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Evaluation of Adherence to Radiation Safety Practices and Protection Protocols at the Radiology Departments in Derna City

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تقييم الالتزام بممارسة السلامة الإشعاعية وبروتوكولات الحماية في أقسام الأشعة بمدينة درنه

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الملخص

تحتاج أقسام الأشعة للتطوير المستمرلمواجهة التحديات في مجال الوقاية من الأشعة وخطط الآمان في أقسام الأشعة . هدفت هذه الدراسة لتقييم مدى إلتزام العاملين بمجال الأشعة بتطبيق الوقاية من الأشعة في أقسام الأشعة في مدينة درنه/ ليبيا. تمت الدراسة المقطعية بتوزيع عدد 70 إستبيان على العاملين بأقسام الأشعة وكانت الإستجابة فقط لعدد 58 من المشاركين بنسبة 82.8%. تم التحليل الإحصائي لتحديد إلتزام المشاركين بتطبيق الوقاية من الأشعة لكل من أنفسهم والمرضى إضافة لحماية البيئة المحيطة. قارنت الدراسة تأثير كل من المستوى التعليمي للعاملين بالمجال وعدد سنوات خبرتهم بالعمل وكذلك بياناتهم الإجتماعية والديموغرافية. كانت نسب إلتزام العاملين بتطبيق الوقاية للبيئة المحيطة وللمرضى ولأنفسهم 86.2%, 74.1 و 60.2% على التوالي. كانت أعلى نسبة إمتثال إيجابي هي إستخدام معدات الوقاية الشخصية (PPE) بإختبار (سبيرمان 0.522 , p=0.000). وعلى الرغم من ملاحظة إرتباط مهم بين المستوى التدريبي وإستعمال معدات الوقاية الشخصية إلا أن الإختبار لم يظهر أهمية لذلك (سبيرمان 0.041 , p=0.75). كذلك تمت ملاحظة علاقة سلبية غير متوقعة بين المستوى التدريبي ومدى الإلتزام (سبيرمان - 0.2760 , p=0.03). أظهر معظم العاملين بالمجال مستوى أقل من المطلوب في مدى تطبيقهم لخطط الوقاية من الأشعة. وعليه فإنه من الضروري إتخاذ إجراءات التعديل الوقائي والقياسات الوقائية لتطوير ثقافة العاملين بالمجال بما يتماشى مع القياسات العالمية في التطبيق الصحيح للوقاية من الأشعة.

الكلمات المفتاحية: الوقاية من الأشعة، خطط الحماية، العاملين بالأشعة، التطبيقات الإشعاعية.

ASTRACT

The most important prospective challenges in radiation protection and safety protocols in radiology departments need to be revised and emphasized. This study assesses radiographers' adherence to radiation protection practices in radiology departments within Derna city/ Libya. A cross-sectional study was conducted among radiographers; 70 self-administrated questionnaires were sent to the participants, only 58 radiographers generating a response of 82.8%. An analysis was conducted to determine participants' adherence to radiation protection practices, including the implementation of personal protection, patient and environmental protection. The educational level of the radiographers, their years of experience and sociodemographic attributes were considered and compared. The percentage of radiographers' adherence to practices related to environmental protection, patient protection and self-protection were 86.2 %, 74.1% and 60.2%, respectively. A highly significant positive relationship was identified between PPE usage and compliance (Spearman's $\rho = 0.522$, $p = 0.000$). However, significant association was observed between training level and PPE usage (Spearman's $\rho = -0.041$, $p = 0.75$). Also, an unexpected negative relationship was found between training level and compliance (Spearman's $\rho = -0.2760$, $p = 0.03$). Most of radiographers' practices proved relatively unsatisfactory in implementing radiation protection protocols. Thus, proactive measures and corrective actions are necessary to develop radiographers' awareness of international standards of accurate radiation protection practices.

Keywords: Radiation Protection, Safety protocols, Radiographers, Radiation practices.

