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Original Article

Occupational Radiation Exposure and Health Effects Among Medical Imaging Staff in Benghazi, Libya: A Cross-Sectional Study, 2026

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Abstract

Background: Medical imaging staff are at risk of occupational radiation exposure, which can lead to serious health effects if proper protective measures are not implemented. This study evaluates radiation protection practices, availability of protective equipment, training, and self-reported health effects among medical imaging personnel in Benghazi, Libya. **Methods:** A cross-sectional study was conducted among 200 medical imaging staff (radiologists, radiologic technologists, and nurses) working in public and private hospitals, diagnostic centers, and clinics in Benghazi, Libya, from January to February 2026. Data were collected using an online structured questionnaire (Google Forms) containing 24 questions covering demographics, protective equipment availability and use, dosimeter availability, radiation safety training, work-related symptoms, diagnosed health conditions, challenges, and priorities for improvement. The questionnaire was shared via social media platforms commonly used by medical imaging staff. Data were analyzed using descriptive statistics (frequencies and percentages).**Results:** Most participants were aged 25–34 years (62%), with 55% female and 45% male. The majority worked in government hospitals (70%). Basic protective equipment was unavailable for 55% of participants, and only 28% had access to lead aprons. Personal dosimeters were absent for 78% of staff. Only 17% reported receiving regular annual safety training. Despite the lack of formal training, 46% of participants rated their personal knowledge as 'good,' 39% as 'moderate,' and 15% as 'poor'; 85% rated workplace protective measures as insufficient. Common symptoms included persistent fatigue (46%), hair loss (41%), headaches (38%), and vision problems (34%). Diagnosed conditions included anemia (19%), thyroid disorders (10%), and cataracts (5%). Major barriers included lack of equipment (65%), no dosimeters (58%), high workload (50%), and lack of accountability (40%).**Conclusion:** There are serious deficiencies in radiation safety infrastructure, training, and health surveillance among medical imaging staff in Benghazi. These gaps are associated with a high prevalence of radiation-related symptoms and conditions. Urgent, multi-level interventions are required to protect this essential healthcare workforce.

Keywords: Occupational radiation exposure, radiation protection, medical imaging staff, dosimetry, radiation safety training, Benghazi, Libya.

Introduction

Ionizing radiation plays a vital role in contemporary medicine, especially for diagnostic imaging, as it allows visualization of internal structures and guides diagnosis and therapy for millions of people globally. Nevertheless, the very characteristics that make radiation valuable, its capacity to penetrate tissues and transfer energy, also create substantial health hazards for healthcare workers who are repeatedly exposed to scattered radiation during imaging examinations [1]. In contrast to patients, who experience only sporadic exposure, medical imaging personnel endure cumulative, prolonged, low-dose radiation that can cause both deterministic outcomes (for instance, skin redness, cataracts, hair thinning) and stochastic effects (such as cancers and genetic alterations) [2]. The core radiation protection approach, known as the ALARA principle ("As Low As Reasonably Achievable"), is built on three elements: reducing time near the source, increasing distance from the source, and using shielding (e.g., lead aprons, thyroid protectors, mobile barriers) [1]. When these measures are correctly applied together with personal dosimeters and periodic training, occupational exposure can be kept at safe levels. However, adherence to these principles varies considerably across different healthcare environments, particularly in low- and middle-income nations where resources are limited and regulatory enforcement may be insufficient [3,4].

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Global and Regional Perspectives on Radiation Protection

Worldwide, research has revealed notable shortcomings in radiation safety practices. In the United Kingdom, although mandatory training is provided to interventional radiology trainees, deficiencies still exist in real-world application and follow-up monitoring [5]. In China, medical staff lack adequate knowledge about radiation emergency preparedness, underscoring the need for continuous, structured education [6]. In Pakistan, even when the theoretical understanding of radiation hazards is reasonable, attitudes toward protective practices are often unsatisfactory, and many workers do not consistently use the available protective gear [7]. Comparable challenges are evident in the Middle East and North Africa. There, occupational radiation safety knowledge, attitudes, and practices are suboptimal, especially in non-hospital facilities [8]. Awareness of safety compliance among healthcare workers exposed to ionizing radiation is strongly linked to the availability of training and protective equipment [9]. Staff attitudes frequently involve risk underestimation and an absence of formal instruction [10]. In Morocco, although basic knowledge exists, actual use of shielding and dosimeters remains poor [11]. Additionally, comprehensive and gender-sensitive safety strategies are required, particularly for female radiographers who may have extra concerns regarding reproductive health and pregnancy [12].

