Alqalam Journal of Medical and Applied Sciences. 2025;8(1):111-118
https://doi.org/10.54361/ajmas.258118

Original article

Knowledge and Awareness about Radiation Protection and Hazards among Healthcare Workers in Tobruk Medical Centre

Nagat Bolowia*

Department of Radiography, Faculty of Medical Technology, University of Tobruk, Tobruk, Libya
Corresponding Email. nagat.bolowia@tu.edu.ly

Abstract
Ionizing radiation has become increasingly applied in medical practice. Accordingly, healthcare workers must be aware of radiation protection procedures and risks and apply the essential countermeasures to minimize occupational exposure. This study evaluated the awareness of radiation hazards and knowledge of radiation protection procedures among radiologists, radiographers, and nurses in diagnostic radiology departments in Tobruk Medical Center. A cross-sectional questionnaire-based study was conducted among 70 medical personnel, including radiologists, nurses, and radiographers, during the period between March and May 2022.The questionnaire collected data on demographic characteristics, awareness of radiation hazards, and knowledge of radiation protection procedures. 57.1% of contributors were males, with 42.9% between the age group of 31–40 years. 74.2% had bachelor`s degrees while 17.1% had diplomas and the minority 8.6% had higher educational degrees. Overall, all contributors showed a good level of radiation protection procedures awareness. The majority of participants (63 % + 31 %) believed that medical radiation causes a serious risk to human health. and a tiny portion of them thought it wasn't dangerous. The current findings recommend that there is a reasonable level of awareness about radiation protection procedures and radiation hazards but a relative lack of knowledge about the As Low As Reasonably Achievable {ALARA} principle and 10-day rule among personnel was noticed. Therefore, continuing medical education on radiation protection and hazards must be authorized.
Keywords. Ionizing Radiation, Radiation Hazard, Radiation Protection.

Introduction

Ionizing radiation from medical applications accounts for the majority of radiation doses from artificial sources. Twenty percent of the population is exposed to radiation in medical practice, and this number is expected to rise globally [1]. Several medical procedures use ionizing radiation, including fluoroscopy, angiography, radiographic imaging, and computed tomography (CT). Globally, over 3600 million diagnostic radiology exams are performed, 37 million nuclear medicine procedures are carried out, and approximately 7.5 million radiation treatments are administered annually [2].

It is clear that, there is a steadily rising demand for radiological examinations, specifically computed tomography with multiple detectors (CTMD), which alone is responsible for roughly half of the total radiation exposure in medicine (3). With the introduction of multidetector row CT, imaging has become faster and more sophisticated. Consequently, this has increased the number of CT exams conducted annually, and subsequently the amount of radiation to which patients are exposed [4,5].

Exposure of radiation workers and patients and to ionizing radiation is unavoidable in medical applications [6]. When the threshold limit is exceeded, ionizing radiation can give rise to chromosomal abnormalities and mutations in males, females, and fetuses [7]. Skin burns, Cataracts, leukemia, and other types of cancers are other negative consequences of ionizing radiation [8-10]. Despite the fact that some potential effects on the patient's health might happen right away after exposure, others might not appear for years [11,12].

Consequently, the International Commission on Radiological Protection (ICRP) has proposed a general principle of radiation protection, which states that radiation protection is based on three principles: justification, dose limitation, and optimization [exposure to ionizing radiation must be kept within the [ALARA] [13]. Furthermore, the risks of ionizing radiation can be reduced by using various methods of radiation protection such as the principles of distance, time, and personal shielding [14]. Decreasing the exposure time and dose a well as increasing the distance from the source could protect patients and occupational health workers [15]. Personal protective equipment such as lead shields, lead aprons, lead gloves, and lead glasses are used to protect employees, patients and members of the public from exceeding radiation exposure [16,17]. In addition, various personal monitoring devices, such as thermo-luminescent dosimeters (TLDs) used to record the radiation dose received. Such a dosimeter can give a continuous readout of received doses and a noticeable alarm when a cumulative dose is exceeded [18].