INTRODUCTION

Currently, radiology is the cornerstone of clinical diagnosis and effective patient management in medical sciences (Khan et al. 2018). The ability of ionizing radiation to penetrate soft tissue and capture images that the human eye cannot see is essential in various branches of medical sciences (Almohaimede,et al. 2020). The exposure of individuals to ionizing radiation is unavoidable due to the use of radiological imaging technology, (Jenkins, et al, 2021). High doses of ionizing radiation, such as X-rays, can have both deterministic and stochastic effects. These types of radiation may lead to severe and irreversible damage, including blood depletion, malignancies and genetic injuries (Edward, 2023). Ionizing radiation can cause direct and indirect damage to DNA and living cells by generating free radicals, which are uncharged and unstable molecules. Unstable radicals can produce new toxic substances, such as hydrogen peroxide, in living tissues to stabilize themselves and cause other cellular alterations (Iannucci, et al, 2016). Therefore, effectively utilizing new medical imaging technologies and adhering to protection principles is essential (Maharjan et al, 2020). Radiographers participate the most important character in radiological imaging to performing radiological investigations and underneath the radiation exposure; thus, their performance should always be optimized to the circumstances of the ALARA principle (as low as reasonably achievable) (Dietze, et al, 2005). Introducing radiological images with high quality while diminishing the staff and patient doses as low as possible can be demanding, and for that reason radiographers have to guarantee entire compliance with radiation protection and safety protocols. Radiographers require capturing sensible steps to protect the whole staff, environment, patients and themselves. The protection from unnecessary radiation exposure is crucial (Sarman, et al, 2013). Generally, radiation protection principles refer to a set of measures aimed at minimizing the exposure of patients, health workers, and the public to ionizing radiation, allowing the benefits of radiography while ensuring patient safety (Rai, 2021). In all medical imaging techniques, three principles are applied: justification, optimization, and dose limitation. The optimization principle serves to increase individuals' knowledge about the effects of radiation exposure. The radiation exposure reduced by 50% for the radiation workers who use lead aprons and thyroid shields during procedures. Various techniques such as increase filtration, higher tube voltage, lower tube current and minimum of three feet distant from the radiation sources can reduce radiation dose (Kargar, et al., 2017). Adequate training and education of using the necessary equipment and tools should be provided to the radiology staff appropriate to their jobs (Faggioni, et al 2017) (Vano, 2011). Radiation safety and protection educational programs should be conducted to improve knowledge and awareness of radiation worker. The aim of this study was to assess the knowledge towards radiation protection and adherence to radiation safety measurements among radiation workers who employ ionizing radiation in the radiology department.

METHOD

Study design

This research adopted a quantitative, descriptive cross-sectional design using a structured questionnaire to assess the A cross sectional study was conducted on radiographic technicians who had been working in radiology departments in hospitals and health centers in Derna city. All included radiographers were from various medical diagnostic imaging departments and had been employed for at least 1 year before participating in the study. The study explored participants' awareness to protect patients, environments and themselves from radiation hazards, as well as to measure to what extent the standard protocols were applied in radiology department in the city hospitals.

Study Population and Setting

The survey targeted staff of radiologists, technologists, technicians and trainers in radiology departments across hospitals and clinics in the city of Derna. Data collection focused on their age, education and experiences.

Data Collection Tool

A self-administrated questionnaire was designed after reviewing the previous literature. It was revised by a panel of consultants in the field of radio-diagnosis to ensure its validity. The questionnaire consisted of both closed-ended and Likert scale questions assessing:

- Awareness of participants about radiation hazards.
- Availability of radiation protection tools and equipment.
- Safety protocols for both of patients and staff.
- Long-term improvements and training plans.
- The questionnaire was piloted prior to distribution to ensure clarity and reliability.

Data analysis:

The collected data was coded, entered into and analyzed using SPSS system files (SPSS package version 20). The data were analyzed using descriptive statistical methods for the social sciences SPSS for data analysis (Cooper & Schondler, 2001) frequency were used to describe the sample and descriptive analysis used to answer questions of study (Mean, Std. Deviation). The Likert scale (1 = Strongly Disagree to 2 = Strongly Agree) was used to measure the level of agreement regarding radiology department preparedness and response.

ETHIC APPROVAL

The study followed to ethical guidelines based on the Belmont Report principles (Gronowski et al, 2019). Participants were informed of the purpose of the study, certain of confidentiality, and given the right to withdraw at any time. No identifying private data were collected.

RESULT

The results of socio-demographic records are summarized in table 1. Of the 70 distributed questionnaires, 58 were returned, generating a response rate of 82.8%. The participants were radiographers employed at governmental hospitals in Derna City of Libya. A slight predominance of females noticed among participation (53.4% female vs. 46.6% male). While, the majority of participants belonged to the 20–30 age group (77.6%), followed by the 41–50 age group (10.3%). On the other hand, Bachelor's degree holders represented the vast majority of the sample (91.4%), with a small proportion of diploma and master's degree holders. Technicians accounted for the largest rate (69.0%), which is expected in studies of daily radiation protection practices, followed by trainee students (29.3%), with only one physician participating. Over half (53.4%) worked in X-ray units, about one-third (36.2%) in CT, and 10.3% in other modalities. This spread provides coverage across key diagnostic imaging services but reflects greater representation of conventional radiography.