The African Context

Countries in sub-Saharan Africa encounter specific difficulties in implementing radiation safety because of scarce resources, inadequate training infrastructure, and fragile regulatory frameworks. In Ethiopia, many radiology workers exceed recommended dose limits due to missing dosimeters and protective equipment [13]. In Dakar, Senegal, while awareness is moderate, actual protective practices fall far behind owing to equipment shortages and insufficient supervision [14]. In the Democratic Republic of Congo, basic protective items are often unavailable, dosimetry is nearly non-existent, and training occurs irregularly at best [4]. In a resource-limited radiotherapy setting in Ghana, staff frequently put patient throughput ahead of their own protection because of high workload pressures and a lack of institutional commitment [3]. In Kabul, Afghanistan, radiation safety awareness and practices among radiology personnel are critically low, with most workers unable to identify even basic protection principles [15].

The Libyan Situation

Several investigations have described the status of radiation protection within Libya. In Benghazi hospitals, professional safeguards against ionizing radiation hazards are insufficient, characterized by limited availability of dosimeters, weak training, and poor administrative oversight [16]. At Misurata Medical Centre, doctors who use fluoroscopy show inconsistent adherence to shielding and distancing rules, and formal training is missing [17]. In Tobruk Medical Centre, the majority of participants cannot correctly state safe distance guidelines or explain the purpose of personal dosimeters [18]. These findings point to a consistent pattern of deficiencies across Libyan healthcare facilities.

Health Effects of Occupational Radiation Exposure

The health consequences of inadequate radiation protection are well established. Acute effects following high-dose exposure include skin burns, radiation sickness, and hair loss, whereas chronic low-dose exposure is linked to elevated risks of cataracts, thyroid disorders, anemia, and various cancers [1]. The lens of the eye is especially sensitive to radiation, and lens opacities (cataracts) can develop at lower doses than previously thought [2]. The thyroid gland, particularly when not shielded, is also highly vulnerable to radiation injury [12]. In Egypt, exposed healthcare workers who practice poor safety report much higher frequencies of fatigue, headaches, hair loss, and vision problems [19]. Moreover, many radiology students underestimate the long-term dangers of radiation, highlighting the need for better education starting at the undergraduate level [20]. Despite this evidence, very few Libyan studies have systematically recorded the health status of medical imaging staff in relation to their occupational exposure. Most existing research has concentrated on knowledge and practices rather than on actual health outcomes. This constitutes a critical gap, because without documentation of real health effects, policymakers and hospital administrators may underestimate how urgently interventions are needed.

Rationale and Significance of the Study

Due to known radiation protection gaps in Libya, this study provides current data on protective equipment and dosimeter availability among Benghazi's medical imaging staff, assesses the frequency, quality, and sources of radiation safety training received by these workers, documents self-reported health symptoms and diagnosed conditions potentially linked to occupational radiation exposure, and identifies barriers to safe practice as well as workers' priorities for improvement, aiming to guide evidence-based interventions, resource allocation, and stronger regulatory enforcement in Libya.

Study Aims and Objectives

The primary aim of this study was to assess occupational radiation exposure, protective practices, training, and health effects among medical imaging staff in Benghazi, Libya.

The specific objectives were:

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1. To describe the demographic and occupational characteristics of medical imaging staff in Benghazi.
2. To evaluate the availability and use of personal protective equipment and dosimeters.
3. To assess the frequency, quality, and sources of radiation safety training.
4. To document self-reported health symptoms and diagnosed conditions among participants.
5. To identify the main challenges to implementing radiation safety measures.