Recently, there has been increasing concern about the lack of awareness of health care workers about radiation doses used in diagnostic radiological procedures [19]. The concern over radiation safety and

Received*: 19-10-2025 -* ***Accepted****: 09-01-2025 -* ***Published****: 17-01-2025*

radioactive source control began in Libya approximately thirty years ago, when the Law on Regulation Associated with the use of Ionizing Radiation and Protection Against Its Hazards (Act No. 2) was published. Therefore, all HCWs who are occupationally exposed to ionizing radiation must adopt current radiation protection principles and apply their knowledge to protect themselves and patients against unwanted doses of ionizing radiation [20]. Moreover, comprehensive knowledge of radiation protection is also necessary for other medical professionals, such as nurses who are assigned to the radiology department [21].
Worldwide, there are many studies with different results assessing the knowledge of HCWs in radiation environments about radiation hazards and radiation protection [22-27]. However, only a few studies have been conducted in this field in Libya [28-29], particularly surveys related to the radiation protection procedures of radiation workers in Tobruk city. Therefore, the aim of this study was to assess the level of awareness and knowledge about radiation hazards and radiation protection procedures among workers occupationally exposed to ionizing radiation in diagnostic radiology departments in Tobruk Medical Center.

Methods

Study Design

This study was a cross-sectional study. It was carried out among seventy (n =70) healthcare workers who were occupationally exposed to radiation in the diagnostic radiology department in Tobruk Medical Center during the period between march to May 2022.

Sampling Technique

All health care workers HCWs (radiologists, radiographers, nurses), who were occupationally exposed to ionizing radiation in the diagnostic radiology departments and who agreed to participate in this study were included. The target population consisted of 70 out of 100 HCWs with a response rate of 70%.

Inclusion Criteria

All health care workers occupationally exposed to ionizing radiation in the various units of radiological departments with work experience of at least one year and who agreed to contribute to the study were included.

Exclusion Criteria

Any health care worker with less than a year of experience working in radiology departments. Any health care workers who did not come into contact with radiation exposure or patients during examinations. For instance, senior staff and pregnant female workers.

Study Methods

The study tool in this research included a self-administered and self-structured questionnaire designed and validated after reviewing previous studies [30-33]. The questionnaire was translated into Arabic and revised by 2 experts; then a pilot study was conducted in 2 different random units on 5 specialists. The questionnaire contains three sections: A, B, and C. Section A comprised questions regarding the demographic data of the participants including, gender, age, educational level, years of experience, occupation, and radiation protection training courses, Section B comprised 10 questions regarding the awareness of radiation protection procedures, and the questions were answered by 'Yes' or 'NO', and Section C also included 10 questions. A 5-point Likert scale was used to rank the responses from strongly disagree, disagree, neutral, agree, and strongly agree to assess participants's knowledge on the hazard of ionizing radiation, especially the risk of induced-radiation cancer.

Statistical Analysis

Data were presented and statistically analysed using statistical package for social sciences (SPSS) version 25. Descriptive analysis was performed for the knowledge level and awareness of healthcare professionals respectively. The number of respondents (n) and percentages (%) were reported for each demographic characteristic and each questionnaire item.

Ethical approval

Ethical approval from the Ethical Committee of the Radiology Department, Tobruk Medical Center, was obtained. A verbal informed consent was given from all the HCWs included in the study.

Results

Socio-demographic Characteristic Data

A total of 70 contributors completed the questionnaire. 57.1% of them were males, with 42.9% between the age group of 31–40 years. The majority of them (74.2%) had bachelor`s degrees while 17.1% had diplomas

Received*: 19-10-2025 -* ***Accepted****: 09-01-2025 -* ***Published****: 17-01-2025*

and the minority, 8.6% had higher educational degrees. Table 1 shows a summary of the socio-demographic characteristics of the participants. The years of experience were from 11-20 years among 47.1.% of HCWs, 27.1% of participants had experience levels more than 20 years old, and 14.2% had 6-10 years of experience.

Table 1. Socio-demographic characteristics of the participants (n=70)

Parameters	No.	%
Gender		
Male	40	57.1%
Female	30	42.8%
Age (years)		
20-30	20	28.6%
31-40	30	42.9%
>40	20	28.6%
Educational level		
Diploma	12	17.1%
Bachelor	52	74.2%
Higher educational degree	6	8.6%
Occupation		
Radiographer	55	78.6%
Nurse	7	10.0%
Radiologist	8	11.4%
Years of experience		
Less than 5 years	8	11.4%
6-10 years	10	14.2%
11-20 years	33	47.1%
More than 20 years	19	27.1%

Despite the fact that 26% of participants attended training courses on a regular basis, the majority of them (74%) had no training courses on radiation safety (Figure1).