The sample was dominated by less experienced staff (1–5 years, 77.6%), with very few having >15 years (13.8%). The high mean variance (SD = 1.06) suggests some heterogeneity, but overall the workforce appears early-career heavy. This could impact both skill level and adherence to safety protocols. A striking majority (93.1%) reported having sufficient knowledge, while only 6.9% denied it. The mean code (1.07 ± 0.26) indicates near-consensus.

Nearly all participants (93.1%) reported direct radiologic imaging responsibility, while only 6.9% were in administrative roles. This confirms that the study sample represents frontline radiology staff rather than managers.

Table (1). Socio-demographic & Professional characteristics of the studied radiographers

Variable	Category	No	Percentage (%)
Gender	Female	31	53.4
	Male	27	46.6
	Mean ± SD 1.53 ± 0.50		
	Min-Max 1-2		
Age	20–30 years	45	77.6
	41–50 years	6	10.3
	31_40	5	8.6
	>51	2	3.4%
	Mean ± SD 1.40 ± 0.82		
	Min-Max 1-4		
Educational qualifications	Bachelor's degree	53	91.4
	Diploma	4	6.9
	Master's	1	1.7
	Mean ± SD 1.16 ± 0.52		
	Min-Max 1-3		
Occupational-responsibility	Radiologic imaging	54	93.1
	responsibility	4	6.9
	Mean ± SD 1.07 ± 0.26		
	Min-Max 1-2		
Nature of Work	Technicians	40	69.0
	Trainee students	17	29.3
	Physician	1	1 .7
	Mean ± SD 1.33 ± 0.51		
	Min-Max 1-3		
Place work	X ray	31	53.4
	CT	21	36.2
	Others	6	10.3
	Mean ± SD 1.57 ± 0.68		
	Min-Max 1-3		
Years of Experience	1–5 years	45	77.6
	More than 15 years	8	13.8
	6_10	4	6.9
	11_15	1	1.7
	Mean ± SD 1.52 ± 1.06		
	Min-Max 1-4		
Radiation Protection Knowledge	Yes	54	93.1
	No	4	6.9
	Mean ± SD 1.07 ± 0.26		
	Min-Max 1-2		
Total	Studied radiographers	58	100

Table 2 displays the radiographers' adherence to the radiation protection measures and standards. The statistical scores of the mean ranged between 4.76 (the highest) and 1.38 (the lowest), which demonstrates a clear variation in the level of compliance across the different items.

These findings suggest that the majority of participants demonstrated very high adherence to these protective measures, reflecting a strong awareness of their critical importance in minimizing radiation exposure. The moderate means these items highlight a more variable adherence level. While certain protective measures are well adopted, others reflect only moderate compliance, indicating areas where further emphasis and reinforcement are required. Furthermore, the low scores point to weak adherence in these specific practices. Possible reasons may include a lack of awareness of their importance, insufficient availability of protective equipment (e.g., lead gloves), or the absence of strict institutional policies to monitor compliance.

