University of Thi-Qar Journal of Science (UTJsci)
E-ISSN:2709-0256, P-ISSN: 1991-8690, Vol. (10), No.1(Special Issue: ISCAMET), April. 2023

Safety measures among workers occupationally exposed to ionizing radiation in hospitals in AL-Muthana Governorate, Iraq

Zaineb Jaber Eoda
Department of Community Health Techniques / College of Health and Medical Techniques/ Southern Technical University
Basra/ Iraq
Zain5577j@gmail.com

Mahmood Salim Thamer
Southern Technical University ,Basrah Technical Institute ,Environmental Pollution research unit,
Basrah,Iraq.
Mahmood.thamir@stu.edu.iq

***Abstract*—Background: Health professionals working in the radiological departments of Al-Muthnia Hospital are at high risk of radiation exposure due to a lack of personal protective equipment (PPE) such as thyroid shields, genital shields, and lead glass in all radiological departments, as well as a lack of staff awareness of the need to use these PPI.**

A study of the extent of the use of personal protective equipment (PPE) for radiation workers in hospitals.

Method: To determine the scope of radiation workers' obligations in hospitals about wearing personal protective equipment, a cross-sectional investigation was carried out among participants in All Radiation Units in Hospitals in the AL-Muthana Governorate. Results: This study involved 95 participants from radiological units 95 people responded overall. Their average age was 37 years, 70.5 percent of them were men, 33.0 percent of them worked as radiographers in x-ray units, the majority of them were married, and 41.1% had diplomas or other credentials. According to the study, only 45.4 percent of staff members wear PPE(lead coat) when dealing with radiation, while 50.9-92 percent of staff members report that additional PPI, including lead glasses, genital shield, and theroid shield, are unavailable. Occupational health and safety training is only provided to 63.2 percent of the staff. At a P value of 0.05, all questions are statistically significant.

Study objective: Identify the extent of the obligations of radiation workers in hospitals in terms of wearing personal protective equipment.

Keywords: **hospitals in the governorate of Al-Muthana, medical personnel, ionizing radiation, safety precautions**

I. INTRODUCTION

Radiation travels so quickly, it carries a lot of energy. Radiation is made up of particles smaller than atoms or waves that have no mass, thus it can pass through solid objects to reach us [1].

Medical professionals who use radiation for diagnostic and therapeutic purposes perform about four billion radiographic examinations each year, according to the United Nations Scientific Committee on the Effects of Atomic Radiation, exposing them to occupational radiation hazards if safety precautions are not taken [2].

Ionizing radiation overexposure and unregulated exposure are key factors in the development of malignancies and genetic abnormalities [3, 4, and 5].

Ionizing radiation (IR) is a type of energy-rich radiation that can eliminate electrons from atoms or molecules, causing them to ionize and become charged. It also has enough energy to produce free radicals, alter cross-linking between macromolecules, form new chemical bonds, and alter human cell molecules like DNA and RNA that control important cell processes, perhaps causing cancer [6].

Human health, environment, diet, age, physiological stress, race, smoking, and other immune-system-influencing factors can all raise a person's sensitivity to IR [7].

The immune system is frequently damaged after a moderate to the high dose of IR exposure. Antibodies and cytokines production will be impacted because lymphoid cells will be affected [8].

When a cell remains alive yet has a mutation, the most serious cellular damage occurs. Whereas this cell will show a change in its reproductive structure and a lack of self-control mechanism, leading to cancer formation [9].

Biological, chemical, physical, and emotional risks are just a few of the dangers that healthcare workers must deal with on the job. Biochemical agents, physical elements, psychological elements, and biological agents are only a few of the many sources from which the risks can come. [10]

A significant medical, social, and economic problem, as well as the main cause of disease and mortality among healthcare workers, is an occupational risk [11]

II. METHOD

A. *Design of the Study*

In order to evaluate occupational risks and safety protocols for staff members of radiation units in hospitals, this study used a cross-sectional study design.

B. *The Sample of the Study*

Participants were healthcare personnel working professionally with radiation at different levels (i.e., Radiographer, medical assistants, dentists, nurse, and physician).

