

## Evaluation of Safety and Security in Medical Laboratories of Babylon University

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### Abstract

**Background:** Scientific laboratories considered a very important means in the development of science and these laboratories began increasing in their quantity and quality day after day and due to the spread of many diseases which have no obvious reasons, we must search for the unexpected underlying causes so we decided to make an assessment of things that provide safety and security in educational laboratories belonging to the Medical Group colleges owing to the large number of employees and students that deal with these laboratories and illustrate weaknesses points and requirements that qualify it to be healthy work environment depending on Internationally recognized guidelines.

**Objective:** to estimate degree of safety and security in Medical Group colleges' laboratories.

**Research design and methods:** this study was Cross sectional study including 30 labs of medicine, dentistry, pharmacy and nursing colleges. Questionnaire involving main five entities (Employee training, Appliances and electrical outlets, Fire safety, Display screen equipment- DSE and Contingency Plan) which Consisting of 95 questions about lab safety and security.

**Statistical analysis:** SPSS version 17 was used. Chi test was used for discreet data. Data expressed as percentage .P < 0.05 was considered significant.

**Result:** Employee training in all labs was 45%, Appliances and electrical outlets were 50.86%, Fire safety was 34.08%, DSE was 61.13% and Contingency Plan 27.78 %. In general, Safety and security in medical laboratories of Babylon University was 43%.

**Conclusion:** this cross sectional study shows that there is weakness in Safety and security requirement which may belong to employees themselves or to Infrastructure of laboratories in general or to unintended causes.

### الخلاصة

**الخلفية:** تعتبر المختبرات العلمية من الوسائل المهمة جدا في تطور العلم وبدأت هذه المختبرات بالتزايد كما ونوعا يوما بعد يوم ونظرا لانتشار العديد من الامراض التي ليس لها اسباب واضحة فعلينا البحث عن المسببات الغير متوقعة ومن هذا المعتقد ارتأينا اجراء تقييم للاشياء الخاصة بتوفير السلامة والامان في المختبرات التعليمية العائدة الى المجموعة الطبية وذلك لكثرة المنتسبين والطلبة المستخدمين لهذه المختبرات وتوضيح نقاط الضعف والاحتياجات التي تؤهلها لان تكون بيئة عمل صحية وذلك بالاعتماد على المبادئ التوجيهية المعترف بها دوليا

**الهدف من الدراسة:** تقدير درجة السلامة والأمن في كليات المجموعة الطبية >

**طريقة العمل** هذه الدراسة دراسة مقطعية شملت ٣٠ مختبر في كليات الطب وطب الأسنان والصيدلة والتمريض. تنطوي استبيان خمسة كيانات رئيسية (تدريب الموظفين، الأجهزة والتوصيلات الكهربائية والسلامة من الحرائق، شاشة العرض DSE-equipment وخطة الطوارئ) والتي تتكون من ٩٥ سؤال حول السلامة والأمن في المختبر.

تم استخدام برنامج SPSS النسخة ١٧ لتحليل الإحصائي. وقد استخدم اختبار chi للبيانات وأعرب البيانات كنسبة مئوية

**النتائج:** كانت نسبة الأجهزة والمنافذ الكهربائية 50.86٪، و السلامة من الحرائق ٣٤.٠٨٪، وكانت نسبة اجهزة العرض 61.1٪ و ٢٧.٧٨٪ خطة الطوارئ، والنتيجة. بشكل عام، كانت السلامة والأمن في المختبرات الطبية في جامعة بابل ٤٣٪.

**الاستنتاج:** تظهر هذه الدراسة المقطعية أن هناك ضعف في السلامة والمتطلبات الأمنية التي قد تنتمي إلى الموظفين انفسهم أو للابنية التحتية للمختبرات او اسباب غير متعمدة بشكل عام

## **Introduction**

Scientific laboratories are considered a very important means in the development of sciences. Most laboratories carry weighty hazards, and the prevention of laboratory accidents requires great care and constant caution. Examples of risk factors include high voltages, high and low pressures and temperatures, corrosive and toxic chemicals, and biohazards including infective organisms and their toxins [1, 2]. In some cases, laboratory activities can also lead to environmental health risks, for example, the accidental or deliberate discharge of toxic or infective material from the laboratory into the environment [3].