Table (2) Adherence to radiation protection practice among radiographers

Protection Practice	Median [IQR]	Mean+_ SD	1 (Never)		2 (Rarely)		3 Sometimes		4 (Often)		5 (Always)		Adherence Level
			No	%	No	%	No	%	No	%	No	%	
Lead apron usage	3.0 [2.0 - 4.0]	2.88 ± 1.33	11	19.0	11	19.0	19	32.8	8	13.8	9	15.5	Moderate adherence
Dosimeter badge usage	1.0[1.0– 1.0]	1.41 ± 0.97	47	81.0	3	5.2	4	6.9	3	5.2	1	1.7	Critically poor
Thyroid shield usage	1.0[1.0–1.0]	1.38 ± 0.88	47	81.0	3	5.2	6	10.3	1	1.7	1	1.7	Critically poor
Lead gloves while using fluoroscopy	1.0 [1.0 – 1.0]	1.47 ± 1.12	47	81.0	3	5.2	3	5.2	2	3.4	3	5.2	Critically poor
Gonadal shield	1.0 [1.0 – 2.0]	1.67 ± 1.24	4.2	72.4	4	6.9	5	8.6	3	5.2	4	6.9	Critically poor
Safe distance maintenance	5.0[4.0–5.0]	4.36 ± 1.16	4	6.9	-	-	5	8.6	11	19.0	38	65.5	Excellent adherence
Beam collimation	5.0[4.0–5.0]	4.43 ± 1.09	3	5.2	1	1.7	4	6.9	10	17.2	40	69.0	Excellent adherence
Patient lead protection	2.0 [1.0 – 3.0]	2.45± 1.45	20	34.5	8	13.8	15	25.9	6	10.3	9	15.5	Excellent adherence
Patient Gonadal shield	1.0 [1.0 – 3.0]	2.21 ± 1.52	31	53.4	7	12.1	7	12.1	3	5.2	10	17.2	Critically poor
Distance maintained between the radiation source and the image receptor	5.0 [4.0 – 5.0]	4.40±1.01	2	3.4	-	-	8	13.8	9	15.5	39	67.2	Excellent adherence
Markers used	5.0 [4.0 – 5.0]	4.12 ± 1.38	5	8.6	5	8.6	3	5.2	10	17.2	35	60.3	Moderate adherence
Exposure time kept as low as reasonably achievable	5.0 [5.0 – 5.0]	4.59±0.79	-	-	1	1.7	7	12.1	7	12.1	43	74.1	Excellent adherence
Lead shielding used for patient companions or medical staff during the examination	2.0 [1.0 – 5.0]	2.83 ± 1.75	23	39.7	5	8.6	7	12.1	5	8.6	18	31.0	Moderate adherence
Room closure during imaging	5.0[5.0–5.0]	4.76±0.76	1	1.7	1	1.7	1	1.7	5	8.6	50	86.2	Excellent adherence

Table 3 demonstrates the scoring for participants' adherence to radiation protection practices which calculated for practices related to the protection of the radiographers themselves, patient protection and environmental protection. Environmental protection Practices recorded the highest percentage of excellent adherence ranged about (86.2 %).

Patient Protection is demonstrated by the high "Always" responses for its key practices (e.g., Exposure time minimized: 74.1%, Beam collimation: 69.0%, Distance source–IR: 67.2%). The "60.2%" This demonstrates a sufficient level of ethical and professional awareness among radiographers towards their primary duty of protecting those they serve. These practices include (Minimizing exposure time and beam collimation to reduce the radiation dose to the patient) (Using radiation field markers. The concerning finding of the Personal Protection (81.0% practices related to the radiographers' own safety recorded the lowest rate of good adherence.

Table (3): The scoring for participants' adherence to radiation protection practices

Rank	Item (Practice)	Median [IQR]	The highest percentage	Mean ± SD	Adherence Level
1	Room closure	5.0 [5.0–5.0]	86.2 % always	4.76 ± 0.76	Excellent
2	Exposure time minimized	5.0 [5.0–5.0]	74.1% always	4.59 ± 0.79	Excellent
3	Beam collimation	5.0 [4.0–5.0]	69.0% always	4.43 ± 1.09	Excellent
4	Distance source–IR	5.0 [4.0–5.0]	67.2% % always	4.43 ± 1.01	Excellent
5	Safe distance	5.0 [4.0–5.0]	65.5% always	4.36 ± 1.16	Excellent
6	Markers used	5.0 [4.0–5.0]	60.3% always	4.12 ± 1.38	Moderate
7	Lead apron	3.0 [2.0–4.0]	32.8 %Sometimes	2.88 ± 1.33	Moderate
8	Lead shielding for companions	2.0 [1.0–5.0]	39.7% never	2.83 ± 1.75	Moderate
9	Patient protection	2.0 [1.0–3.0]	34.5% never	2.45 ± 1.45	Moderate
10	Patient gonadal shield	1.0 [1.0–3.0]	53.4% never	2.21 ± 1.52	Critically poor
11	Gonadal shield	1.0 [1.0–2.0]	72.4 % never	1.67 ± 1.24	Critically poor
12	Lead gloves	1.0 [1.0–1.0]	81.0% never	1.47 ± 1.12	Critically poor
13	Dosimeter badge	1.0 [1.0–1.0]	81.0% never	1.41 ± 0.97	Critically poor
14	Thyroid shield	1.0 [1.0–1.0]	81.0 never	1.38 ± 0.88	Critically poor

The Kruskal–Wallis non-parametric tests were conducted to examine whether adherence to radiation protection practices varied by age, education, or years of experience. ($\alpha = 0.05$). Table 4 pointed out the differences were not statistically significant ($H = 1.1989$, $p = 0.7533$). The differences observed between age groups were not statistically significant indicating that age was not a determining factor in adherence to radiation protection practices.

