

## Occupational Toxicity and Health Hazards of the Healthcare Providers at Healthcare Facilities in Sulaimani City, Iraq

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### Abstract

The present study aimed to evaluate the occupational health hazards that face health care providers in Sulaimani City. A cross-sectional study conducted utilizing quantitative data collection methods. It involved 159 respondents including Physicians, Pharmacists, Medical assistants, Laboratory Instructors and Nurses who worked in 8 major health facilities in Sulaimani city, Kurdistan region, Iraq.

Nurses were the most susceptible group to sharp related injuries (13.84%), cuts and wounds (10.69%) than the others and they were more experiencing verbal abuse in the workplace (15%). Laboratory instructors represent the most exposed group to contaminated specimens/biohazards (17.6%) and blood borne pathogens (13.84%), while the physicians represent the most prone group to acquire infectious diseases (15.1%) and both the physicians and the nurses were equally exposed to airborne diseases (11.32%). Furthermore, physicians were the most group that suffered from work related stress (13.8%); and medical assistants were the most susceptible to radiation (3.1%). Meanwhile, Laboratory instructors were the most exposed group to physical distress (15.1%), falls (5%), unsafe staffing (13.8%), chemical spills (8.8%) and noise (5.4%).

Healthcare providers in these settings experienced various types of occupational hazards in their workplaces, which became a dominant issue among the health care providers. Interventions should be established to alleviate these hazards.

**Keywords:** Occupational hazards Biological, Non-biological, Healthcare providers, Iraq, Sulaimani City.

المخاطر المهنية لمقدمي الرعاية الصحية في المرافق الصحية في مدينة السليمانية- العراق  
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### الخلاصة

هذه الدراسة صممت لتقييم المخاطر المهنية التي تواجه الكوادر الصحية اثناء عملهم في المستشفيات في محافظة السليمانية. اجريت الدراسة على مائة وتسع وخمسين كادر صحي والذي شمل كل من الاطباء والصيادلة و العاملين في المختبرات ومساعدى الاطباء والكادر التمريضي الذين كانوا يعملون في ثماني مستشفيات في محافظة السليمانية بواسطة استخدام استبيان خاص بهذه الدراسة. اظهرت الدراسة بان الكادر التمريضي اكثر الفئات عرضة للاصابة بالمواد الحادة بنسبة 13,84% و الجروح بنسبة 10,69% و الاكثر عرضة للإساءات اللفظية بنسبة 15%. اما العاملين في المختبرات فهم الفئة الاكثر عرضة للاصابة من العينات الملوثة بنسبة 17,6% وللعدوى المنقولة عن طريق الدم بنسبة 13,84%. كما وبينت الدراسة ان الاطباء هم الاكثر عرضة للامراض المعدية بنسبة 15,1% وهم يتشاركون مع الكادر التمريضي كونهم الاكثر عرضة للعدوى المنقولة عن طريق الهواء بنسبة 11,32%. هذا واطهرت الدراسة ايضا ان الاطباء هم اكثر الفئات من ناحية ضغوطات المهنة بنسبة 13,8%. اما مساعدى الاطباء فهم الاكثر تعرضا لمخاطر الاشعاع بنسبة 3,1% بينما العاملين في المختبرات هم الاكثر تعرضا للمحن الجسدية 15,1% وحوادث السقوط 5% والتوظيف غير الامن بنسبة 13,8% والمواد الكيماوية بنسبة 15,1% ومخاطر الضوضاء بنسبة 5,4%.  
الكلمات المفتاحية: المخاطر المهنية، البيولوجية و غير البيولوجية، الكوادر الصحية، العراق، مدينة السليمانية.

### Introduction

The healthcare workforce constitutes 12% of the working population around the world<sup>(1)</sup>. According to National Institute for Occupational Safety and Health (NIOSH), healthcare providers are facing expanding numbers of occupational hazards including wounds and ailments, with rates having increased significantly during the previous

decade<sup>(2)</sup>. It has been assessed by the International Labour Organization (ILO) that 160 million people in the world suffer from occupation-related illnesses such as musculoskeletal diseases and psychiatric problems. Meanwhile, 270 million lethal and non-lethal work-related accidents resulted in more than 350, 000 victims and over two million work-related deaths each year were reported and indorsed to occupational hazards<sup>(3)</sup>.