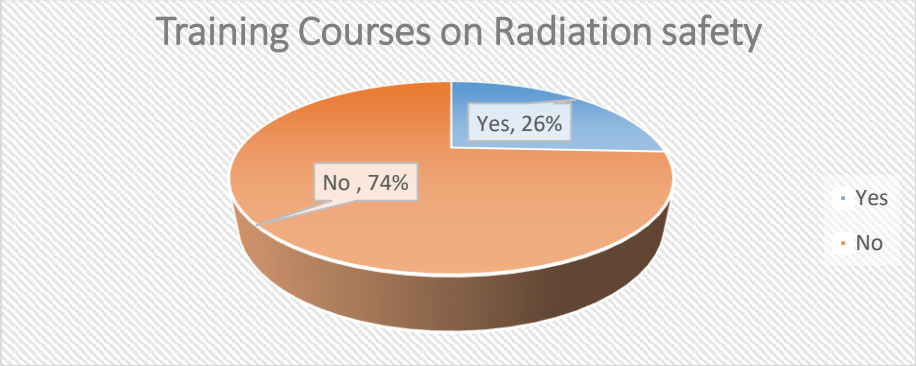

Figure 1. Radiation protection training of the participants

Awareness of Radiation Protection procedures

Generally, good awareness of radiation protection was recorded among all contributors as shown in Table 2. All HCWs were highly aware of radiation protection procedures regarding the Lead apron, Gonad shields, Thyroid shield, and Lead gloves as protective tools against radiation exposure (95.7%, 95.7%, 91.4%, and 85.7%, respectively).

Quite an impressive percentage (92.9%) of the HCWs are aware of the importance of transferring female health care workers to another department when they get pregnant. Familiarity of the participants with terms of Distance and Time recorded as 92.9%, 90%, and 84.3% for shielding. Approximately two-thirds of responders (67.1%) had adequate knowledge of the term (Dose optimization). However, incorrectly (34.3%) identified ALARA as the general principle of radiation protection that has been proposed by the ICRP.

Received*: 19-10-2025 -* ***Accepted****: 09-01-2025 -* ***Published****: 17-01-2025*

Table 2. The awareness of radiation protection among participants.

Radiation Protection Procedures	Yes		No	
	No.	%	N0.	%
Are you familiar with Term (Dose Optimization)?	47	67.1	23	32.9
Do you know the term ALARA?	24	34.3	46	65.7
Do you know what TLD badge is?	51	72.9	19	27.1
Do you know what film badge is?	63	90	7	10
Are you familiar with the 10 days rule concept?	14	20	56	80
Are you familiar with the following terms?				
Time,	63	90	7	10
Distance	65	92.9	5	7.1
Shielding	59	84.3	11	15.7
Do you have an idea about different personal protective tools which help to reduce radiation exposure? Example-				
Lead apron	67	95.7	3	4.3
Lead gloves	60	85.7	10	14.3
Gonad shields	67	95.7	3	4.3
Thyroid shield	64	91.4	6	8.6
If one of the females of HCWs gets pregnant; will she be transferred to another department?	65	92.9	5	7.1
The maximum effective dose of ionizing radiation that a radiation worker aged 18 years or older should not exceed annually is 20mSv.	59	84.3	11	15.7
Health care workers in Interventional Radiology Unit are likely to be exposed to the highest radiation dose in the diagnostic radiology department.	21	30	49	70

ALARP = As Low As Reasonable Achievable TLD= thermos-luminescent Detector

84.3% of HCWs who correctly answered the questions relating to the maximum effective dose of ionizing radiation that a radiation worker aged 18 years or older should not exceed annually. In addition, 21 responders (70%) were incorrect in their assumption that health care workers in the Interventional Radiology Unit are likely to be exposed to the lowest radiation dose in the diagnostic radiology department. The above table indicated that the film badge (90%) was better recognized by health care workers in the diagnostic radiology department than the thermoluminescent dosimeter badge (72.9 %). Furthermore, unexpectedly, the familiarity with the 10-day rule concept is 20%.

