Assessing Knowledge of Occupational Safety Measures among Laboratory Health Workers in Governmental Hospitals in Mosul

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ABSTRACT

Objective: To assess the knowledge of occupational safety measures among laboratory health workers.
Materials and Methods: A cross-sectional study designed to achieve the aim of the present study. The questionnaire comprised two sections: section one covered sociodemographic parameters, and section two covered knowledge parameters.
Results: The study consisted of 400 participants over six months, starting on Nov 3, 2023, and ending on May 3, 2024, and about three-fifths of the participants (59.2%) were females, and around a half of them (51.0%) had a university education. Less than half (45.4%) have less than five years of experience. Nearly two-thirds (68.8%) received the hepatitis B viral vaccine. Overall, the percentage of knowledge assessment regarding occupational hazards ranged from (1.8%) who thought masks were one of the personal protective measures to (90.2%) of participants who believed that blood and body fluid were the most frequent causes of infection. Knowledge assessment regarding accident control measures ranged from (17.8%) who thought that the most common cause of needle stick injury is handling equipment before use, to (86.5%) who believed that immediately washing the eyes with water was the most essential way to reduce the risk of exposure to a chemical substance. Knowledge assessment regarding the availability of emergency safety measures ranged from (12.8%) of the participants who knew the eyewash unit in their lab to (94.8%) who thought that the equipment/ chemical had been appropriately kept after use.
Conclusions: Despite much academic concentration on this topic, lab staff still have some defects, and lab safety measures should be more frequent clinical training sessions due to their paramount importance.

Keywords: Laboratory, Occupational Safety, Knowledge.

تقييم المعرفة لتدابير السلامة المهنية بين العاملين الصحيين في مختبرات المستشفيات الحكومية في الموصل

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الخلاصة

الهدف: تقييم المعرفة بتدابير السلامة المهنية بين العاملين في مجال الصحة في المختبرات.
المواد و الطرق: دراسة مقطعية تهدف إلى تحقيق هدف الدراسة الحالية. تتكون الاستبانة من قسمين، القسم الأول يغطي المعايير الاجتماعية والديموغرافية والقسم الثاني يغطي المعايير المعرفية.
النتائج: تكونت الدراسة من ٤٠٠ مشارك، على مدى ستة أشهر تبدأ في ٣ نوفمبر ٢٠٢٣ وتنتهي في ٣ مايو ٢٢٤، وكان حوالي ثلاثة أخماس المشاركين (٢.٥٩%) من الإناث، وحوالي النصف (٥١%) حصل على تعليم جامعي. ما يقرب من أقل من النصف (٥٤.٤%) لديهم أقل من ٥ سنوات من الخبرة. وقد تلقى ما يقرب من ثلثيهم (٦٨.٨%) اللقاح الفيروسي ضد التهاب الكبد B بشكل عام، تراوحت نسبة تقييم المعرفة فيما يتعلق بالمخاطر المهنية من (١.٨%) الذين اعتقدوا أن الأقنعة هي أحد إجراءات الحماية الشخصية إلى (٩٠.٢%) من المشاركين الذين اعتقدوا أن الدم وسوائل الجسم هي الأسباب الأكثر شيوعًا للعدوى. تراوح تقييم المعرفة فيما يتعلق بتدابير مكافحة الحوادث بين (١٧.٨%) ممن يعتقدون أن السبب الأكثر شيوعاً للإصابة بوخز الإبرة هو التعامل مع المعدات قبل استخدامها إلى (٨٦.٥%) الذين يعتقدون أن غسل العينين فوراً بالماء هو أهم وسيلة لتقليل الإصابة. خطر

التعرض لمادة كيميائية. تراوح تقييم المعرفة فيما يتعلق بتوافر تدابير السلامة في حالات الطوارئ من (١٢.٨٪) من المشاركين الذين كانوا يعرفون وحدة غسيل العين في مختبرهم إلى (٩٤.٨٪) الذين اعتقدوا أن المعدات / المادة الكيميائية قد تم حفظها بشكل صحيح بعد الاستخدام.

الخلاصة: على الرغم من التركيز الأكاديمي الكبير على هذا الموضوع، لا يزال لدى موظفي المختبر بعض العيوب، ويجب أن تكون تدابير السلامة في المختبر جلسات تدريب سريرية أكثر تواترا بسبب أهميتها الكبرى.

الكلمات المفتاحية : المختبر، السلامة المهنية، المعرفة.

INTRODUCTION

Occupational health promotes and maintains the maximum level of employees' physical, mental, and social welfare through risk management, health hazard prevention, and job adaptation[1].

Laboratory health professionals are essential in many scientific domains, such as pharmaceuticals, environmental monitoring, diagnostics, and medical research[2]. With the advancement of medical technology in recent years, the medical field has changed from one of convention to one of innovation. Clinical professionals can now choose from a wide range of diagnostic procedures, which means that skilled laboratory technicians are needed more than before to carry out these tests effectively and safely[3].

