfort	48	16
Ignorance	45	15
Skin irritant	3	1
On need	12	4
Hinder the work	10	3.3

F=Frequency    %=Percentage

#### 4. Discussion

Chemical exposure occurs in a variety of work environments, including research and healthcare facilities, which are distinguished by the high unpredictability of the used substances. However, numerous industrial and agricultural occupational settings have examined chemical dangers in detail [13]. Furthermore, this study observed among 300 participated workers almost forty percent of them have to deal with different types of chemical hazards such as Sodium Hypochlorite, Chlorine, Chloroxlyenol, Sulfuric Acid, Fexofenadine (hydrochloride), Polyethylene and Trichloroethylene. They are available in the form of liquid, solid, solvent, gas or vapor at workplace.

The study shows slightly more than half percent of the workers subjected to moderate level of chemical

hazards and almost fewer of them exposed to high levels of chemical hazards. The chemicals that come into touch with or enter the body of the workers, some produce local damage, while others have systematic consequences; they are transmitted throughout the body to different organs before causing damage. Chemicals get in the human body by three main ways: inhalation, ingestion, and skin absorption. Prolonged exposure to a chemical substance at small concentrations can cause chronic effects. The consequences can be catastrophic at great quantities [14].

Most of workplaces in the current study lacked to adequate ventilation, the workers were not familiar with the manifestation of hazardous chemicals, and even there were not placards displayed for workers. Additionally, there were not clear procedures for the safe clean-up of spilled chemicals and disposition of unused or unnecessary chemicals substances in a safe manner. However, workers at participated factories were provided with the necessary information about chemical substances that they work with like chemical manufacturer's labels or supplemental hazard labels and or Material Safety Data Sheets, which contains information about a chemical's hazards.

In the workplace, only a small subset of chemical occupational exposures is taken into account, tracked, and regulated. Calculations of the global burden of disease are frequently omitted from or grossly understated as a result of the lack of comprehensive information on chemical exposure of workers and respective outcomes like death, cancer, etc. Despite the phase-out of some hazardous chemicals, many toxic substances are still in use worldwide, putting workers in low- and middle-income countries (LMIC) at particular risk. More than 200 compounds have been identified as known or potential human carcinogens, with many of these exposures happening at work. Cancer is the most common cause of job-related death. Workplace chemical exposures have harmful effects on a variety of bodily functions, including the immune, reproductive, cardiovascular, and respiratory systems, as well as on particular organs like the liver and brain [10].

Despite the fact that the health problems initiated by the length of the latent period, the extent of the excess risk varies depending on the individual's age at the time of exposure, the length and intensity of the exposure, and other concurrent exposures [5]. Personal Protective Equipment (PPE) is the directly safeguard a person from hazards in the workplace. Further the study also shows that most of the workers used some form of PPE. The majority of them wear gloves, masks industries uniforms or work apron and safety helmets etc. which protect them from workplace hazards. Meanwhile, some of them did not give attention to using PPE due to reasons like, as they mentioned it: ignorance about their usefulness, or they are not comfortable when using it, and unavailability of PPE at workplace, this might be because the industries have not had enough income to supply all workers with all protection equipment.

Several studies showed that workers have a clear understanding of safety precautionary issues and the usage of personal protective equipment, and that a large percentage of workers use personal protective equipment too [2]. In contrast, [4] observed lacking of awareness regarding workplace risks as well as the usage of PPE among the welders [4] Additionally, [9] identified that the majority of workers did not use different types of PPE.

Furthermore, unavailability of PPE, ignorance and not being comfortable with using PPE were the reasons for not wearing or using PPE by workers. Additionally, some of factories do not provide PPE or provide workers with only some types of PPE such as gloves or masks, as it is found by this study, one of the reasons for not wearing PPT is that it was not available. Factories should mandate providing necessary PPE for their workers, the workers should be educated and trained to use PPE too. If not, workers who didn't use the PPE at workplace were more liable to get injured [11].

## 5. Conclusion

In conclusion, according to the respondents' ratings of five distinct sort of actual chemical dangers at workplace, over 50 percent of the respondents reported been exposed to chemical hazards. It is important to awareness raising about chemical substances and their health issues to protect industry workers' health, and there must be a greater understanding of occupational health and safety measurement. And at the national and workplace levels, a preventative safety and health culture should be formed, with different stakeholders involved at all levels.

### Ethical considerations and Participant Confidentiality

The ethical considerations were issued for the instrument of the study by scientific committee of University of Raparin. In addition to the Ministry of Trade and Factories in the Kurdistan Regional Government. Furthermore, all participant laborers gave oral informed consent before to participating in this study.

Conflict of Interest: The author reports no conflict of interest.

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