Knowledge of Radiation Hazards

As illustrated in Table 3 below, a majority of the participants (63.1%+31.4%) considered medical radiation to be very hazardous to human beings. and a small percentage of them considered it to be non-hazardous. Moreover, 58.6% of respondents strongly agree that radiation exposure can cause congenital malformations in babies delivered by pregnant women exposed to ionizing radiations. Nearly half of HCWs (34.3%) had good knowledge that radiation exposure can cause skin injuries such as erythema, skin pigmentation, and bone marrow depression. Additionally, 41.4% of the participants had adequate awareness that exposure to radiation can cause cataracts of the eye lens and infertility issues in males and females. Approximately one-third of participants agreed that overexposure to ionizing radiation causes acute radiation sickness, such as nausea and vomiting. However, 21.4% of them were neutral in response, neither agreeing nor disagreeing. On the contrary, only 10 % of participants correctly stated that babies are more sensitive to radiation than other gender categories, and almost 78.6 % of those respondents reported that radiation risk is independent of age. Approximately two-thirds of responders (67.1 %) were not aware that the breast is the tissue with the highest susceptibility to radiation damage.

Table 3. The awareness of radiation hazards among the study participants.

Research Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Radiation has numerous and varied risks.	1 1.4%	1 1.4%	2 2.9%	22 31.4%	44 62.9%
Female breast tissue is highly sensitive to the carcinogenic effects of radiation.	18 25.7%	29 41.4%	13 18.6%	3 4.3%	7 10%
Generally, children are more sensitive to radiation than adults.	24 34.3%	31 44.3%	8 11.4%	4 5.7%	3 4.3%

Received*: 19-10-2025 -* ***Accepted****: 09-01-2025 -* ***Published****: 17-01-2025*

Over exposed to ionizing radiation cause acute radiation sickness such as nausea and vomiting.	1 1.4%	3 4.3%	15 21.4%	24 34.3%	27 38.6%
Exposure to Radiation can cause Skin injuries such as erythema, skin pigmentation	4 5.7%	2 2.9%	7 10%	24 34.3%	33 47.1%
Exposure to Radiation can cause Cataract of the eye lens	4 5.7%	4 5.7%	8 11.4%	29 41.4%	25 35.7%
Radiation exposure can cause bone marrow depression	5 7.1%	3 4.3%	13 18.6%	24 34.3%	25 35.7%
Over exposed to ionizing radiation can cause acute Infertility in men and women	2 2.9%	2 2.9%	7 10%	29 41.4%	30 42.9%
Radiation exposure can cause congenital malformations in babies delivered by pregnant women exposed to ionizing radiations	1 1.4%	3 4.3%	8 11.4%	17 24.3%	41 58.6%
The main stochastic effects of radiation is cancers such as skin cancer and leukaemia.	1 1.4%	1 1.4%	15 21.4%	25 35.7%	28 40%

Discussion

To the best of our knowledge, the knowledge of ionizing radiation protection techniques and awareness of radiation hazards among healthcare professionals in the Diagnostic Radiology Department in Tobruk Medical Center who are exposed to radiation hazards at work is being examined for the first time in this study.

The study group included radiographers, radiologists, and nurses, who usually come in contact with patients during procedures involving ionizing radiation during their daily work. A good level of knowledge was found among most of the participants toward radiation hazards and protection. This finding is similar to a study conducted in Italy, which showed good knowledge among most of the Italian radiographers [34]. Likewise, a high degree of awareness was found among participants in Nigeria regarding the harmful effects of ionizing radiation [35]. Additionally, similar to this, the International Commission on Radiological Protection (ICRP, 1992) ruled that work in radiological centers is prohibited for anyone younger than eighteen [36]. The study's results show that, with an average age of thirty-five, research participants behave in accordance with the ICRP's age restriction guidelines.

Satisfactory awareness of participants regarding the usage of dosimeters, such as TLD and film badges as radiation monitoring devices. A similar study also shows a high level of awareness among participants in Northern Nigeria regarding the usage of personal radiation dosimeters [37]. In addition, the safety precautions concerning time, distance, and shielding were stated. These results are consistent with the research conducted by Salah Eldeen NG and Farouk SA, which revealed that higher than 72.8% of participants were familiar with the terms of time, distance, and shielding. Female HCWs showed excellent awareness concerning precautions taken in case of pregnancy.