Materials and Methods

Study Design and Setting

A descriptive, cross-sectional, questionnaire-based study was conducted to assess occupational radiation exposure, protective practices, training, and health effects among medical imaging staff in Benghazi, Libya. All data were collected between January and February 2026.

Study Population and Sampling

The study used convenience sampling and involved 200 participants. The target population consisted of all healthcare professionals working in diagnostic imaging departments who are routinely exposed to ionizing radiation during the course of their duties. This included:

- **Radiologists** (specialist physicians interpreting and sometimes performing imaging procedures)
- **Radiologic technologists/radiographers** (technicians operating X-ray, CT, and fluoroscopy equipment)
- **Radiography specialists** (advanced technologists with additional responsibilities)
- **Nurses** working in radiology departments (assisting with procedures and patient care)
- **Other roles** (e.g., medical physicists, trainees, or support staff occasionally exposed)

Data Collection Instrument

A structured, self-administered online questionnaire was developed specifically for this study. The instrument was designed based on a thorough review of the literature on radiation protection practices, including previous studies from Libya [16,17,18], other African countries [13,14], and international guidelines [1,2].

The questionnaire was originally drafted in English and then translated into Arabic, the native language of all participants, to ensure comprehension and accurate responses. The Arabic version was pilot-tested on 10 medical imaging staff (not included in the final sample) to identify ambiguous or unclear questions. Minor modifications were made in response to pilot feedback.

Data Collection Procedure

Data were collected over 8 weeks, from January to February 2026. The following procedure was followed:

Participant recruitment via social media: We shared a link to an online Google Form questionnaire on social media platforms commonly used by medical imaging staff in Benghazi. The researchers explained the purpose of the study and invited eligible staff to take part. We reached out to radiologists, radiologic technologists, radiography specialists, and nurses working in government hospitals, private hospitals, diagnostic imaging centers, and clinics across Benghazi. Before starting the questionnaire, participants read a brief explanation of the study's purpose. They were told that taking part was voluntary, their answers would be kept private, and they could stop at any time with no consequences. By continuing to the questionnaire, they gave their consent electronically.

Anonymity and confidentiality: We did not collect any personal identifiers such as names, ID numbers, or exact workplace addresses. Each response was automatically assigned a unique code. All data were stored securely and were only accessible to the principal investigator.

Data Analysis

Data entry and analysis were performed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). The analytical approach consisted of quantitative and qualitative components.

Results

Demographic and Occupational Profile

The study included 200 medical imaging staff. The sample had a slight female predominance (55% vs. 45% male). Most of the participants were young adults aged 25–34 years (62%), with 24% aged 35–44 years. Educationally, most held a bachelor's degree (72%), while postgraduate degrees (master's or doctorate) accounted for 16% combined. Nearly half of the participants were radiologists (48%), followed by radiologic technologists (18%), nurses (20% according to the new table), and radiography specialists (14%). Over half (52%) had less than 5 years of experience, and 70% worked in government hospitals. **(Table 1)**

Access to Protective Equipment

Access to basic radiation protection was strikingly poor. Only 28% had lead aprons, and 55% reported a complete lack of basic protective equipment. Thyroid shields, goggles, and gloves were available to only 17%. Personal dosimeters were available and used by merely 5% of staff, while 78% had no access at all. Regarding the principle of distance, 42% reported they always try to stay outside the room, when possible, but 18% stayed less than 1 meter from the source, directly increasing their radiation exposure. **(Table 2)**

Knowledge Levels and Training Status

Radiation safety training was severely deficient: 60% received no training at all, and only 17% had regular annual training. Despite this, 46% rated their own knowledge as "good," and 39% as "moderate," suggesting possible overestimation or informal learning. The adequacy of current safety measures was rated as insufficient by 85%

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of participants, with only 8% considering them fully adequate. This disconnect between self-perceived knowledge and actual safety provision is a major concern. **(Table 3)**