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Healthcare providers are exposed to a wide range of work related hazards; these include biological and non-biological hazards. Biological hazards refer to organisms or organic matters produced by these organisms that are harmful to human health. These include parasites, viruses, bacteria, fungi and protein. Generally, there are three major routes of entry for these micro-organisms into our body, i.e. through the respiratory system, transmission through contact with body fluids of the infected person or contact with contaminated objects<sup>(4)</sup>. Regarding non-biological hazards it includes chemical, physical, psychological hazards, noise, stress and others<sup>(5)</sup>.

Only few hospitals have sorted out extensive work related surveillance frameworks and most of these hospitals do not have a definitive plan. Hospitals incorporate various "mini-industries" inside their partitions, and health workers regularly move from one department to another during their shift. The threats mainly come from exposure to chemicals, radioactive substances, infectious agents, mechanical agents, latex, violence, and mental, psychosocial, and physical stressors<sup>(6, 7)</sup>. A few of these threats have been managed, for instance exposure to blood borne pathogens, ethylene oxide, and formaldehyde. Substances such as glutaraldehyde and hazardous drugs are not being addressed as biohazards however, it represent a danger to the workers wellbeing. In addition to managed substances and those regulated by NIOSH and different agencies, risks specifically to health workers incorporate exposures to natural rubber latex, infectious diseases, anesthetic gases, ergonomic stressors, hazardous drugs, and psychological, psychosocial, and physical stress. Health care-specific hazards must be considered while developing a surveillance program for healthcare workers<sup>(8)</sup>.

There are only a few existing researches focusing on the wellbeing of workers in the healthcare settings. Studies that have concentrated on worker's injury in healthcare facilities recommend that poorly controlled work environment and high workloads are directly correlated with the increments in health care worker's injuries, including needle stick wounds and near-misses to medical nurses<sup>(8,9)</sup>. Another important point is that till now most of the studies focused on patient safety-related outcomes and sets procedures to improve patient safety, without paying attention to the hazards that faces health workers daily during performing their work<sup>(10,11)</sup>. Some reports on patient-related adverse events and patients mortality showed that hospitals with better

safety climate overall had lower relative incidence of adverse events in hospitals<sup>(12,13)</sup>. Accordingly, the present study was designed to shed a light on the daily occupational hazards that face healthcare providers while performing their work.

## Study Design and Setting

This cross-sectional study utilized quantitative data collection methods. It was carried out in Sulaimani city, Kurdistan region, Iraq. The study was conducted between November 2019 and February 2020. The study protocol was approved by the Research Ethics Committee of the College of Pharmacy, University of Sulaimani (certificate no.(1) in September 3, 2018), in accordance with the Declaration of Helsinki revised in 2000.

## Sampling

Eight major hospitals were targeted during the study. These were purposively selected based on size and patient capacity. The selection ensured a combination of governmental and private facilities. These included Sulaimani Teaching Hospital, Shar Hospital, Central Laboratory, Sarwari Healthcare Center, Piramerd Dental Center, Pediatrics Teaching Hospital and Shorsh Hospital as public facilities in addition to some of private clinics and laboratories.

## Study population

The study population comprised a range of healthcare workers working in the selected health facilities. To select the respondents, sampling proportionate to size was used to determine the number of healthcare workers to be interviewed from each hospital. At the hospital, all healthcare workers who were presented at the facility were considered. Among 200 healthcare workers interviewed, one hundred and fifty nine (159) responded. The selection was made according to their occupation in the healthcare facility, and they were categorized into five groups as follow: (a) Physicians (b) Pharmacists (c) Medical assistants (d) Laboratory Instructors and (e) Nurses.

## Data Collection

All participants were interviewed by the researchers using a structural questionnaire designed and validated for this study (Appendix I). It included demographic data, duration of exposure, use of personal protective equipment (PPE), health status, and working condition; and whether they have been trained to protect themselves against different types of work place-related health hazards. Consensual agreement is signed by the subjects at the end of each questionnaire. Each interview consumed approximately 35–45 minutes.