Another area of concern was the conception of dose limits and radiation exposure. The very low percentage (15.7%) of correct responses concerning maximum dose limits showed a lack of understanding of accurately identifying the maximum dose limit per year. A similar study also shows a low level of awareness among participants regarding the basic understanding of the threshold of effective dose for a medical radiation worker [38]. A study was done by Alotaibi et al. in Kuwait to explore the awareness level of radiation hazards amongst nurses employed in nuclear medicine departments [39]. Such study presented that almost all nurses were not aware of the ALARA principle, and this is consistent with ours.

The study's additional findings, which relate to participant responses to inquiries relating to the reduction of radiation exposure by using protective shields such as Lead apron, Lead gloves, Gonad shields, and Thyroid shield, are satisfactory and similar to the study that also shows a high level of awareness among participants regarding the usage of dosimeters as radiation monitoring devices [40].

Regrettably, as shown in Table 2, healthcare professionals at the Radiology Department in Tobruk Medical Center have not demonstrated a satisfactory level of proficiency in the understanding of the 10-day rule concept. It may be due to its not being exactly known by the name in spite of its application.

Furthermore, the outcome of the question relating to health care workers in the interventional radiology unit who are likely to be exposed to the highest radiation dose in the diagnostic radiology department stated a low level of awareness and lack of basic knowledge, which is unacceptable at 70%. Therefore, it is clear that, despite the good radiation knowledge of participants, regular training courses on radiation safety are still necessary to protect HCWs and patients from the dangers of ionizing radiation.

Received*: 19-10-2025 -* ***Accepted****: 09-01-2025 -* ***Published****: 17-01-2025*

The study's key finding is that according to the majority of participants, radiation exposure that happens during regular work is extremely dangerous. In contradistinction to a survey conducted among 92 Turkish health care workers in the radiology department which demonstrated that 42.4% and 21.7% of them were unaware of radiation hazards and considered common radiologic studies to be moderately safe [41].
Furthermore, our finding is not supported by the hypothesis that low-dose ionizing radiation, and particularly exposures during childhood, increase breast cancer risk. Such a result is different from those of other studies conducted by Huiyan Ma and others, which stated that the risk was higher for women who were first exposed to these medical radiation procedures as children than for those who were first exposed later in life [42].
In addition, the research produced some rather unexpected results regarding paediatric exposures to ionizing radiation. 44.3% of participants disagreed on that children are at a greater risk than adults of developing cancer after being exposed to ionizing radiation. Due to the fact that children are developing bodies and have long life expectancy post-exposure, appropriate actions are required to minimize the negative health effects of paediatric exposures to ionizing radiation.
Satisfactory responsiveness of participants regarding radiation sickness results when humans are exposed to very large doses of ionizing radiation. In addition, regarding the knowledge of skin injuries such as erythema, skin pigmentation, Cataracts of the eye lens, and bone marrow depression, the radiographers demonstrated greater knowledge and that was impressive. This finding supports the findings of another study, which showed good awareness of radiation hazards among the participants [43].
High awareness in the present study about the fact that radiation exposure can cause congenital malformations in babies delivered by pregnant women exposed to ionizing radiations, particularly when exposure takes place in the first trimesters of pregnancy. Given that radiation is known to cause genetic mutations and cancer, a higher percentage was anticipated [44].
Almost two-thirds of contributors presented that the long-term ionizing radiation exposure increases the risk of carcinogenesis such as skin cancer and leukaemia. This good awareness regarding this point may be because of the well-known stochastic effects of radiation exposure [45]. 83.3% of participants in the current study presented satisfactory awareness concerning male and female infertility as radiation exposure hazards. This good awareness regarding this point may be because of the well-known effect of radiation exposure on the reproductive system and the genetic mutations.

Limitation of the study

This research has numerous limitations. First, the sample size was relatively small. Secondly, about 78.6% of participants were radiographers; as a result, our sample may not have accurately represented the awareness of other healthcare providers. Lastly, employees from specialized private radiation centers were excluded in this study, where there may be increased occupational radiation hazards because of the increased exposure to radiation.

Conclusion

In summary, our study demonstrated a medium- good level of knowledge regarding radiation protection procedures among healthcare professionals in the Diagnostic Radiology Department in Tobruk Medical Center. Apart from that, this study revealed inadequate implementation of the ALARA principle and the 10-day rule in the workplace. In addition, in terms of overall awareness of radiation hazard, most of the HCWs in the current study demonstrated adequate knowledge. However, the health effect of radiation on children and breast females was generally not recognized. Therefore, this study has highlighted the importance of assessing the knowledge of radiation protection hazards and procedures to ensure patient safety, minimize radiation risks, and promote effective and efficient patient care in the present and future.