In laboratories where dangerous conditions might exist, safety precautions are important. Rules exist to minimize the individual's risk, and equipment is used to protect the lab users from injury or to assist in responding to an emergency.

Safety — frequently defined as free from hazards. However, it is practically impossible to completely eliminate all hazards. Safety is therefore a matter of relative protection from exposure to hazards [4].

Occupational health and safety (OHS) is a multidisciplinary field concerned with the safety, health, and welfare of people at work. These terms of course also refer to the goals of this field [5].

In 2001, the International Labor Organization (ILO) published ILO-OSH 2001, also titled "Guidelines on occupational safety and health management systems" to assist organizations with introducing OSH management systems [6]. These guidelines encourage continual improvement in employee health and safety, achieved via a constant process of policy, organization, planning, implementation, evaluation, and action for improvement, all supported by constant auditing to determine the success of OSH actions [6].

laboratories began increasing in their quantity and quality day after day and due to the spread of many diseases which have no obvious reasons, we must search for the unexpected underlying causes so we decided to make an assessment of things that provide safety and security in educational laboratories belonging to the Medical Group colleges in Babylon university owing to the large number of employees and students that deal with these laboratories [7], and illustrate weaknesses points and requirements that qualify it to be healthy work environment depending on Internationally recognized guidelines [8].

## **Results**

This Cross sectional study for Checking safety and security requirements including 30 labs found in medicine, dentistry, pharmacy and nursing colleges. Questionnaire involving main five entities (Employee training, Appliances and electrical outlets, Fire safety, Display screen equipment- DSE and Contingency Plan) which Consisting of 95 questions about lab safety and security.

### ***I. Staff training and awareness***

Check safety requirements and security Record (training and staff awareness) in all medical colleges labs were compared .All staff of nursing college labs was training while only 25% of Dentistry College was trained. There was insignificant differences between groups ( $P>0.5$ ).

Regarding documentation, no significant difference were seen among medical labs ( $p>0.05$ ).

Regarding emergency plans, All Nursing College labs had emergency plans while no plan in Dentistry College labs. There was significant differences among medical labs ( $P<0.5$ ). About processing of spilled chemicals, there was significant differences among medical labs ( $P<0.5$ ). While there was insignificant differences among medical labs ( $P>0.5$ ) regarding site of cleansing materials. Most medical labs staff knew the safety officer except dentistry labs staff ( $P<0.05$ ). While there was insignificant differences among medical labs ( $P>0.5$ ) regarding knowing of material safety data sheets (MSDSs) ( $P>0.05$ ). About Personal safety equipment, Most medical labs staff had Personal safety equipment except dentistry labs staff ( $P<0.05$ ). While most medical labs staff didn't knew how processing the chemical waste ( $P<0.05$ ) and Most medical labs staff didn't knew the most harmful chemicals in their labs ( $P>0.05$ ). All medical labs didn't have Shower chemical safety. Most medical labs staff didn't had Documentation of wounds ( $P>0.05$ ). Most medical labs staff allows Visitors to sit in their lab ( $p>0.05$ ). There was significant differences among groups regarding storing chemical substances below eye level ( $P<0.5$ ).

**Table (1): Staff training and awareness of all medical labs.**

Q	Medicine	Dentistry	Pharmacy	Nursing	Total	P value
1	62.50%	25%	70%	100%	69%	0.07
2	37.50%	0%	60%	57.10%	44.80%	0.227
3	37.50%	0%	70%	100%	58.60%	0.02*
4	12.50%	0%	50%	.0%	20.70%	0.031*
5	75%	75%	80%	100%	82.80%	0.18
6	62.5%	25.0%	90.0%	100.0%	75.90%	0.002**
7	100.0%	25.0%	50.0%	57.1%	85.60%	0.066
8	100.0%	33.3%	80.0%	100.0%	75.90%	0.035*
9	12.5%	.0%	50.0%	.0%	3.40%	0.017*
10	40.0%	.0%	25.0%	.0%	10.30%	0.65
11	.0%	.0%	.0%	.0%	0.00%	-
12	28.6%	.0%	.0%	.0%	6.90%	0.091
13	14.3%	25.0%	50.0%	64.9%	38.0%	0.45
14	12.5%	.0%	70.0%	28.6%	34.50%	0.015*
<b>Average</b>	<b>42.53%</b>	<b>15%</b>	<b>53%</b>	<b>51%</b>	<b>45%</b>	

In general, regarding Staff training and awareness in all medical colleges labs, The pharmacy labs were better.