Self-Reported Health Symptoms Among Medical Imaging Personnel

A high burden of symptoms potentially related to radiation exposure was reported. Persistent fatigue (46%), visible hair loss (41%), frequent headaches (38%), and vision problems (34%) were the most common. Skin problems (18%) and dizziness/nausea (16%) were also noted. Notably, only 22% reported no symptoms, meaning nearly four out of five participants experienced at least one symptom they attributed to occupational exposure. **(Table 4)**

Diagnosed Illnesses Among Medical Imaging Personnel (Last 5 Years)

Although the majority (65%) had no formally diagnosed condition, a substantial minority reported illnesses with known associations to chronic radiation exposure: anemia (19%), thyroid disorders (10%), chronic skin diseases (6%), cataracts (5%), and fertility problems (4%). The presence of cataracts and thyroid disorders in this relatively young population (median age 25–34 years) is particularly alarming and warrants further investigation. **(Table 5)**

Barriers to Implementing Safety Practices

Participants identified multiple systemic obstacles. The most frequently cited barriers were lack of protective equipment (65%) and absence of personal dosimeters (58%). High workload and time pressure (50%) and unclear safety policies (44%) were also major hurdles. Additionally, lack of accountability (40%), ineffective or absent training (38%), and low commitment from colleagues/management (32%) highlight a weak safety culture. **(Table 6)**

Interventions to Improve Radiation Protection

There is strong participant support for interventions to improve radiation protection. The top three priorities were: providing modern and sufficient protective equipment (88%), mandatory practical periodic training (85%), and supplying personal dosimeters with regular result monitoring (80%). Strict safety policies (70%), routine medical checkups (68%), awareness campaigns (60%), and reducing workload pressure (50%) were also strongly recognized. **(Table 7)**

Table 1: Demographic and Occupational Characteristics of Participants (N = 200)

Variable		N	%
Gender	Female	110	55%
	Male	90	45%
Age	< 25 years	4	2%
	25–34 years	124	62%
	35–44 years	48	24%
	45–54 years	16	8%
	≥ 55 years	8	4%
Education	Bachelor's degree	144	72%
	Diploma	24	12%
	Master's degree	16	8%
	Doctorate	16	8%
Job Title	Radiologist	96	48%
	Radiologic technologist	36	18%
	Radiography specialist	28	14%
	Nurse	40	20%
Experience	< 5 years	104	52%
	5–10 years	48	24%
	11–15 years	28	14%
	16–20 years	8	4%
	> 20 years	12	6%
Workplace	Government hospital	140	70%
	Private hospital	20	10%
	Private diagnostic center	16	8%
	Private clinic	24	12%

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Table 2: Access to Protective Equipment among Participants

Variable		N	%
Protective equipment availability	Have access to lead aprons	56	28%
	lack of basic protective equipment	110	55%
	Thyroid shields, goggles, and gloves are available	34	17%
Personal dosimeters	Available and used	10	5%
	Available but not used	24	12%
	Not available at all	156	78%
	No response / unsure	10	5%
Protective practices (distance)	Always try to stay outside the room when possible	84	42%
	Maintain distance of 1–2 meters	56	28%
	Stay less than 1 meter from source	36	18%
	Maintain distance > 2 meters	24	12%

Table 3: Knowledge Levels and Training Status of Participants

Variable		N	%
Training received	Regular annual training	34	17%
	Irregular or insufficient training	46	23%
	No radiation safety training at all	120	60%
Knowledge assessment	Good	92	46%
	Moderate	78	39%
	Poor	30	15%
Safety adequacy of current measures	Fully adequate	16	8%
	Insufficient	170	85%
	Neutral	14	7%

Table 4: Self-Reported Health Symptoms Among Medical Imaging Personnel

Symptom	N	%
Persistent fatigue	92	46%
Visible hair loss	82	41%
Frequent headaches	76	38%
Vision problems (e.g., blurring, cataracts)	68	34%
Skin problems on hands or exposed areas	36	18%
Dizziness or nausea	32	16%
No symptoms	44	22%

Table 5: Diagnosed Illnesses Among Medical Imaging Personnel (Last 5 Years)