**Appendix I. Questionnaire**

**Occupational Toxicity and Health Hazards at the Healthcare Facilities of Sulaimani City, Iraq**

This is where I describe the study and let people know that their participation is voluntary and that their data are anonymous and confidential.

Name						
Gender	Male			Female		
Contact Number						
Age						
Weight						
Hight						
Marital status	Single		Married		Divorced	
Cadre of health worker	(a) Physician		b)Pharmacist		(c) Medical assistant	(d) Lab. Instructor
8. Monthly income	(a) > 500,000 ID			(b) < 500,000ID		
9. Type of health care facility:	(a) Public			(b) Private		
10. Duration of service	(a) > 5 years			(b) < 5 years		
11. Description of the current job:	(a)Part time			(b)Full time		
12. Have you had training course about hazards and safety of your job?	(a) Yes			(b) No		
13. What protective measures do you use?	Answer					
Protective measures	(a) Yes			(b) No		
Work clothes	(a) Yes			(b) No		
Goggles	(a) Yes			(b) No		
Gloves	(a) Yes			(b) No		
Mask	(a) Yes			(b) No		
14. Do you drink Alcohol?	(a) Yes			(b) No		
15. Do you smoke?	(a) Yes			(b) No		
16. Do you wash your hands before and after work?	(a) Yes			(b) No		
17. Do you wear your work clothes at home?	(a) Yes			(b) No		
18. Do you have frequent exercise?	(a) Yes			(b) No		
19. Daily hours of sleep	(a) > 8 hrs			(b) < 8 hrs		
20. Do you face pressure from your job?	(a) Yes			(b) No		
21. Have you noticed any negative change in your health during your work?	(a) Yes			(b) No		
22. Do you take the necessary vaccines required from your job?	(a) Yes			(b) No		
23. What types of hazards do you expose to at the workplace?	Answer					
A. Biological Hazards	Answer					
Sharp related injury (such as needle sticks)	(a) Yes			(b) No		
Cuts and wounds	(a) Yes			(b) No		
Direct contact with contaminated specimens /biohazards materials	(a) Yes			(b) No		
Airborne diseases	(a) Yes			(b) No		
Infectious diseases and/or infection	(a) Yes			(b) No		
Others	(a) Yes			(b) No		
B. Non-Biological Hazards	Answer					
Stress	(a) Yes			(b) No		
Physical, psychological, sexual, and/or verbal abuse	(a) Yes			(b) No		
Musculoskeletal injuries (slips, trips, falls and/or fractures)	(a) Yes			(b) No		
Unsafe staffing	(a) Yes			(b) No		
Others (chemical spills, noise, burns, and radiation)	(a) Yes			(b) No		

24. Do you have periodic follow-up examination tests to ensure health safety?	(a) Yes	(b) No
25. Do you have preventive or risk control measures in the place of work?	(a) Yes	(b) No
26. Does your work provide health care protection when you face injury?	(a) Yes	(b) No
27. Has there been any accidental death in your workplace?	(a) Yes	(b) No
28. Has your work been supervised by institutions like Directorate of health (DOH)?	(a) Yes	(b) No
I agree to give the above information and for that purpose I am signing.....		

**Statistical analysis**

Data analysis was performed using the Statistical Package for Social Science (SPSS) for Windows using the linear regression model and bivariate correlation to analyze and test the relationship between variables.

**Results**

A total of 159 interviews were conducted with the participants and they were categorized in a descending manner as follow: laboratory instructors,

physicians, medical assistants, nurses, and pharmacists. Most respondents were female (91) and the number of males were (68), about 76.1% were married in the age range 20–40 year old. The majority were with body mass index (BMI) of 25-35 kg/m<sup>2</sup>. More than half of the participants were on part time working and in the public sector. Most of them had a work experience of more than 5 years. Maximum number of the participants kept hand hygiene and more than half of them had more than 8 hours of sleep a day (Table1).