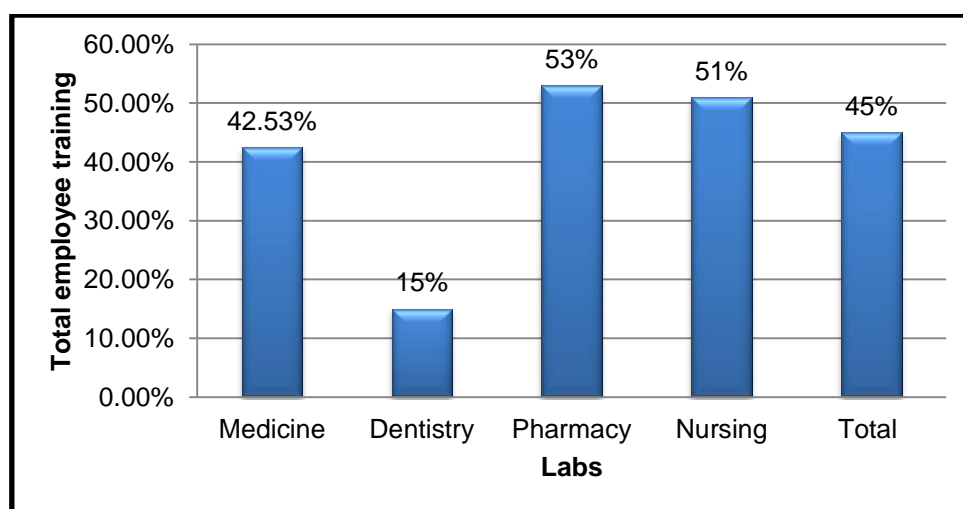


Figure (1): Check safety requirements and security Record (training and staff awareness in all medical colleges' labs

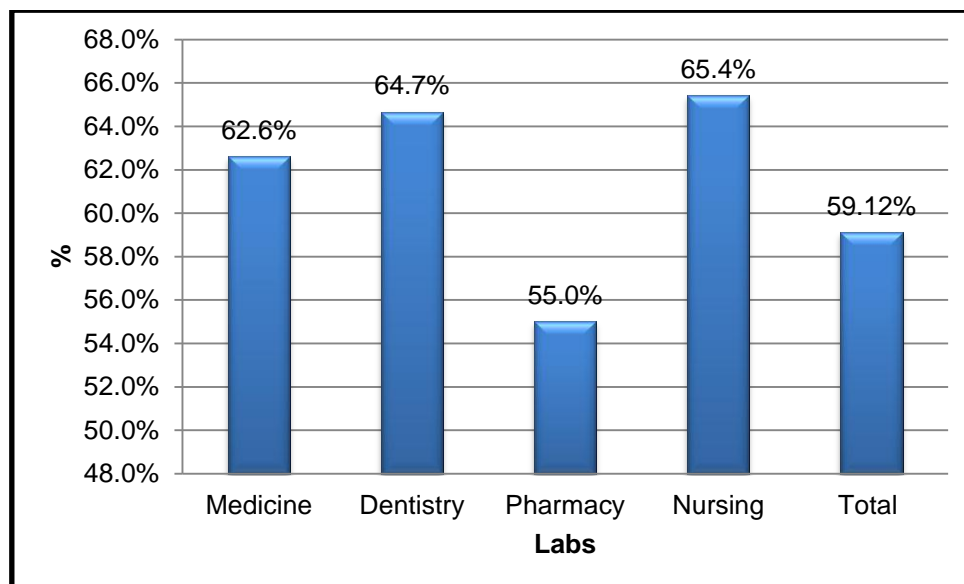
**II. Safety check requirements for electrical equipment record**

Safety check requirements for electrical equipment Record are compared among medical colleges labs. There were significant difference among them regarding dependence on DSE , Adjustment of the height and tilt of the screen , cleaning of the screen ,Effect of the screen on vision , the sufficiency and adjustment of light , presence of footrest and not use the phone while the screen work(P<0.05).