Illnesses	N	%
Anemia	38	19%
Thyroid disorders	20	10%
Chronic skin diseases	12	6%
Cataracts	10	5%
Fertility problems	8	4%
Other conditions	12	6%
No diagnosed conditions	130	65%

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Table 6: Barriers to Implementing Safety Practices

Barrier	N	%
Lack of protective equipment	130	65%
No personal dosimeters available	116	58%
High workload and time pressure	100	50%
No clear safety policies or procedures	88	44%
Lack of accountability or supervision	80	40%
Ineffective or no training provided	76	38%
Lack of commitment from colleagues or management	64	32%
Insufficient recognition of safety importance among staff	50	25%
Perception that safety procedures hinder workflow	36	18%

Table 7: Interventions to Improve Radiation Protection

Interventions	N	%
Provide modern and sufficient protective equipment	176	88%
Mandatory, practical, and periodic training for all staff	170	85%
Supply personal dosimeters with regular result monitoring	160	80%
Apply strict and clear safety policies	140	70%
Establish routine medical checkups for exposed staff	136	68%
Increase awareness of safety culture	120	60%
Improve working conditions and reduce workload pressure	100	50%

Discussion

This cross-sectional study among 200 medical imaging staff in Benghazi, Libya, revealed serious deficiencies in radiation protection infrastructure, practices, and health surveillance, alongside a high prevalence of self-reported symptoms and diagnosed conditions potentially related to occupational radiation exposure.

Availability and Use of Protective Equipment and Dosimeters

A prominent finding of our study is that 55% of participants reported a complete lack of basic protective equipment, and only 28% had access to lead aprons. Personal dosimeters were absent for 78% of staff. These figures are considerably worse than those reported in other regional studies. For instance, a previous study in Benghazi hospitals found inadequate protection, but not to this extent, suggesting a possible deterioration over time due to ongoing instability [16]. Similarly, a study in Tobruk Medical Centre reported better availability of basic protective gear [18].

Comparatively, our results are far below international standards and even lag behind other African nations. Research from Ethiopia reported that while dosimeter use was low, basic personal protective equipment was more consistently available [13]. In Kinshasa, Democratic Republic of Congo, moderate availability of lead aprons was found, but similarly poor dosimeter coverage was noted [4]. The near-absence of dosimeters in our study is particularly alarming, as it makes it impossible to practice the fundamental principle of dose optimization (ALARA) or to detect unsafe exposure trends early [1,2].

Furthermore, the lack of thyroid shields (<10% availability) is especially concerning given the radiosensitivity of the thyroid gland, a finding also emphasized in a study focusing on female radiographers [12].

Training and Knowledge Gaps

Despite 60% of our participants receiving no radiation safety training at all, 46% rated their personal knowledge as "good," 39% as "moderate," and 15% as "poor." This overestimation of knowledge in the face of no formal training is a recognized phenomenon. Previous research on radiology students similarly found that those with inadequate training often had inflated self-assessments [20]. This "unconscious incompetence" is dangerous because it reduces motivation to seek improvement.

Our training deficit mirrors findings from other resource-limited settings. Studies from Kabul and Dakar both reported irregular or absent training programs [14,15]. The lack of structured training in Benghazi likely contributes directly to the poor safety practices observed.

Health Effects: Symptoms and Diagnosed Conditions

The prevalence of symptoms in the present study is concerning: persistent fatigue (46%), hair loss (41%), headaches (38%), and vision problems (34%). These rates are substantially higher than those reported in comparable studies. Research from Egypt reported lower rates of similar symptoms among exposed workers [19].

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The diagnosed conditions in the present study were anemia (19%), thyroid disorders (10%), and cataracts (5%), all of which have known associations with radiation exposure. Thyroid disorders are of particular concern given the radiosensitivity of the thyroid gland, especially in the absence of thyroid shields. These findings are supported by other work that found a correlation between poor safety compliance and increased health complaints among healthcare workers exposed to ionizing radiation [9].