**Table 1. Demographic Data of the Study Sample**

Demographical Data of Healthcare Providers	Percentage	Demographical Data of Healthcare Providers	Percentage
Gender			
Male	42.77%	Public	58.49%
Female	57.23%	Private	2.51%
Age (years)		Both	38.99%
20-40	64.78%	Duration of service	
40-60	35.22%	Less than 5 years	24.53%
BMI (kg/m <sup>2</sup> )		More than 5 years	75.47%
15-25	32.70%	Description of the current job	
25-35	69.30%	Part time	52.20%
Marital status		Full time	47.80%
Single	23.90%	Personal Behavior of Healthcare Providers	
Married	76.10%	Drinking Alcohol	4.40%
Cadre of health workers		Smoking	9.43%
Physician	20.75%	Washing Hands Before and After Work	93.08%
Pharmacist	16.35%	Wearing Work Clothes at Home	1.26%
Medical assistant	20.12%	Frequent Exercise	35.85%
Lab. Instructor	23.90%	Daily Hours of Sleep	
Nurse	18.87%	< 8 hr	67.29%
Type of health care facility		> 8 hr	32.70%

**Safety measurements of the study sample**

In the current study the results of the safety measures followed by the study sample were as follow and in a descending manner, from the highest percent to the lowest: supervision from directorate of health (DOH), necessary vaccines, periodic

follow-up examination to ensure health status, preventive or risk control measures in the place of work, training course about work-place hazards and work safety, and health care protection when facing injury (Table 2).

Table 2. Safety measurements of the study sample

Safety Measurements	Percentage	Highest %	Lowest %
Training Course About Hazards & Work Safety	38.99%	Nurses 10.6%	Pharmacists 4.4%
Necessary Vaccines	72.33%	Physicians 20.12%	Pharmacists 4.4%
Periodic Follow-up Examination Tests to Ensure Health	61.01%	Lab instructors 15.7%	Pharmacists 8%
Preventive or Risk Control Measures in the Place of Work	60.38%	Nurse 16.9%	Pharmacists 7.54%
Health Care Protection When Facing Injury	18.24%	Medical assistants 5%	Pharmacists 2.5%
Accidental Death in the Work Place	0%	-	-
Supervision from DOH	93.08%	Lab instructors 23.89%	Physicians 18.23%

### Types of biological and non-biological hazards exposure in the study sample

Nurses were most susceptible to sharp related injuries, cuts and wounds than the other groups. Laboratory instructors represent the most exposed group to contaminated

specimens/biohazards and blood borne pathogens, while the physicians represent the most prone group to acquire infectious diseases and both the physicians and the nurses were equally exposed to airborne diseases (Table 3).

Table 3. Biological hazards in different healthcare providers

Health Care Provider	Biological	Gender M/F	Sharp Related Injury	Cut and Wound	Contact with Contaminated Specimen / Biohazard	Airborne Disease	Infectious Disease	Blood Borne Pathogen
Physician	20.12%	19/ 14	11.32%	6.29%	11.95%	11.32%	15.10%	10.10%
Pharmacist	8.17%	9/4	0.63%	0.63%	1.26%	7.55%	5.66%	0.63%
Medical Assistant	13.21%	9/12	6.92%	5.66%	5.66%	5.66%	5.03%	6.92%
Lab Instructor	23.90%	11/27	12.58%	10.10%	17.61%	4.40%	10.70%	13.84%
Nurse	18.24%	9/20	13.84%	10.69%	7.55%	11.32%	8.80%	6.29%
Total	83.64%	57/77	45.29%	33.37%	44.03%	40.25%	45.29%	37.78%

Regarding the non-biological hazards, the results showed that physicians were the most likely group to suffer from work related stress; and medical assistants were the most susceptible to radiation.

Meanwhile, laboratory instructors were the most exposed group to physical distress, falls, unsafe staffing, chemical spills and noise. Furthermore, nurses were more prone to experience verbal abuse in the workplace (Table 4).

Table 4. Non-Biological Hazards in different Healthcare Providers.