A. *Data Collection*

The researcher and supervisor designed and constructed the questionnaire, which was then modified by specialists. Five experts were given the draft questionnaire to review, analyze, and discuss in order to determine whether it was clear and appropriate for the current study's goals. For revision and revision, all expert suggestions have been taken into consideration.

Data were gathered between the first of November 2021 and the first of May 2022. The Specialized Dental Center and other governorate hospitals were repeatedly visited. The purpose of the first visits was to notify the office of the day and time of the visits to the locations where a sample of the medical staff would be collected. The other visits consisted of a random selection of cadres and instructions on how to complete the form. All medical personnel working in the chosen unit at the time of the survey received the forms, and they were made aware that participation in the survey was voluntary. They were also informed that their responses would be kept private and asked not to enter their names on the form.

Demographic details collected included sex, age, marital status, Educational level and Occupational title.

Further, one question about occupational risk in radiological units

III. RESULTS

The socio demographic details of the study sample are shown in Table 1. Their median age was 37 years, 70.5 percent of them were men, 33.0 percent of them worked as radiographers in x-ray units, the majority were married, and 41.1% had diplomas.

TABLE(1):SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION

			Mean±SD	**Median (Min.-Max.)**
Age			37.99±10.21	35.00 (20 – 65)
			Frequency	**Percent**
Gender		Male	67	70.5
		Female	28	29.5
Unit	X-Ray		34	35.8
	CT –Scan		24	25.3
	Cardiac Catheterization		12	12.6
	Sonar		7	7.4
	Dental X Ray		7	7.4
	MRI		6	6.3
	Lithotripsy		5	5.3
Marital Status		Single	15	15.8
		Married	80	84.2
Occupational Title	Radiographer		32	33.7
	Physician Radiologist		17	17.9
	Physical		13	13.7
	Nurse		11	11.6
	Medical Assistant		7	7.4
	Urology Specialist Doctor		4	4.2
	Diagnostic Radiology Technologist		4	4.2
	Dentist		4	4.2
	Cardiologist		3	3.2
Education	PhD		24	25.3
	MSc		1	1.1
	BSc		20	21.1
	Diploma		39	41.1
	Secondary Education		11	11.6

TABLE (2): ASSESSMENT OF RADIOLOGICAL UNITS IN MEDICAL INSTITUTIONSACCORDING TO CHECKLIST OF OCCUPATIONAL EXPOSURE TO RADIATION IN AL-MUTHANA PROVINCE DURING.

N	Statements	Not available No. (%)	Poor No. (%)	Acceptable No. (%)	good No. (%)
1	The outer door of the radiation rooms is made of wood that contains lead inside, and the door must be sturdy to bear the weight of lead	0 (0.0)	6 (33.3)	0 (0.0)	12 (66.7)
2	The presence of the identification card for each device (device name-manufacturer-date of manufacture origin)	0 (0.0)	0 (0.0)	8 (44.4)	10 (55.6)
3	Commitment of workers who work in radiation unit to working hours and according to the schedule organized by the administration (morning, guards)	0 (0.0)	0 (0.0)	3 (16.7)	15 (83.3)
4	The obligation of workers in radiology unit to wear a white medical coat	0 (0.0)	1 (5.6)	8 (44.4)	9 (50.0)
5	Employees must wear the radiation film badge	1 (5.6)	0 (0.0)	6 (33.3)	11 (61.1)
6	The existence of a record documenting the periodic medical examination for workers in radiation units	15 (83.3)	0 (0.0)	2 (11.1)	1 (5.6)