**Table (2): safety check requirements for electrical equipment record in all medical colleges' labs**

Q	Medicine	Dentistry	Pharmacy	Nursing	Total	P value
1	75.0%	100.0%	90.0%	42.9%	75.90%	0.09
2	62.5%	100.0%	100.0%	66.7%	75.70%	0.13
3	62.5%	100.0%	100.0%	100.0%	89.70%	0.046*
4	75.0%	100.0%	100.0%	50.0%	86.80%	0.07
5	75.0%	100.0%	88.9%	50.0%	72.40%	0.21
6	75.0%	100.0%	100.0%	100.0%	93.10%	0.16
7	12.5%	.0%	.0%	50.0%	13.80%	0.042*
8	12.5%	.0%	.0%	50.0%	13.80%	0.042*
9	12.5%	.0%	.0%	33.3%	10.30%	0.20
10	12.5%	.0%	.0%	50.0%	13.80%	0.042*
11	62.5%	75.0%	55.6%	83.3%	62.10%	0.68
12	62.5%	25.0%	22.2%	83.3%	44.80%	0.07
13	75.0%	100.0%	100.0%	100.0%	86.20%	0.16
14	75.0%	75.0%	44.4%	100.0%	65.50%	0.16
15	62.5%	.0%	22.2%	50.0%	34.50%	0.12
16	62.5%	100.0%	55.6%	100.0%	69.00%	0.13
17	50.0%	.0%	66.7%	.0%	34.50%	0.02*
18	100.0%	100.0%	60.0%	50.0%	65.50%	0.07
19	100.0%	100.0%	40.0%	100.0%	79.30%	0.002**
20	100.0%	100.0%	20.0%	100.0%	72.40%	0.001**
21	100.0%	75.0%	60.0%	100.0%	82.80%	0.07
22	25.0%	75.0%	10.0%	28.6%	27.60%	0.11
23	12.5%	.0%	10.0%	42.9%	17.20%	0.24
24	100.0%	75.0%	100.0%	100.0%	96.50%	0.09
25	87.5%	75.0%	90.0%	100.0%	89.60%	0.62
26	100.0%	100.0%	90.0%	100.0%	96.60%	0.56
27	75.0%	100.0%	100.0%	66.7%	82.80%	0.13
28	62.5%	100.0%	70.0%	.0%	55.20%	0.008**
29	28.6%	0%	0%	0%	65.50%	0.001**
	62.6%	64.7%	55.0%	65.4%	59.12%	

In general, regarding Safety check requirements for electrical equipment Record are compared among medical college's labs. The Nursing college labs was better.



**Figure (2): safety check requirements for electrical equipment Record in all medical colleges' labs**

### ***III. Safety check requirements for chemical substances Record***

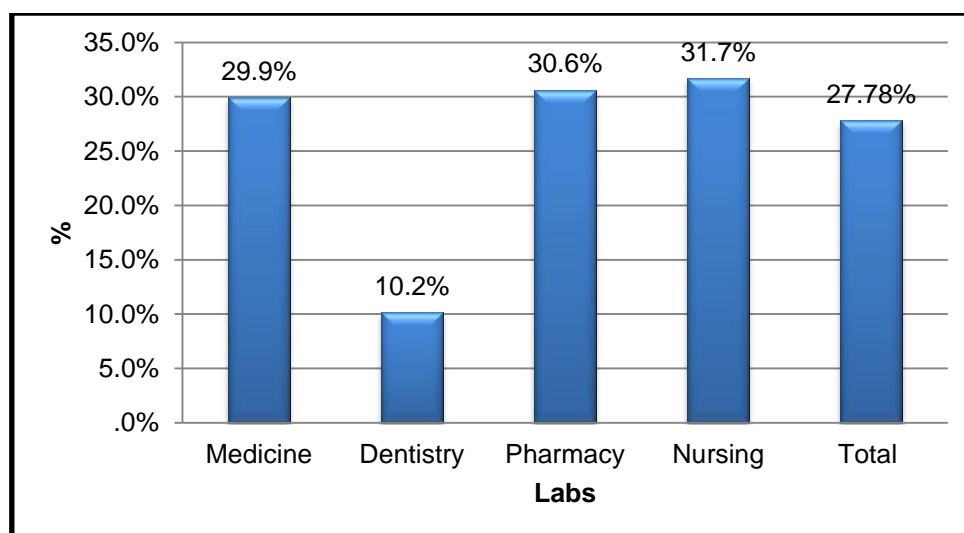
Safety check requirements for chemical substances Record are compared among medical colleges' labs. There were significant difference among them regarding the Minimum Quantity of these substances, Shelves packed in quantities with their capacity and far from ceiling about 61 cm, separation of oxidant and reducing substances, storage of chemicals below eye level, presence of chemical substance Containers. Experience about the mechanism of damage of sharps material, presence of Compressed gas cylinders and knowledge of their storage, and if these cylinders had Strapped regulator and cover, and empty on return to supplier and gases pulling power and speed ( $p < 0.05$ ).