Challenges and Barriers

The major challenges identified by our participants, lack of equipment (65%), no dosimeters (58%), high workload (50%), and no clear policies (44%), are remarkably consistent with those reported in similar contexts. Studies from Morocco and from Misurata, Libya, both identified the same triad: lack of resources, inadequate training, and weak enforcement [11,17]. This pattern contrasts with countries such as Jordan and the United Arab Emirates, where written policies exist even if they are not fully implemented [8,12].

Comparison with International Best Practices

International guidelines from the International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA) mandate the three core pillars of radiation protection: time, distance, and shielding, supported by personal dosimetry and regular training. Our participants reported using distance (42% stay outside the room), but shielding is almost nonexistent, and dosimetry is absent. This selective adoption of protective practices has been observed elsewhere. Previous research emphasized that awareness alone is insufficient; a culture of safety must be embedded through continuous education, accessible equipment, and leadership commitment [9].

Engineering and Administrative Procedures for Public Safety in Radiation Protection

Combining administrative controls with engineering solutions enhances worker protection and advances public health objectives. As radiation safety continues to evolve alongside technological progress and deeper health knowledge, ongoing research and adaptive strategies remain essential. By prioritizing these integrated approaches, organizations can foster safer workplaces, reduce occupational risks, and improve employee well-being in radiation-sensitive fields [21].

Study Limitations

Several limitations must be acknowledged. First, the cross-sectional design precludes causal inference between exposure and health effects. Second, all data are self-reported, introducing recall and social desirability biases. Third, the absence of objective dosimetry data means we cannot correlate symptom prevalence with actual radiation doses. Despite these limitations, this study provides essential baseline data for a vulnerable population that has been largely ignored in the medical literature, a necessary first step for future longitudinal and dosimetry-based research

Conclusion

This study demonstrates that occupational radiation protection among medical imaging staff in Benghazi, Libya, is critically deficient. The lack of basic protective equipment, near-absence of personal dosimeters, and absence of regular training are associated with a high prevalence of radiation-related symptoms and conditions.

Recommendations

Based on our findings and the supporting literature, we recommend the following actions to improve radiation safety among medical imaging staff in Libya:

Provide protective equipment and dosimeters

All medical imaging departments must be supplied with modern, sufficient protective equipment (lead aprons, thyroid shields, goggles, and gloves) and personal dosimeters for every exposed staff member.

Enforce radiation safety regulations

Strengthen and enforce existing radiation safety laws. Establish clear, written policies with defined responsibilities and consequences for non-compliance.

Establish a national radiation protection authority

Create an independent national body to oversee radiation safety standards, conduct regular inspections, and maintain a registry of all exposed workers.

Engage hospital administrators

Hospital administrators should form radiation safety committees, perform regular audits, provide dosimeters to all exposed staff, and arrange routine health checkups for workers.

Strengthen training bodies

Training institutions must develop hands-on, practical ALARA training programs delivered every 6–12 months. All new hires must complete safety training before starting clinical work.

Involve international organizations (e.g., WHO)

International bodies should provide technical support, equipment donations, and capacity-building for radiation safety training in Libyan institutions.

Improve healthcare facility management

Facility management must reduce workload pressures by ensuring adequate staffing levels and implementing rotational schedules to minimize individual exposure time.

Empower workers and professional associations

Workers and their professional associations should

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promote safer working conditions and actively promote a culture of safety among colleagues.