Laboratory workers should be current on safe and effective working practices in the labs and know how these practices are implemented[4].

One of the reasons for low-quality care and professional burnout is unsafe working circumstances. Infections (hepatitis, respiratory infections), ergonomic hazards (back injuries, musculoskeletal problems), chemical hazards (allergies, hazardous medications), radiation hazards, and psychosocial hazards are the main occupational risks that healthcare providers have to face[5].

Vaccination against diseases, handling hazardous chemicals safely, and wearing personal protective equipment (PPE), including masks, gloves, gowns, and head coverings, are a few examples of how safety procedures assist the protection of healthcare professionals, visitors, and health providers.

There is a significant danger of infection from body fluid exposure when safety precautions are inadequate[6].

Knowledge is the cornerstone of safety procedures, which means the laboratory personnel have sufficient awareness of safety precautions, emergency protocols, and potential hazards[7].

The study assesses laboratory health workers' knowledge of occupational safety measures.

SUBJECT AND METHODS

A Cross-sectional study design involved 400 participants from all health workers in the medical laboratories of all governmental hospitals (Al Salam Teaching Hospital, Al Khansa'a Teaching Hospital, Ibn Al-Atheer Children's Teaching Hospital, Al-Hadba'a Specialized Hospital, Ibn Sina Teaching Hospital, Al-Jumhori Teaching Hospital, Al-Batoul Teaching Hospital, Mosul General Hospital, Al-Shifa'a Hospital, and Oncology and Nuclear Medicine Specialized Hospital) in Mosul City, both sexes and all shifts, who agreed to participate in the study and present at the time and date of data collection were included. The questionnaire comprised two sections: section one covered sociodemographic parameters, and section two covered knowledge parameters.

Ethical approval had been taken from the Scientific Committee in the Department of Family and Community Medicine, the High Education Committee of the College of Medicine, University of Mosul, and the Nineveh Directorate of Health. All the participants were well-informed about the study objectives and advantages. The confidentiality of the participants was improved.

Sample size will be estimated according to the following equation of cross-sectional study design as following: $\mathbf{N=Z^2P(1-P)/d^2}$ [N=sample size, Z=Z statistics for a level of confidence of 95% (1.96), P=estimate of expected prevalence or proportion (in a proportion of one if 15%, P=0. 15, 1-p=0.85), and d= estimate absolute error or precision (if 5%, d=0.05)]. The calculated sample size for desired precision is 195, multiplied by 2(for design effect) = 390, and the total sample is 400. The data collected over six months started on Nov 3, 2023, and ended on May 3, 2024. Special programs are managed and analyzed using a computer facility Laptop (HP) provided in computer facilities (Microsoft Offices 2016: word & excel program).

The data was analyzed using SPSS, version 25. The number (percentage) and mean ± standard deviation (SD) were calculated for demographic data. The differences between categorical variables were assessed using the Z-test and Chi-squared test. A *P*-value of < 0.05 was considered as statistically significant.

RESULTS

The total sample size was 400 individuals. As shown in Table 1, about 40.5% of the participants were under 30 years old, and more than half (59.2%) were females. Approximately two-thirds (67.5%) were married, and around half (51.0%) had a university education. About one-third of the scientific branch participants are in hematology (33.8%), and less than half (45.4%) have <5 years of experience. Most health workers are nonsmokers (85.5%), and 68.8% received hepatitis B vaccine.

Table 1. Sociodemographic Characteristics of the study population (n=400)

Sociodemographic parameter	No.	%	P-value*
Age group (in years):			
< 30	162	40.5	0.001
30-40	138	34.5	
> 40	100	25.0	
Gender:			
Male	163	40.8	0.000
Female	237	59.2	
Marital status:			
Single	119	29.8	0.000
Married	270	67.5	
Divorced	6	1.5	
Widowed	5	1.2	
Educational level:			
Technical institute	159	39.8	0.000
University	204	51.0	
Higher education	37	9.2	
Years of experience:			
< 5	182	45.4	0.000
5-10	71	17.8	
> 10	147	36.8	
Scientific branch:			
Microbiology	106	26.5	0.000
Hematology	135	33.8	
Biochemistry	106	26.5	
Histopathology	53	13.2	
Smoking:			
Smoker	58	14.5	0.000
Nonsmoker	342	85.5	
Hepatitis B vaccine:			
Received	275	68.8	0.000
Not received	125	31.2	

* Chi-square for goodness of fit

Table 2 explores the participants' knowledge of occupational hazards. Two-thirds of participants (67.3%) knew biological hazards are the most prevalent occupational hazard. More than three-quarters (75.7%) of respondents understood the significance of wearing all types of personal protective equipment to reduce laboratory occupational hazards. Most participants (90.2%) said that direct contact with blood or body fluids is the most frequent source of cross-infection. It was shown that 44.3% of laboratory health professionals knew they should change their gloves after every test.