Table (4) Differences between age group in adherence personal protection

Variable	Group	n	df	Mean ± SD	H (Chi²)	p-value	Significance (α=0.05)
Personal protection score	20–30 years	45	3	8.76 ± 4.29	1.199	0.753	Not significant
	31_40	6		8.67 ± 4.59			
	41–50 years	5		9.40 ± 4.56			
	>51	2		9.00 ± 0.00			

The table 5 indicates that no statistically significant differences in personal protection scores across educational levels using Kruskal–Wallis test (H=0.717, p=0.699).

Table (5) differences between education Group in adherence personal protection

Variable	Education Group	n	Df	Mean ± SD	H (Chi²)	p-value	Significance (α=0.05)
Personal protection score	Bachelor's degree	53	2	8.70 ± 4.06	0.717	0.699	Not significant
	Diploma	1		7.00 ± nan			
	Master's	4		10.75 ± 6.45			

Table 6 illustrates differences between years of experience in adherence personal protection. The table assessed that the Kruskal-Wallis test (H=3.008, p=0.390) indicated that these differences were not statistically significant.

Table (6): The differences between experience Group in adherence personal protection

Variable	Experience Group	n	df	Mean ± SD	H (Chi²)	p-value	Significance (α=0.05)
Personal protection score	1-5	45	3	8.93 ± 4.38	3.008	0.390	Not significant
	6-10	4		6.50 ± 1.91			
	11-15	1		13.00 ± nan			
	>15 years	8		8.75 ± 3.88			

Table 7 clarify the relationships between training level, personal protective equipment (PPE) usage, and compliance with radiation protection standards produced mixed outcomes using Spearman's analysis.

- H02: There is no a direct relationship between the level of training level and the availability of personal protective equipment and compliance with radiation protection standards in radiation handling facilities.
- H01: No differences between year of experience in adherence personal protection (α = 0.05)

Table 7. The relation between (Training Level, PPE Usage, Compliance)

Relationship	Spearman ρ	p-value	Significance (α=0.05)	Effect Size	Direction / Interpretation
Training Level ↔ PPE Usage	-0.041	0.75	Not significant	Negligible	No relationship
Training Level ↔ Compliance	-0.276	0.03	Significant	Small	Negative correlation (unexpected)
PPE Usage ↔ Compliance	0.522	0.000	Highly significant	Medium	Strong positive correlation

First, no significant association was observed between training level and PPE usage (Spearman's $\rho = -0.041$, $p = 0.75$). Second, an unexpected negative relationship was found between training level and compliance (Spearman's $\rho = -0.2760$, $p = 0.03$). Although statistically significant, the correlation was small and in the opposite direction to what was hypothesized. This counterintuitive result could reflect a tendency for individuals with higher training or greater knowledge to become overconfident or complacent, thereby neglecting strict adherence to safety protocols. Such a finding highlights the complex dynamics between knowledge and behavior, emphasizing that training alone does not guarantee compliance.

Third, a highly significant positive relationship was identified between PPE usage and compliance (Spearman's $\rho = 0.522$, $p = 0.000$). This medium effect size indicates that PPE usage is a strong and meaningful predictor of overall compliance with radiation protection standards. Unlike training, which may influence knowledge at a theoretical level, the consistent and practical use of protective equipment directly reinforces safe behaviors.

DISCUSSION

Radiological imaging is extensively accessible and can afford invaluable punctually information that can conduct both of clinical diagnosis and treatment protocols. On the other hand, radiation exposure has hazardous effects vary depending on the severity of radiation dose and the time of exposure. Effects such as blood depletion, hair loss, erythematic consequences, infertility and malignancy have been related to the exposure of radiation (Selmi & Natarajan, 2016).

This study accomplished with the objective to assess radiographers' adherence to the standards of radiation protection. Assorted similar studies have been performed in many countries which were utilized for comparison intentions. The results confirmed nearly all participants reported direct radiologic imaging responsibility, while few of them were in administrative roles. This corroborates that the study sample signifies frontline radiology staff rather than managers.