**Table (3): Safety check requirements for chemical substances Record**

Q	Medicine	Dentistry	Pharmacy	Nursing	Total	P value
1	12.5%	.0%	40.0%	.0%	17.20%	0.109
2	12.5%	.0%	.0%	.0%	3.40%	0.43
3	50.0%	25.0%	40.0%	57.1%	44.80%	0.74
4	28.6%	.0%	50.0%	.0%	24.10%	0.07
5	.0%	.0%	.0%	.0%	0.00%	
6	62.5%	50.0%	10.0%	28.6%	34.50%	0.113
7	28.6%	.0%	.0%	.0%	6.90%	0.09
8	50.0%	.0%	50.0%	42.9%	41.40%	0.109
9	50.0%	.0%	70.0%	42.9%	48.40%	0.029*
10	37.5%	.0%	20.0%	.0%	17.20%	0.028*
11	12.5%	.0%	60.0%	.0%	24.10%	0.005**
12	12.5%	.0%	50.0%	14.3%	24.10%	0.003**
13	37.5%	.0%	50.0%	28.6%	34.50%	0.01*
14	25.0%	.0%	50.0%	42.9%	34.50%	0.043*
15	25.0%	.0%	50.0%	28.6%	31.00%	0.065
16	75.0%	100.0%	100.0%	100.0%	93.10%	0.46
17	62.5%	.0%	40.0%	14.3%	34.50%	0.118
18	12.5%	.0%	10.0%	.0%	6.90%	0.61
19	50.0%	50.0%	80.0%	.0%	48.20%	0.03*
20	75.0%	.0%	40.0%	71.4%	51.70%	0.111
21	62.5%	100.0%	70.0%	100.0%	79.30%	0.35
22	12.5%	.0%	10.0%	.0%	6.80%	0.65
23	.0%	.0%	.0%	.0%	0.00%	
24	37.5%	.0%	10.0%	100.0%	37.90%	0.002**
25	12.5%	.0%	30.0%	71.4%	31.00%	0.017*
26	25.0%	.0%	.0%	57.1%	20.60%	0.006**
27	12.5%	.0%	20.0%	71.4%	27.60%	0.002**
28	.0%	.0%	.0%	71.4%	17.20%	0.001**
29	.0%	.0%	.0%	71.4%	17.20%	0.001**
30	25.0%	.0%	10.0%	.0%	10.30%	0.085
31	25.0%	.0%	10.0%	.0%	10.30%	0.008**
32	25.0%	.0%	10.0%	.0%	10.30%	0.008**
33	29.9%	10.2%	30.6%	31.7%	27.78%	

In general, regarding Safety check requirements for chemical substances Record are compared among medical colleges labs., The nursing college labs was better .





**Figure (3): Safety check requirements for chemical substances**

***IV. Safety check requirements for electrical equipment Record***

Safety check requirements for electrical equipment Record are compared among medical colleges' labs. There were significant differences among them regarding Knowledge of the way checking electrical conductors, Examination of electrical equipment, Devices that are not involved in the amortized from the source, Maintenance by specialists, presence of Posters for treatment of electrical trauma and usage of phone ( $P < 0.05$ )