Acknowledgments

The author would like to thank the Radiographers, Radiologists, and nurses in Diagnostic Radiology department in Tobruk Medical Centre for support and generous cooperation.

Conflicts of Interest

The author declare that they have no conflict of interest in relation to this article.

References

1. Behzadmehr R, Doostkami M, Sarchahi Z, Dinparast Saleh L, Behzadmehr R. Radiation protection among health care workers: knowledge, attitude, practice, and clinical recommendations: a systematic review. Rev Environ Health. 2021;36(2):223–34.
2. World Health Organization [WHO]: Ionizing radiation, health effects and protective measures/ factsheet 29April 2016.
3. Hricak H, Brenner DJ, Adelstein SJ, Frush DP, Hall EJ, Howell RW et al. Managing radiation use in medical imaging: a multifaceted challenge. Radiology. 2011; 258:889–905.

Received*: 19-10-2025 -* ***Accepted****: 09-01-2025 -* ***Published****: 17-01-2025*

4. Brix G, Nagel HD, Stamm G, Veit R, Lechel U, Griebel J, et al. Radiation exposure in multi-slice versus single slice spiral CT: results of a nationwide survey. Eur Radiol 2003; 13:1979–91.
5. Yates SJ, Pike LC, Goldstone KE. Effect of multislicescanners on patient dose from routine CT examinations in East Anglia. Br J Radiol 2004; 77:472–8.
6. Briggs-Kamara MA, Okoye PC, Omubo-Pepple VB. Radiation safety awareness among patients and radiographers in three hospitals in Port Harcourt. Am J Sci Ind Res 2013;4: 83-8.
7. Valuckiene Z, Jurenas M, Cibulskaite I. Ionizing radiation exposure in interventional cardiology: current radiation protection practice of invasive cardiology operators in Lithuania. J Radiol Prot. 2016;36(3):695–708.
8. Stewart F, Akleyev A, Hauer-Jensen M, Hendry J, Kleiman N, Macvittie T, et al. ICRP publication 118: ICRP statement on tissue reactions and early and late effects of radiation in normal tissues organs-threshold doses for tissue reactions in a radiation protection context. Ann ICRP 2012; 41:1-322.
9. Popanda O, Marquardt JU, Chang-Claude J, Schmezer P. Genetic variation in normal tissue toxicity induced by ionizing radiation. Mutat Res 2009; 667:58-69.
10. The 2007 recommendations of the international commission on radiological protection: ICRP publication 103. Ann ICRP 2007; 37:1-332.
11. Aras S, Tanzer IO, Ikizceli T. A survey study of radiation protection awareness among radiology technicians in Mogadishu, Somalia. Radiat Protect Dosim. 2020;192(1): 36–40.
12. Sherfad M, Shaka M, Alhaddad O. Radiation Protection Knowledge, Attitudes, and Practices Among Fluoroscopy-Utilizing Doctors at Misurata Medical Centre, Libya. AlQalam Journal of Medical and Applied Sciences. 2024 Aug 1:664-70.
13. Gendelberg D, Hennrikus W, Slough J, Armstrong D, & King S. A Radiation Safety Training Program Results in Reduced Radiation Exposure for Orthopaedic Residents Using the Mini C-Arm. Clinical Orthopaedics & Related Research. 2016; 474(2): 580–584.
14. Bushong SC. Radiologic science for technologists: Physics, Biology, and Protection (10th edition). 2012; Mosby: St. Louis.
15. Dianati M, Zaheri A, Talari HR, Deris F, Rezaei S. Intensive Care Nurses' Knowledge of Radiation Safety and Their Behaviors Towards Portable Radiological Examinations. Nursing and Midwifery Studies, 2014;3: e23354.
16. Protection R. Safety in Medical Uses of Ionizing Radiation, IAEA Safety Standards Series No. 2018. SSG-46, IAEA, Vienna.
17. University of Houston-Clear Lake, 2019: X-ray Safety Manual; page 1 of 15
18. Srinivasan VS, Pandya A. Dosimetry aspects of hafnium oxide metal-oxide-semiconductor (MOS) capacitor. Thin Solid Films. 2011;31;520(1):574-7.