The outcomes of the assessment of adherence to radiation protection practices revealed a stark contradiction in the behavior of the radiographers. Their diligence in protecting others (patients and the environment) appears to be significantly greater than their diligence in protecting themselves. The results are both surprising and alarming, as the radiographers should educated on and aware about the implementation of recommended radiation protection protocols and practices in radiology departments is vital for the safety of the radiographers, the patients and the environment (Abuzaid, et al, 2019) (Kargar, et al, 2017). Likewise, practices related to environmental protection recorded the highest percentage of excellent adherence. This indicates that the institutional safety culture is well-established concerning procedures that affect everyone (Fatahi-Asl, et al, 2013). Patient Protection is demonstrated by the high responses for its key practices. However, the rate was not ideal, as significant shortcomings were observed in practices like patient gonadal shielding; indicating a gap in the comprehensive application of all safety protocols.These results were in accordance with previous studies (Sharma, et al, 2016) (Talab, et al, 2016).

On the other hand, this contradiction raises questions about the prevailing culture and awareness of personal risk. These neglected practices include (Wearing a thyroid shield and lead gloves during procedures involving direct radiation exposure (e.g., fluoroscopy) (Almohaimede, et al, 2020) (Hoogeveen, et al, 2016). Consistently wearing a personal dosimeter badge, this is crucial for monitoring cumulative radiation exposure. The regular use of lead aprons is the most alarming finding was the severe neglect of fundamental PPE: a vast majority never used thyroid shields, lead gloves, or their dosimeter badges (Memon, et al, 2010). Furthermore, the use of lead aprons was inconsistent, with only a minority reporting always using them (Hyun, et al, 2016). The results in this regard are similar to those obtained in other studies (Han, et al, 2013) (Briggs-Kamara, et al, 2013).

The results of comparing age group in adherence personal protection revealed that the age did not play a significant role in determining the level of adherence to radiation protection practices. As well, education levels were not a decisive factor in adherence to radiation protection practices (Briggs-Kamara, et al, 2013). Although variations in mean personal protection scores were observed across different experience groups, the Kruskal-Wallis test indicated that these differences were not statistically significant. This finding suggests that professional experience, measured in years of practice, was not a decisive factor in determining adherence to radiation protection practices. This was to some extent in divergence with previous study which is evident that older radiographers adhere to the personal protection practices to a greater extent with a significantly higher adherence score was observed for more experienced radiographers (Schueler, 2010). However, the study also revealed no significant difference was found regarding the adherence score in relation to the radiographers' educational qualifications (Abuzaid, et al, 2019).

In our study, the relationship between the level of training level and the availability of personal protective equipment and compliance with radiation protection standards in radiation handling facilities produced mixed outcomes. First, no significant association was observed between training level and PPE usage (Abuzaid, et al, 2019). This finding suggests that higher levels of training do not necessarily translate into increased utilization of PPE. It may indicate that the availability of protective equipment, rather than the level of training, is the primary determinant of PPE use (Schueler, 2010).

Second, an unexpected negative relationship was found between training level and compliance. This counterintuitive result could reflect a tendency for individuals with higher training or greater knowledge to become overconfident or complacent, thereby neglecting strict adherence to safety protocols. Such a finding highlights the complex dynamics between knowledge and behavior, emphasizing that training alone does not guarantee compliance (Abuzaid, et al, 2019).

Third, a highly significant positive relationship was identified between PPE usage and compliance. This medium effect size indicates that PPE usage is a strong and meaningful predictor of overall compliance with radiation protection standards. Unlike training, which may influence knowledge at a theoretical level, the consistent and practical use of protective equipment directly reinforces safe behaviors (Schueler, 2010).

The hypothesis was partially supported, as two out of three tested relationships reached statistical significance. PPE usage emerged as the strongest predictor of compliance, while training showed no meaningful association with PPE usage and an unexpected negative association with compliance (Abuzaid, et al, 2019).

Although the limitations of our study was due to restricted response of participants and the study was confined only in Derna City. Nevertheless, the practical implications ensuring accessibility and enforcement of PPE use may be more effective than relying solely on training programs. Moreover, monitor highly trained staff and continuous auditing and reinforcement of compliance are necessary to counter potential overconfidence among more knowledgeable workers. In addition, adopt integrated interventions as a balanced approach combining training, PPE availability, and behavioral monitoring is essential to optimize radiation safety standards (Abuzaid, et al, 2019)

CONCLUSION

Within the limitations of the study, it can be concluded that the preventive measures of the ionizing radiation among the radiographers in Derna city was unsatisfactory in regard to reducing radiation exposure for themselves. On the other hand, in regard to patient's protection, the radiographers' knowledge of radiation hazard was applied fairly to protect the patients. The radiation protection methods need to be underlined in more focusing among the radiographers' in the arrangement of corrective manners to guarantee that radiation protection measures and standard protocols are appropriately employed in radiology departments. Furthermore, extensive educational programs are essential for all radiographers.

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