7	The presence of a bullet-proof barrier between the radiation devices and those working on the devices in the radiation unit	7 (38.9)	0 (0.0)	0 (0.0)	11 (61.1)
8	The presence of ministerial protocols (working on the device and preventing its dangers) in the radiation unit	14 (77.8)	3 (16.7)	0 (0.0)	1 (5.6)
9	The city of the ceilings and walls (there are no cracks or cracks) and according to the measurements of the nature of the unit work	0 (0.0)	0 (0.0)	11 (61.1)	7 (38.9)
10	The ity of the floor (there are no cracks and failures) and according to the measurements of the nature of the work of the unit	0 (0.0)	1 (5.6)	12 (66.7)	5 (27.8)
11	Luminous means (luminous strength)	0 (0.0)	1 (5.6)	14 (77.8)	3 (16.7)
12	Air conditioning achieves a temperature of 20-23 C	0 (0.0)	0 (0.0)	16 (88.9)	2 (11.1)
13	Availability of fire sensors	0 (0.0)	1 (5.6)	11 (61.1)	6 (33.3)
14	Suspended cylinder fire extinguishers (cylinder type)	0 (0.0)	1 (5.6)	12 (66.7)	5 (27.8)
15	Windows are available in the work environment and help to bring in lighting and air circulation	1 (5.6)	2 (11.1)	9 (50.0)	6 (33.3)
16	Is the work area organized and free of clutter in terms of arranged furniture, papers, brochures, and not scattered	0 (0.0)	3 (16.7)	7 (38.9)	8 (44.4)
17	Are all electrical wires insulated and undamaged	0 (0.0)	2 (11.1)	14 (77.8)	2 (11.1)
18	Putting signs or signs indicating the danger of radioactive places (graphs, signs, signs) that warn of the danger of radiation	3 (16.7)	9 (50.0)	3 (16.7)	3 (16.7)
19	Wearing protective clothing (bulletproof vest bulletproof paws- goggles- thyroid shields-gonad shields) from radiation for workers in the radiation field	14 (77.8)	1 (5.6)	1 (5.6)	2 (11.1)
20	Continuously train workers by setting up workshops or courses related to radiation, notifying it, qualifying them to work in radiation units, and providing bulletins that are useful in radiation protection	0 (0.0)	15 (83.3)	0 (0.0)	3 (16.7)
21	There is a distance between the radiation source and the radiation factor	5 (27.8)	3 (16.7)	0 (0.0)	10 (55.5)

B. Assessment of radiological units relevant to protection from exposure to radiation according to checklist of occupational health and safety.

Regarding the assessment of radiological units in medical institutionsaccording to checklist of occupational health and safety. The study reviled that most of assessment questions about occupational and safety were wellapplicable to the radiological units' checklist except statements included: statement number six "The existence of a record documenting the periodic medical examination for workers in radiation units " 83.3%was not applicable to radiological units, statement eight"The presence of ministerial protocols (working on the device and preventing its dangers) in the radiation unit ", and statement number 19 "Wearing protective clothing (bulletproof vest bulletproof paws-goggles- thyroid shields-gonad shields) from radiation for workers in the radiation field" were 77.8% was not applicable in radiological units.On the other hand, the study found that 83.3% was poor applicable in radiological units in statement number 20 "Continuously train workers by setting up workshops or courses related to radiation, notifying it, qualifying them to work in radiation units, and providing bulletins that are useful in radiation protection "as shownin Table (2).

TABLE (3): COMPARISON OF THE MEDICAL INSTITUTION ACCORDING TO ASSESSMENT OF CHECKLIST IN AL-MUTHANA PROVINCE DURING 2021-2022

Institution	Not available	Poor	Expectable	Good	Total	Sig.*
The existence of a record documenting the periodic medical examination for workers in radiation units?						
Al-Hussein Teaching Hospital	5	0	1	0	6	0.045
	33.3%	0.0%	50.0%	0.0%	33.3%	
El-Waladah Teaching Hospital	4	0	0	0	4	
	26.7%	0.0%	0.0%	0.0%	22.2%	
Warka General Hospital	0	0	0	1	1	
	0.0%	0.0%	0.0%	100.%	5.6%	
Al-Khader General Hospital	3	0	0	0	3	
	20.0%	0.0%	0.0%	0.0%	16.7%	
Rumaitha General Hospital	3	0	0	0	3	
	20.0%	0.0%	0.0%	0.0%	16.7%	
Specialized Dental Center	0	0	1	0	1	
	0.0%	0.0%	50.0%	0.0%	5.6%	
The presence of ministerial protocols (working on the device and preventing its dangers) in the radiation unit?						
Al-Hussein Teaching Hospital	4	0	2	0	6	0.047
	28.6%	0.0%	66.7%	0.0%	33.3%	
El-Waladah Teaching Hospital	4	0	0	0	4	
	28.6%	0.0%	0.0%	0.0%	22.2%	
Warka General Hospital	0	0	0	1	1	
	0.0%	0.0%	0.0%	100.	5.6%	