19. Chun-Sing W, Bingsheng H, Ho-Kwan S, Wai-Lam W, Ka-Ling Y, & Tiffany C. Y. C. A Questionnaire Study Assessing Local Physicians, Radiologists and Interns' Knowledge and Practice Pertaining To Radiation Exposure Related To Radiological Imaging. European Journal of Radiology. 2012; 81(3).
20. Eze CU, Abonyi LC, Njoku J, Irurhe NK, Olowu O. Assessment of radiation protection practices among radiographers in Lagos, Nigeria. Niger Med J 2013;54:386-91.
21. Alzubaidi M, Mutairi H, Alakel S, Al Abdullah H, Albakri I, Alqahtani S. Assessment of Knowledge and Attitude of Nurses towards Ionizing Radiation During Radiography in Jeddah City. The Egyptian Journal of Hospital Medicine. 2017;69(7): 2906-2909.
22. Alyousef K, Assiri A, Almutairi S, Aldalham T, Felimban G. Awareness of Radiation Protection and Common Radiation Dose Levels Among Healthcare Workers. Glob J Qual Saf Healthc. 2023;6(1):1-5.
23. Guena M N, Nguemeleu DN, Ndah TN, and Moifo B. An Assessment of Both Patients and Medical Staff Awareness of the Risks of Ionizing Radiation from CT scan in Cameroon. Open Journal of Radiology.2017; 7:199-208
24. Alavi SS, Dabbagh ST, Abbasi M, Mehrdad R. Medical radiation workers' knowledge, attitude, and practice to protect themselves against ionizing radiation in Tehran Province, Iran. J Educ Health Promot. 2017;6:58.
25. Abuzaid MM, Elshami W, Shawki M, et al. Assessment of compliance to radiation safety and protection at the radiology department. Int J Radiat Res. 2019;17(3): 439–446.
26. Salah Eldeen NG, Farouk SA. Assessment of awareness and practice of ionizing radiation protection procedures among exposed health care workers. Egypt J Occup Med. 2020; 44(1):529–544.
27. Soye JA, Paterson A. A survey of awareness of radiation dose among health professionals in Northern Ireland. Br J Radiol. 2008; 81(969):725-729.
28. Abdalla A, Alarefee H, Alwerfaley M, Kribat E, Yosif N. Evaluation of the Safety Rate in the Diagnostic Radiology Departments in Alkhoms City, Libya. Khalij-Libya J Dent Med Res. 2024;8(2):4–7.
29. Abdelkader S. Assessment of Knowledge and Awareness towards Radiation among Medical Staff. Journal of Medical Sciences. 2018;13(1):254–259.
30. Abuzaid MM, Elshami W, Shawki M, et al. Assessment of compliance to radiation safety and protection at the radiology department. Int J Radiat Res. 2019;17(3): 439–446.
31. Salah Eldeen NG, Farouk SA. Assessment of awareness and practice of ionizing radiation protection procedures among exposed health care workers. Egypt J Occup Med. 2020;44(1):529–544.
32. Alotaibi M, Bakir YY, Al-Abdulsalam A and Mohammed AM. Radiation awareness among nurses in nuclear medicine departments. Australian Journal of Advanced Nursing. 2015;32(3):25-33.
33. El-Feky AA, El-Sallamy RM, El-Sherbeni AA, Hagras HE. Safety measures among workers occupationally exposed to ionizing radiation in Tanta University Hospitals. Tanta Medical Journal. 2017; 45:166–74.
34. Paolicchi F, Miniati F, Bastiani L, et al. Assessment of radiation protection awareness and knowledge about radiological examination doses among Italian radiographers. Insights Imaging. 2016;7(2):243-4.
35. Briggs-Kamara MA, Okoye PC, Omubo-Pepple VB. Radiation safety awareness among patients and radiographers in three hospitals in Port Harcourt. Am J Sci Ind Res. 2013; 4: 83-88.
36. International Commission on Radiological Protection. Report 60. Recommendations of the International

Received*: 19-10-2025 -* ***Accepted****: 09-01-2025 -* ***Published****: 17-01-2025*