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References

1. Ahmad D, Almatari M, Tumayhi M. Occupational Exposure of Scatter Radiation and Proper Protective Methods. J Healthc Sci. 2022;2(1):1-8.
2. Siddiquee A. The Impact of Occupational Radiation Exposure on Radiographers and the Practical Realities of Radiation Protection Practices. Int J Sci Res Eng Manage. 2025;9(1):1-9.
3. Kyei K, Addo H, Daniels J. Radiation safety: knowledge, attitudes, practices, and perceived socioeconomic impact in a limited-resource radiotherapy setting. ecancermedicalscience. 2025;19:1855.
4. Malunda R, Kiyombo G, Kieto E, Beya C. Analysis of the implementation of radiation protection measures in imaging services: A cross-sectional study of health facilities in Kinshasa, Democratic Republic of the Congo. Ann Afr Med. 2025;18(3):210-218.
5. Patel S, Jenkins P, Zhong J. Better safe than so ray: national survey of radiation protection amongst interventional radiology trainees in the United Kingdom. Br J Radiol. 2023;96(1142):20230071.
6. Xie Y, Wang X, Lan Y. Assessment of radiation knowledge among medical personnel in nuclear emergency preparedness: a cross-sectional study. Front Public Health. 2025; 13:1547818.
7. Safina F, Tabassum S, Satiwan K, Shahbaz B, Naeem M. Knowledge of Radiation Hazards and Attitude toward Radioprotection among Radiography Healthcare Professionals. Biol Clin Sci Res J. 2025;6(6):1875.
8. Radaideh K, Matalqah L, Radaideh L. Knowledge, Attitudes, and Practices of Occupational Radiation Safety Among Healthcare Professionals: A Multi-Setting Study in Jordan. Health Phys. 2025;128(2):101-110.
9. Allam S, Algany M, Khider Y. Radiation safety compliance awareness among healthcare workers exposed to ionizing radiation. BMC Nurs. 2024; 23:115.
10. Haddar A, Sellami I, Ghrab M, Hajjaji M, Hammami J, Masmoudi M. Attitude and Perceptions of Healthcare workers regarding ionizing radiation. Eur Psychiatry. 2024;67(S1):S819-S820.
11. Elmorabit N, Marrakchi A, Chelh F, Zaizoune S, Azougagh M, Ennibi O. Knowledge and practices of interventional radiology staff regarding radiation protection. Multidiscip Rev. 2024;7(1):e2025062.
12. Almohammed H, Elshami W, Hamd Z, Abuzaid M. Enhancing radiation safety awareness and practices among female radiographers: a comprehensive approach. BMC Health Serv Res. 2024; 24:210.
13. Alemayehu T, Bogale G, Bazie G. Occupational radiation exposure dose and associated factors among radiology personnel in Eastern Amhara, Ethiopia. PLOS ONE. 2023;18(6):e0286400.
14. Diop O, Diawara A, Diatta A. Knowledge and practices in radiation protection of workers under ionizing radiation in hospitals in Dakar. Pakistan J Nucl Med. 2024;12(2):55-63.
15. Sahoo T, Ahmadi A, Amarkhil O. Radiation Safety Awareness and Practice among Radiology Staff in Kabul National Specialty Hospitals. Eximia. 2023; 11:145-153.
16. Ali Q. Status Study of Professional Protection from Ionizing Radiation Hazards Among Radiation Workers in Diagnostic Radiology Departments at Benghazi Hospitals, Libya. ARID Int J Sci Technol. 2019;2(3):45-52.
17. Sherfad M, Alhaddad O. Radiation Protection Knowledge, Attitudes, and Practices Among Fluoroscopy-Utilizing Doctors at Misurata Medical Centre, Libya. AlQalam J Med Appl Sci. 2024;7(3):331-338.
18. Bolowia N. Knowledge and Awareness about Radiation Protection and Hazards among Healthcare Workers in Tobruk Medical Centre. AlQalam J Med Appl Sci. 2025;8(1):145-152.
19. Ng S, Sa F. Assessment of Awareness and Practice of Ionizing Radiation Protection Procedures Among Exposed Health Care Workers. Egypt J Occup Med. 2020;44(3):529-544.
20. Khan H, Ahmad B, Ullah I, Gul G. Assessment of Knowledge Regarding Harmful Effects of Radiation and Protection Protocols Among Radiology Undergraduate Private Sector Students. Insights J Health Rehabil. 2025;3(2):45-52.
21. Abuzreda A, Yousif AB, Alzayani A, Abdulrahman SA, Mohammed AA, Shomata MM. Comprehensive Administrative and Engineering Strategies for Radiation Protection and Occupational Health Safety. Clinical and Medical Engineering Live. 2025 ;3(1):1-8.

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