**Table (4): Safety check requirements for electrical equipment Record**

Q	Medicine	Dentistry	Pharmacy	Nursing	Total	P value
1	75.0%	.0%	90.0%	85.7%	72.40%	0.005**
2	0%	0%	0%	0%	0%	
3	0%	0%	0%	0%	0%	
4	100.0%	50.0%	90.0%	100.0%	89.70%	0.036*
5	75.0%	75.0%	50.0%	42.9%	58.60%	0.50
6	37.5%	50.0%	20.0%	.0%	24.10%	0.21
7	50.0%	.0%	30.0%	14.3%	27.50%	0.45
8	37.5%	.0%	.0%	14.3%	13.80%	0.15
9	87.5%	100.0%	80.0%	100.0%	89.70%	0.51
10	100.0%	25.0%	100.0%	100.0%	89.70%	0.001**
11	100.0%	50.0%	90.0%	85.7%	86.20%	0.12
12	50.0%	25.0%	50.0%	.0%	34.50%	0.12
13	62.5%	.0%	40.0%	100.0%	55.50%	0.008**
14	62.5%	.0%	30.0%	57.1%	40.10%	0.14
15	50.0%	.0%	.0%	.0%	13.80%	0.007**
16	22.5%	0%	0%	72.4%	23.7%	0.002**
17	.0%	.0%	.0%	42.9%	10.30%	0.015*
	53.5%	22.1%	39.4%	48.0%	42.92%	

In general, regarding Safety check requirements for electrical equipment Record are compared among medical colleges labs, The medicine labs was better .

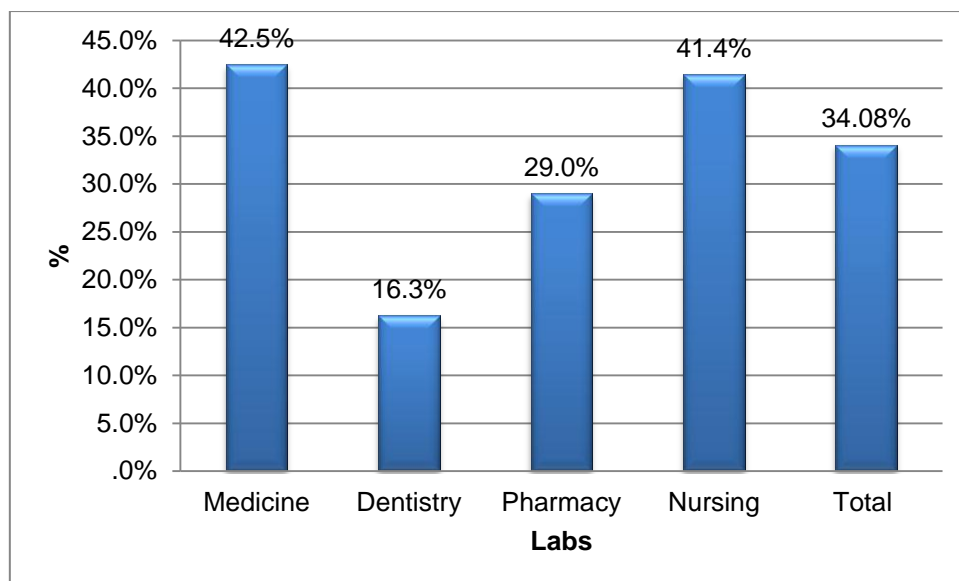
***V. Safety check requirements for Firefighters equipment Record***

Safety check requirements for Firefighters equipment Record are compared among medical colleges' labs. There were significant difference among them regarding Ashtrays filled with foam and powder. Knowledge of the use of them, good ventilation of the lab, Lighting when the electricity goes off, presence of Communication between the laboratory and the center of the main and the workers are Trains to extinguish the fire( $p < 0.05$ ).