Commission on Radiological Protection. Annals of the ICRP. 1999;21(13).
37. Awosan KJ, Ibrahim M, Saidu SA, et al. Knowledge of Radiation Hazards, Radiation Protection Practices and Clinical Profile of Health Workers in a Teaching Hospital in Northern Nigeria. J Clin Diagn Res. 2016;10(8):LC07-LC12.A.
38. Bolbol, Sarah & Zaitoun, Mona & El-Magd, Sahar & Mohammed, Noha. Knowledge and Practice of Healthcare Workers in Diagnostic Radiology Department Towards Ionizing Radiation. Malaysian Journal of Medicine and Health Sciences. 2021;17. 224-231.
39. Alotaibi, Muhammad & Al-Abdulsalam, Amal & Bakir, Yousif & Mohammed, Ahmed. Radiation awareness among nurses in nuclear medicine departments. The Australian journal of advanced nursing: a quarterly publication of the Royal Australian Nursing Federation. 2015; 32. 25-33.
40. Dave N, Raj A, Mohd Radzi J. Assessment of Knowledge and Practice on Radiation Protection in Radiological Imaging Among Healthcare Professionals at HPUniSZA. Asian Journal of Medicine and Biomedicine.2023;1. 9-20.
41. Yurt A, Cavusoglu B and Gunay T. Evaluation of awareness on radiation protection and knowledge about radiological examinations in healthcare professionals who use ionized radiation at work. Mol Imaging Radionucl Ther 2014; 23(2): 48–53.
42. Ma H, Hill CK, Bernstein L, Ursin G. Low-dose medical radiation exposure and breast cancer risk in women under age 50 years overall and by estrogen and progesterone receptor status: results from a case-control and a case-case comparison. Breast Cancer Res Treat. 2008;109(1):77-90.
43. Salah Eldeen NG; Farouk SA. Assessment of awareness and practice of ionizing radiation protection procedures among exposed health care workers. Egyptian Journal of Occupational Medicine. 2020; 44(1): 529-544.
44. Valuckiene Z, Jurenas M, Cibulskaite I. Ionizing radiation exposure in interventionalcardiology: current radiation protection practice of invasive cardiology operators in Lithuania. J Radiol Prot. 2016;36(3):695–708.
45. The 2007 Recommendations of the International Commission on Radiological Protection. ICRP publication 103 (2007) Ann ICRP 37:1–332.

المستخلص

أصبح استخدام الإشعاع المؤين مطبقًا بشكل متزايد في الممارسة الطبية. وعليه، يجب أن يكون العاملون في مجال الرعاية الصحية على دراية بإجراءات ومخاطر الحماية من الإشعاع وتطبيق التدابير المضادة الأساسية لتقليل التعرض المهني. قامت هذه الدراسة بتقييم الوعي بمخاطر الإشعاع ومعرفة إجراءات الحماية من الإشعاع بين أخصائيي الأشعة والمصورين بالأشعة والممرضات في أقسام الأشعة التشخيصية في مركز طبرق الطبي. أجريت دراسة مقطعية تعتمد على الاستبيان بين 70 من العاملين في المجال الطبي، بما في ذلك أخصائيو الأشعة والممرضات والمصورين بالأشعة، خلال الفترة بين مارس ومايو 2022. جمع الاستبيان بيانات حول الخصائص الديموغرافية والوعي بمخاطر الإشعاع ومعرفة إجراءات الحماية من الإشعاع. كان 57.1٪ من المساهمين من الذكور، و42.9٪ في الفئة العمرية 31-40 عامًا. كان 74.2٪ حاصلين على درجات البكالوريوس بينما كان 17.1٪ حاصلين على دبلومات والأقلية 8.6٪ حاصلون على درجات تعليمية أعلى. بشكل عام، أظهر جميع المساهمين مستوى جيدًا من الوعي بإجراءات الحماية من الإشعاع. اعتقدت أغلبية المشاركين (63٪ + 31٪) أن الإشعاع الطبي يسبب خطرًا خطيرًا على صحة الإنسان. واعتقد جزء صغير منهم أنه ليس خطيرًا. توصي النتائج الحالية بوجود مستوى معقول من الوعي بإجراءات الحماية من الإشعاع ومخاطر الإشعاع ولكن لوحظ نقص نسبي في المعرفة حول مبدأ أقل ما يمكن تحقيقه بشكل معقول {ALARA} وقاعدة العشرة أيام بين الموظفين. لذلك، يجب السماح بالتعليم الطبي المستمر حول الحماية من الإشعاع والمخاطر.

Received*: 19-10-2025 -* ***Accepted****: 09-01-2025 -* ***Published****: 17-01-2025*