				0%		
Al-Khader General Hospital	3	0	0	0	3	
	21.4%	0.0%	0.0%	0.0%	16.7%	
Rumaitha General Hospital	3	0	0	0	3	
	21.4%	0.0%	0.0%	0.0%	16.7%	
Specialized Dental Center	0	0	1	0	1	
	0.0%	0.0%	33.3%	0.0%	5.6%	
Is the work area organized and free of clutter in terms of arranged furniture, papers, brochures, and not scattered?						
Al-Hussein Teaching Hospital	0	0	0	6	6	0.032
	0.0%	0.0%	0.0%	75.0 %	33.3%	
El-Waladah Teaching Hospital	1	0	2	1	4	
	33.3%	0.0%	28.6%	12.5 %	22.2%	
Warka General Hospital	0	0	1	0	1	
	0.0%	0.0%	14.3%	0.0%	5.6%	
Al-Khader General Hospital	1	0	1	1	3	
	33.3%	0.0%	14.3%	12.5 %	16.7%	
Rumaitha General Hospital	1	0	2	0	3	
	33.3%	0.0%	28.6%	0.0%	16.7%	
Specialized Dental Center	0	0	1	0	1	
	0.0%	0.0%	14.3%	0.0%	5.6%	
Wearing protective clothing (bulletproof vest bulletproof paws- goggles- thyroid shields-gonad shields) from radiation for workers in the radiation field?						
Al-Hussein Teaching Hospital	4	0	0	2	6	0.029
	28.6%	0.0%	0.0%	100. 0%	33.3%	
El-Waladah Teaching Hospital	4	0	0	0	4	
	28.6%	0.0%	0.0%	0.0%	22.2%	
Warka General Hospital	0	1	0	0	1	
	0.0%	100. 0%	0.0%	0.0%	5.6%	
Al-Khader General Hospital	3	0	0	0	3	
	21.4%	0.0%	0.0%	0.0%	16.7%	
Rumaitha General Hospital	3	0	0	0	3	
	21.4%	0.0%	0.0%	0.0%	16.7%	
Specialized Dental Center	0	0	1	0	1	

C. Comparison of the medical institution according to the assessment of the checklist

It is clear from Table (3) That the only questions, which answers were significantly statistically different when compared according to the medical institution, were the existence of a record documenting the periodic medical examination for workers in radiation units at p value of 0.045; the presence of ministerial protocols (working on the device and preventing its dangers) in the radiation unit at p-value of 0.047; the work area was organized and free of clutter in terms of arranged furniture, papers, brochures, and not scattered at p value of 0.032; and wearing protective clothing (bulletproof vest bulletproof paws- goggles- thyroid shields-gonad shields) from radiation for workers in the radiation field. At p-value <0.05.

IV. Discussion

This result table (2)This result is similar approximately with the study done by Salama et al. In Saudi Arabia itrevealed that since most hospitals had lead aprons and thyroid shields, only about half of them had lead eye goggles and lead shields. However, the majority of medical personnel (99%) wore lead aprons, 37% wore lead glasses, and 42% wore thyroid shields. [11]. according to [12].72 % of the participants wore lead aprons, 22.7 percent wore lead gloves, 25.3 % wore gonad shields, and 36% wore thyroid shields. However, Elamin found that despite the fact that all government and private hospitals are provided with lead aprons, the radiographers did not always use them [13]Furthermore ,it has been reported insufficient availability of lead aprons [14],[15].

This result table (3) This result is similar to finding of study carried out by Nureddin, &Alatta which found there is not Availability of quality control programs in hospitals mentioned in the study in all radiology departments [16]

It's easy to see how poorly personnel are monitored for radiation. The majority of X-ray technicians believe it is not covered by the hospital's annual budget. Another blunder committed by hospitals is the failure to consider dosimetry records when hiring new employees. People who have previously worked with radiation should make their dosimetry records available to their new employers in other parts of the world. This is critical because it assists in determining the new employee's radiation morbidity risk [17].