Table 2: Knowledge assessment of the study population regarding occupational hazards

No.	Knowledge parameter (n=400)	Present		Absent		P-value*
		No.	%	No.	%	
Q1	**Type of occupational hazard**					
	Biological	269	67.3	131	32.7	0.000
	Chemical	170	42.5	230	57.5	0.003
	Physical	116	29.0	284	71.0	0.000
Q2	**Type of personal protective measures that should be used daily within the lab**					
	Lab coat	90	22.5	310	77.5	0.000
	Mask	7	1.8	393	98.2	0.000
	Gloves	41	10.3	359	89.7	0.000
	All	303	75.7	97	24.3	0.000
Q3	**The most likely source of cross-infection in the laboratory:**					
	Blood and body fluid	361	90.2	39	9.8	0.000
	Air born	77	19.3	323	80.7	0.000
	Feces and urine	61	15.3	339	84.7	0.000
Q4	**The laboratory worker is changing gloves.**					
	Once daily	133	33.3	267	66.7	0.000
	If disruption	122	30.5	278	69.5	0.000
	After each test	177	44.3	223	55.7	0.024

* Z test of one proportion.

Table 3 reveals that most participants (86.5%) recognized that needle sticks occur more commonly in laboratory settings and that participants (72.5%) perform follow-up testing and provide counseling to minimize injury accidents when they happen. After being sprayed with a chemical, most participants (86.5%) immediately washed their eyes.

Table 3: Knowledge assessment of the study population regarding accident control measures

No.	Accident control measures	Present		Absent		P-value*
		No.	%	No.	%	
Q1	**During which of the following activities is a needle stick injury most likely to occur:**					
Recapping		346	86.5	54	13.5	0.000
They were transported to Sharp's disposal safety box		134	33.5	266	66.5	0.000
We are handling equipment before use		71	17.8	329	82.2	0.000
Q2	**Sharp injury accident control**					
Provide immediate care to the exposure site		221	55.3	179	44.7	0.040
Evaluate exposure and report		156	39.0	244	61.0	0.000
Taking post exposure prophylaxis (tetanus toxoid)		223	55.8	177	44.2	0.024
Perform follow-up testing and provide counseling		290	72.5	110	27.5	0.000
Q3	**Control measures toward chemical splash to the eyes**					
Don't rub the eyes		229	57.3	171	42.7	0.004
Immediately wash the eyes with tap water		346	86.5	54	13.5	0.000
Don't apply any eye drops		87	21.8	313	78.2	0.000
I am cleaning my hands thoroughly		247	61.8	153	38.2	0.000

* Z test of one proportion.

Table 4 shows the results of an assessment regarding the availability and knowledge of emergency safety measures among the participants. It shows that most participants notified the safety start before entering the laboratory (81.5%). Most participants (85.5%) understood the importance of the availability of fire extinguishers in the lab. Many participants recognized ideal precaution measures like hand hygiene and cleaning and disinfection of equipment (83.8%, 82.5%), respectively. The p-values for all options, except "walk, don't run, to the nearest exit, then to a designated evacuation site "and "Do you know an emergency exit plan?" were statistically significant ($p < 0.05$).

Table 4: Availability of emergency safety measures according to study population opinions

No.	Safety measures parameters	Present		Absent		P-value*
		No.	%	No.	%	
Q1	**The available emergency safety equipment in the laboratory**					
Eyewash unit		51	12.8	349	87.2	0.000
Fire extinguisher		342	85.5	58	14.5	0.000
First aid kit		157	39.3	243	60.7	0.000
Safety shower		128	32.0	272	68.0	0.000
Chemical fume hood		67	16.8	333	83.2	0.000
Q2	**Ideal precaution measures in the laboratory**					
Hand hygiene		335	83.8	65	16.2	0.000
Use of personal protective equipment		240	60.0	160	40.0	0.000
Cleaning and disinfection of equipment		330	82.5	70	17.5	0.000
Q3	**Emergency safety measures are taken when an accident occurs.**					
Follow the instructions of emergency personnel		247	61.8	153	38.2	0.000
Walk, don't run, to the nearest exit, then to a designated evacuation site		203	50.8	197	49.2	0.803
Don't use elevators		173	43.3	227	56.7	0.008
Immediately notify emergency personnel of any disabled or injured persons needing assistance		259	64.8	141	35.2	0.000
Q4	**Laboratory safety starts before entering the laboratory work**	326	81.5	74	18.5	0.000
Q5	**keep the equipment/chemicals in their usual place after use**	379	94.8	21	5.2	0.000
Q6	**Safety data sheets are available in the laboratory**	223	55.8	177	44.2	0.024
Q7	**Emergency exit plan**	194	48.5	206	51.5	0.582
Q8	**Knowing how to use a fire extinguisher in case of a fire?**	169	42.2	231	57.8	0.002

* Z test of one proportion.