Health Care Provider	Non Biological	Gender M/F	Stress	Physical	Psychological	Verbal Abuse	Fall	Fracture	Unsafe Staffing	Chemical Spills	Noise	Radiation
Physician	18.9%	17/13	13.8%	9.4%	0.0%	9.4%	1.8%	1.3%	9.4%	1.9%	2.3%	1.3%
Pharmacist	13.2%	14/7	5.0%	2.5%	0.6%	3.8%	3.1%	0.0%	5.0%	2.5%	1.5%	0.0%
Medical Assistant	19.4%	13/17	11.3%	9.4%	0.6%	9.4%	3.1%	0.0%	10%	1.9%	2.3%	3.1%
Lab Instructor	23.3%	11/26	10.0%	15.1%	1.9%	9.4%	5.0%	1.2%	13.8%	8.8%	5.4%	1.9%
Nurse	18.3%	8/21	11.9%	12.6%	0.0%	15%	1.3%	0.0%	12.5%	1.2%	3.9%	0.6%
Total	93.1%	63/84	52%	49.0%	3.1%	46.9%	14.3%	2.5%	50.7%	16.3%	15.4%	6.9%

### Correlation between vaccination and incidence communicable diseases

The results of this study indicated that taking the required vaccines by the healthcare providers can reduce the exposure to blood borne

diseases ( $p= 0.016$ ), but do not significantly reduce the risk of infectious ( $p= 0.74$ ) and air borne diseases ( $P= 0.80$ ) (Table 5).

**Table 5. Correlation between Vaccination and Communicable Diseases.**

Subject	Vaccination		Infectious Disease		Air borne Disease		Blood Borne Disease	
	Yes/No	Yes %	Yes/No	Yes %	Yes/No	Yes %	Yes/No	Yes %
Physicians	32/1	97	24/9	73	18/15	54	16/17	48
Pharmacists	7/19	27	9/17	35	12/15	46	1/25	4
Medical Assistants	22/10	69	8/24	45	9/23	18	11/21	58
Lab Instructors	32/6	84	17/21	25	7/31	28	22/16	34
Nurses	22/8	73	14/16	47	18/12	60	10/20	33
P value			0.7439 ns		0.7988 ns		0.0156*	
r <sup>2</sup>			0.000415		0.000682		0.0367	

\*:  $p \leq 0.05$ , Fair evidence against the  $H_0$ .

ns:  $P > 0.05$ , not significant.

### Correlation between Training Course and Biological/Non Biological Hazards

The study revealed that there is no significant difference between the healthcare

providers who have had training course about occupational safety and those who did not, regarding exposure to biological ( $p= 0.06$ ) and non-biological hazards ( $p= 0.85$ ) (Table 6).

**Table 6. Correlation between Training Course and Exposure to Biological/Non Biological Hazards.**

Subject	Training Course		Biological Hazards		Non-Biological Hazards	
	Yes/No	Yes %	Yes/No	Yes %	Yes/No	Yes %
Physician	14/19	42	32/1	97	30/3	91
Pharmacist	7/19	27	13/13	50	21/5	81
Med.Assis.	12/20	37	21/11	66	31/1	97
Lab.Inst.	12/26	31	38/0	100	37/1	97
Nurse	17/13	57	29/1	97	29/1	97
P value			0.0604 ns		0.8541 ns	
r <sup>2</sup>			0.02228		0.000216	

ns:  $P > 0.05$ , not significant.

### Summary of Exposure to Biological /Non-Biological Hazards

Table 7 summarizes the exposure to biological and non-biological hazards among the studied subjects,

where exposure to sharp materials (45.9%) was the major biological hazard and stress represents the highest rate (52.2%) of non-biological hazards among the studied sample.

**Table 7. Summary of Biological/Non-Biological Hazards within the study Sample**

Hazards experienced by health workers	Frequency (N= 159) Yes (%)
<b>Biological hazards</b>	<b>133 (83.64)</b>
Sharp related injuries (such as needle sticks)	73 (45.29)
Cuts and wounds	53 (33.37)
Direct contact with contaminated specimens/biohazardous materials	70 (44.03)
Airborne diseases	64 (40.25)
Infectious diseases and/or infections	72 (45.29)
Blood borne pathogens	60 (37.78)
<b>Non-biological hazards</b>	<b>148 (93.1)</b>
Stress	83 (52)
Physical	78 (49)
Psychological	5 (3.1)
Verbal abuse	76 (46.9)
Falls	23 (14.3)
Fractures	4 (2.5)
Unsafe Staffing	81 (50.7)
Chemical spills	26 (16.3)
Noise	20 (15.4)
Radiations	13 (6.9)