V.Conclusions

Radiation workers had a strong understanding of the participants' exposure to radiation dangers, but poor radiation protective practices were seen. Radiological tests and radiation protection screenings knowledge and awareness among healthcare workers who work with ionizing radiation were assessed.

REFERENCES

1-Hargreaves, T., &Moridi, R. (2010).X-Ray Safety Awareness Handbook. Radiation Safety Institute of Canada

2-**Fazel, R., Krumholz, H. M., Wang, Y., Ross, J. S., Chen, J., Ting, H. H., &Nallamothu, B. K. (2009**). Exposure to low-dose ionizing radiation from medical imaging procedures.New England Journal of Medicine. 361(9): 849-857

3-Hricak, H., Brenner, D. J., Adelstein, S. J., Frush, D. P., Hall, E. J., Howell, R. W., & Wagner, L. K. (2011). Managing radiation use in medical imaging: a multifaceted challenge. Radiology.258 (3):889-905

4-Bouraoui, S., Mougou, S., Drira, A., Tabka, F., Bouali, N., Mrizek, N., & Saad, A. (2013). A cytogenetic approach to the effects of low levels of ionizing radiation (IR) on the exposed Tunisian hospital workers. International journal of occupational medicine and environmental health.26 (1): 144-154

5-Borgen, L., &Stranden, E. (2014). Radiation knowledge and perception of referral practice among radiologists and radiographers compared with referring clinicians. Insights into imaging. 5(5): 635-640

6-Cohen, B.L. (2002). Cancer Risk from Low-level Radiation. Am J Roentgenol . 179:1137-43

7-Heidrich, J., Wellmann, J., Heuschmann, P. U., Kraywinkel, K., & Keil, U. (2007).Mortality and morbidity from coronary heart disease attributable to passive smoking.European heart journal. 28(20): 2498-2502**.**

8-Greenberger, J. S. (2009).Radioprotection. In vivo, 23(2): 323-336.

9-Almayahi N, Jasim A, Alibraheem SH. (2021) .Occupational Risk Assessment in Light of the Corona Pandemic in Some Health Institutions of Wasit Governorate-Iraq. Annals of the Romanian Society for Cell BiologyJun 9; 25(6):9748-858.

10-Daham, F. H., Jasim, A. K., &Zakair, K. Y. (2020). Study and Assess the Occupation Hazards to Health Workers in the City of Kut/Wassit. *Indian Journal of Forensic Medicine & Toxicology*, *14*(4).

11-Salama, K. F., AlObireed, A., AlBagawi, M., AlSufayan, Y., &AlSerheed, M. (2016). Assessment of occupational radiation exposure among medical staff in health-care facilities in the Eastern Province, Kingdom of Saudi Arabia. Indian Journal of occupational and Environmental medicine, 20(1), 21.

12-Ahmed, R. M., Elamin, A. M. T., Elsamani, M., & Hassan, W. B. (2015). Knowledge and performance of radiographers towards radiation protection, Taif, Saudi Arabia.IOSR J Dent Med Sci, 14(3), 63-8.

13-Mohamed, A. T. E., &Elamin, T. (2015). Radiation safety awareness and practice in sudanese medical facilities: a descriptive. *Int J Sci Res*, *4*, 2190-2195.

14-Eze, C. U., Abonyi, L. C., Njoku, J., Irurhe, N. K., &Olowu, O. (2013). Assessment of radiation protection practices among radiographers in Lagos, Nigeria. Nigerian medical journal: journal of the Nigeria Medical Association, 54(6), 386.

15-Bhatt, C. R., Widmark, A., Shrestha, S. L., Khanal, T., & Ween, B. (2012). Occupational radiation exposure in health care facilities. *Kathmandu University Medical Journal*, *10*(3), 48-51.

16-Nureddin, A. S., &Alatta, N. O. (2016). Effects of long-term exposure to low X-ray on the blood consists of Radiology Department staff of health centers in Libya. *Age (year)*, *37*(1.60).

17-Ohagwu, A. O. C., & Njoku, J. (2010). Evaluation of personnel radiation monitoring in radiodiagnosticcentres in South Eastern Nigeria. African Journal of Basic & Applied Sciences, 2(1-2), 49-53.