DISCUSSION

Laboratory workers in hospitals and other healthcare facilities are subject to various risks; for example, handling clinical specimens can put them at risk of infection and contamination[8]. Samples of blood, tissue, or other body fluids, as well as medical waste, are considered the primary sources of infections among laboratory workers and present potential biological hazards[9]. If not handled carefully, chemicals, gasses, and solvents can be toxic, explosive, or flammable, resulting in explosions, gas leaks and fires in laboratories, and infection. Other non-infectious risks include burns from corrosives, wounds, and skin injuries. Electrical shock is another frequent hazard[10-11].

However, we acknowledge that our observation was limited because the investigator had a theoretical assessment of the lab workers' knowledge without observing them closely, which means many of them may know the proper safety practices. Still, they don't follow them or vice versa. Moreover, our study does not estimate lab workers' efficiency in their knowledge, and this issue needs further studies and is dependent on academic scores. Third, our results were based on the Mosul population. Whether the same results would be observed in other regions remains to be investigated. Finally, our small number of study participants can affect the analysis results.

The Present study has several strengths. First, a structured questionnaire enabled us to adjust to theoretical and practical points. Second, the investigator notes that the participants indirectly followed the safety measures they missed while the author performed the study. Lastly, we translated the text into Arabic before data collection to ensure the participants understood each question well.First, the demographic section of the study's age distribution may relate to the fact that most employees over forty years old prefer to work in places other than hospitals due to the many hazards they face in this setting. As a result, there is a relatively minor number of employees compared to those under thirty. Additionally, lab staff numbers at each department can indirectly reflect the load of patients doing different lab investigations. The study found that (68.8 %) received the hepatitis B vaccine, which is considered part of the Iraqi policies before employment; this finding goes with Ahmed and Shareef's (2019) results about the employees of governmental hospitals having vaccinated against infectious diseases within the health facility (76%).[12] The second section of our study dealt with lab workers' knowledge despite academic colleges' continuous concern about teaching and reaching the fundamental safety goal of minimizing accidents and injuries.

Many lectures and training courses promote a thorough understanding of risks and practical preventive measures. The graduate lab worker still needed to be reinforced from time to time regarding this significant topic. Only, (44.3%) of laboratory health professionals knew that they should change their gloves after every test. Comparing to another study conducted in 2021 in Nicosia, Cyprus, by Gulifeiya Abuduxike *et al.* found that (89%) of lab workers changed their gloves after every test[13]. Our finding is thought to be because of poor government supplies of sufficient gloves and many patients attending hospital labs. As a result, lab staff didn't change their gloves frequently.[14]

Concerning the knowledge of emergency safety measures availabilities, the study found that most participants believe there is a lack of eye wash units, chemical fume hoods, and safety showers versus most of them (85.5%) who thought a fire extinguisher was found. Generally, these wrong impressions were considered to be due to destroyed hospital infrastructures and, depending on substitutional solutions, many fire accidents occurred at different hospitals in Iraq[15].

Most participants were notified that laboratory safety should be started before entering the laboratory (81.5%). And (94.8%) of the respondents thought they should keep the equipment/chemicals in their usual place after use, 48.5 % were notified about the lab safety data sheets, 42.2% knew the proper use of fire extinguishers. These findings were statistically significant, while less than half (48.5 %) don't know an emergency exit plan, which is statistically not significant. This finding goes with Teka (2018), as preventing and handling lab emergencies are aspects of laboratory safety. Effective prevention is always preferable to others.[16] These findings concur with research conducted in 2021 by Abu-Siniyeh and Al-Shehri, which found that some areas of laboratory safety were not sufficiently understood or known. Academic institutions should implement efficient safety policies, instruction, and training to increase student safety.[17]

CONCLUSIONS AND RECOMMENDATIONS

Despite the availability of free and safe hepatitis B virus vaccines and awareness campaigns, many medical staff and lab workers remain unvaccinated. They often face chemical, physical, and biological hazards without proper personal protective equipment due to lack of knowledge, poor control systems, or defective governmental supply.

It's recommend stricter laws for lab workers who pose a threat, increased funding for personal protective equipment, and further studies to improve lab work efficiency. It also recommends warning signs and symbols for dangerous materials and hospital emergency procedures. Non-lab personnel should not enter labs without proper equipment. Hospitals should establish a special team to monitor infection prevention and control activities (IPC). Additionally, suitable eating, drinking, and smoking areas should be provided to ensure respectful behavior toward staff and patients.

DECLARATION OF INTERESTS

The authors have no conflicts of interest to disclose.

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