**Table (5) safety check requirements for Firefighters Equipment Record**

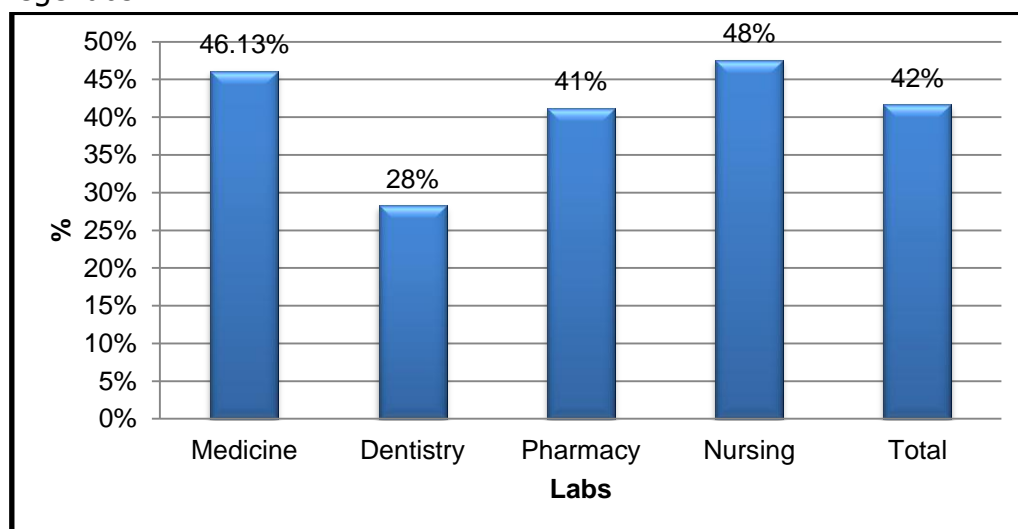
Q	Medicine	Dentistry	Pharmacy	Nursing	Total	P value
1	87.5%	75.0%	80.0%	100.0%	86.20%	0.56
2	12.5%	.0%	70.0%	.0%	27.60%	0.01*
3	25.0%	.0%	10.0%	28.6%	17.20%	0.53
4	87.5%	75.0%	.0%	85.7%	55.20%	0.001**
5	87.5%	75.0%	80.0%	100.0%	86.20%	0.41
6	75.0%	.0%	40.0%	85.7%	58.60%	0.029*
7	37.5%	.0%	10.0%	14.3%	17.20%	0.32
8	12.5%	.0%	10.0%	14.3%	10.30%	0.66
9	75.0%	25.0%	100.0%	85.7%	79.30%	0.018*
10	37.5%	.0%	.0%	.0%	10.30%	0.032*
11	.0%	.0%	10.0%	.0%	3.40%	0.58
12	.0%	.0%	10.0%	.0%	3.40%	0.38
13	37.5%	.0%	10.0%	.0%	13.80%	0.13
14	25.0%	.0%	.0%	.0%	6.90%	0.13
15	25.0%	.0%	.0%	.0%	6.90%	0.13
16	75.0%	50.0%	100.0%	100.0%	86.20%	0.047*
17	.0%	.0%	.0%	14.3%	3.40%	0.35
18	25.0%	25.0%	30.0%	14.3%	24.10%	0.90
19	62.5%	.0%	10.0%	100.0%	44.00%	0.001**
20	62.5%	.0%	10.0%	85.7%	41.30%	0.005**
	42.5%	16.3%	29.0%	41.4%	34.08%	

In general, regarding check requirements for Firefighters equipment Record are compared among medical colleges labs., The medicine labs was better .



**Figure (4) safety check requirements for Firefighters Equipment Record**

At the end of this cross sectional study, the nursing college labs were the better following by medicine labs, then pharmacy labs and finally dentistry college labs.



**Figure (5): Check safety requirements and security Record in all medical labs**

### Discussion

Unsafe working practices, working environments, disposable waste products, and chemicals in clinical laboratories contribute to infectious and non-infectious hazards [9, 10]. We conducted a study to describe safety practices in laboratories of the Medical Group colleges in Babylon University.

The findings of this study show that these laboratories were below the standard set by WHO, Good Clinical Laboratory Practice (GCLP) [11].

Poor handling of chemicals in terms of storage and disposal pose a particular risk to the worker and the community [12].

Electrical standards and equipment management system were far below the reported standards, and are considered as the primary cause of physical and mechanical hazards [13].

In general, the laboratory workers are at high risk of combined physical, chemical and microbial hazards. Prompt recognition of the problem and immediate action is mandatory to ensure safe working environment in health laboratories. Furthermore, these laboratories may be potential threats to the environment. On the other hand, to see the bigger picture in the country, national and large scale study should be conducted.

## **Conclusion**

Laboratory safety in in laboratories of the Medical Group colleges in Babylon University is below the standard. The laboratory workers are at high risk of combined physical, chemical and microbial hazards. Prompt recognition of the problem and immediate action is mandatory to ensure safe working environment in laboratories.

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