## Discussion

Occupation related health injuries, wounds and sicknesses cause a lot of human suffering and bring about high costs, both for those affected individuals and for the society in general<sup>14</sup>. There are limited studies that focus on the safe environment in the workplace. Research that have concentrated on healthcare employee injury outcomes endorse that bad organizational status and high workloads are associated with increased injuries, including needle stick injuries and near-misses to practicing nurses.<sup>15</sup> Additionally, most of the efforts on hospital and healthcare safety climate to date are patient oriented rather than employee oriented. These studies focused mainly on patient safety-related strategies to improve patient safety rather than employee safety. Previous studies investigating medical institution and healthcare safety state exhibit fewer patient-associated injury events and mortality associated with superior work place protection climates<sup>16,12</sup>.

In the current study, health care providers who have participated in training courses on the safety and hazards exposure were less exposed to biological hazards yet statistically non-significant. A study conducted by Sarbaz et al. concluded that training had a remarkable effect and reported substantial decrease in the number of exposure events<sup>17</sup>. The

present study revealed that the majority of respondents had experienced both types of hazards. Lab instructors were the most exposed category and the least were the pharmacists; these findings were highly comparable with those reported in other studies that reported women are the majority of health care providers, exposed to risks of different types of hazards like infection, violence, musculoskeletal injuries<sup>5,16</sup>.

In the current study, the nurses were the most healthcare personnel who follow the safety control measures, through taking training courses on hazards and work safety while the pharmacists are the least in this respect. Meanwhile, taking necessary vaccinations was mostly reported in the physicians and least among pharmacists. Regarding the periodic follow up examinations, they are mostly observed among lab instructors and the least among pharmacists. Additionally, the presence of preventive or risk control measures in the place of work was mostly accessible by the nurses and least by the pharmacists. Healthcare protection when facing injuries are mostly reported by the medical assistants and least by pharmacists. An interesting finding in our study is that healthcare providers who had taken the necessary vaccines related to their occupation were significantly less exposed to blood

borne diseases with no significant changes in infectious diseases and air borne diseases, compared to those who did not take the suitable vaccinations. Nurses were found to be more prone to sharp related injuries and cut/wound in the hospitals compared to other professionals; this can be attributed to the nature of their work and handling of sharp equipment when practicing their job. Similar finding was reported by Ilhan et al. who claimed that the percentage of nurses facing a sharp or needle stick injury during their professional life was high<sup>(18)</sup>. The present study also showed that lab instructors are more exposed to contact with contaminated specimens/biohazards and air borne diseases, which may be due to the fact that they are dealing with the biological specimens in public and private health sectors during practicing their daily work. Unsafe disposal of medical wastes is a major challenge in developing countries as they contributes largely to occupational injuries and infections<sup>(19, 20)</sup>.

Additionally, in the present study, other hazards such as psychological, chemical spills and fall although are uncommon at healthcare settings<sup>(5)</sup>, but lab instructors are still relatively more prone to such types of hazards<sup>21</sup>. Lab instructors, nurses, medical assistants, physicians, and pharmacists are exposed to the risks of noise, in descending order. Furthermore, medical assistants are most at risk of radiation in the work place due to dealing with radiating machinery at the hospitals.

Regarding the risks of exposure to infectious disease, physicians are on the top of the list, since they are more prone to acquire infections among other healthcare providers that mainly resulted from their close contact with infected patients in both public and private clinics<sup>(22)</sup>. Moreover, physicians are also the most exposed group to stressful conditions compared to others and the study reported two cases of fractures which could be probably due to their hard duty in the hospital and the necessity to make critical decisions on a daily basis. Other studies showed that long work hours of physicians increase the incidence of stress and depression<sup>(23,5)</sup>.

### Study Limitations

The main limitation of this study is the small sample size and the results could have been affected by recall bias as respondents were required to recall past experience.

### Conclusion

Healthcare providers in healthcare settings of Sulaimani city experience several hazards in their workplaces. Occupational hazards became a dominant issue among health care providers, since they get exposed to a wide variety of hazards ranging from biological, chemical, physical, to psychosocial hazards. Interventions should be established to alleviate these hazards. Training courses on the risk of health hazards and safety measures suggested mitigating these hazards.

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