Assessing the Level of Radiation Protection and Safety Compliance of Radiographers Currently Employed in the Makkah Cluster Hospitals

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Abstract

This study examines radiation protection practices among fifty radiographers from eight Ministry of Health (MOH) cluster facilities in the Western Region of Saudi Arabia. The survey, which had 64% male participants, classified respondents' clinical experience into five categories: 1-3 years, 4-8 years, 9-11 years, 12-15 years, and over 16 years. The study focused on three main areas: personal radiation protection, patient radiation protection, and radiation protection for the public. Results revealed that while a significant majority (90%) understand the importance of maintaining a safe distance from radiation sources, 12% of respondents neglect using lead aprons during mobile radiography. Furthermore, 16% allow staff to hold patients without protective aprons, which goes against NCRP guidelines. For patient protection, 86% adhere to maintaining an appropriate distance in line with the ALARA principle, but 12% never use protective shielding for patients' reproductive organs. Public safety practices showed varied compliance, with 94% utilizing radiation warning systems and signage, but 28% fail to prevent unnecessary exposure to other patients. Compliance levels among facilities also varied, with some being highly compliant and others moderately so, especially concerning the presence of non-essential individuals during x-ray procedures. This study highlights the need for better adherence to radiation protection guidelines and suggests that years of clinical experience may influence these practices. Enhanced training and strict enforcement of radiation safety protocols are recommended to mitigate risks to patients, staff, and the public.

Keywords: Radiation Protection, Safety Compliance, MOH Cluster Hospital

Introduction

Radiation protection and safety compliance are critical aspects of healthcare practices, particularly in radiography where exposure to ionizing radiation is inherent. This study delves into evaluating the adherence of radiographers who are currently working in the Saudi Ministry of Health (MOH) in Makkah cluster hospitals to establish safety measures within the hospital setting.

Soon after the discovery and utilization of X-rays for medical purposes, the observation of immediate harmful health effects led to the necessity for radiation protection measures. The introduction of lead shielding originated in the late 1800s to early 1900s, largely due to the contributions of William Rollins, an early advocate of radiation protection (Brodsky, A, 1989). Following the establishment of the International Commission on Radiological Protection (ICRP) in 1928, formerly known as the International X-ray and Radium Protection Committee, formal radiation protection standards began to be developed (Edwards M., 2013).

The need to limit potential radiation-induced effects has been a central pillar in the protection of patients, staff, and the public in the development of modern radiology. Justification of radiation usage, optimization of protection, and the application of dose limits have remained the fundamental principles of protection to prevent the induction of tissue reactions and reduce the risk of stochastic effects (The 2007 recommendations of the International Commission on Radiological Protection. Ann ICRP. 2007; 37(2-4): 1-332)

Radiation exposure in radiology departments has been a concern due to its potential health effects, such as increased cancer risk and genetic damage, to minimize these risks, regulatory bodies and professional organizations have established radiation protection standards and guidelines. However, the extent to which these standards are implemented and followed within the Makkah Health Cluster Hospitals remains unclear. This research seeks to bridge this knowledge gap by investigating the radiographer's compliance with radiation protection standards and practices in radiology departments among hospitals in the Makkah cluster and identifying areas for improvement.

The findings of this study will enhance radiation safety practices and well-being for patients and radiology staff. By pinpointing areas for improvement, insights on compliance with safety protocols will guide targeted interventions to optimize practices, minimize risks, and potentially increase compliance with PPE usage. Standardized protocols may improve the positioning of shielding devices and ensure adherence to dose limits, promoting consistent safety measures and quality patient care in Makkah health cluster hospitals.

Primary Objective:

To assess the level of radiation protection and safety compliance of radiographers currently employed in the Makkah Health Cluster Hospitals

Secondary Objectives:

- To determine if there is a significant correlation between radiographers' radiation protection and safety compliance when grouped according to their demographic profiles.
- To identify potential challenges and barriers to the implementation of radiation protection standards.
- To propose recommendations for enhancing radiation protection practices within the Makkah Health Cluster Hospitals based on the findings of the study.

Review of Related Literature

Ever since the discovery of X-rays by Wilhelm Conrad Roentgen in 1985, the use of ionizing radiation in the field of medicine has been rapidly increasing, which is attributable to recent advancements in imaging technology, that are promising in solving a wide array of clinical problems (Panchbhai A., 2015). The International Commission on Radiological Protection (ICRP) recommends an annual maximum permissible dose (MPD) of 20 mSv for designated radiation workers. In contrast, the recommended MPD for the general public is 1 mSv per year. However, the effective dose to organs and tissues from a single CT scan examination has been suggested to approach or even exceed doses calculated from epidemiological studies. These higher doses are known to increase the chances of deterministic effects, as stated by (Simon SL, Weinstock RM, et al., 2013).

Radiation protection is the field that focuses on safeguarding individuals and the environment from the detrimental effects of ionizing radiation. It encompasses both the scientific and artistic aspects of minimizing radiation exposure during x-ray procedures, aiming to protect patients and medical personnel. This definition is in line with the explanation provided by (Johnston J, Killion, et al., 2011) Radiation protection can be defined as the protection of people and the environment from the detrimental effects of exposure to ionizing radiation. The increasing occurrence of harmful effects caused by ionizing radiation can be attributed to the limited and inadequate knowledge of the radiological staff regarding radiation protection measures, practices, and the radiation doses associated with standard imaging methods (Maharjan et al.,2020). The emphasis is on the connection between the rising negative effects of ionizing radiation and the insufficient understanding of radiation protection measures and practices by the radiological staff.

In one of the studies conducted regarding the evaluation of technical, protective, and technological operation of radiologists in hospitals of Mazandaran medical science universities reported by Rahimi, et. al ,(2007) about 63.4% of the personnel were found to be aware of where to wear the film badges and in another study regarding the protection knowledge of technologists in Shiraz hospitals, only 26.3% personnel awareness as reported by Amirzadeh and Tabatabaie (2006). In a study conducted by Megan Whittaker et.al, in 2014 and published in the Journal of Radiology Research and Practice, it was found that orthopaedic surgeons and theatre staff showed poor compliance with wearing thyroid shields. The study highlighted the susceptibility of the thyroid gland to radiation-induced neoplastic transformation. Previous research has indicated that the thyroid may receive a potentially hazardous dose of 65µSv per procedure during standard orthopaedic operations, which exceeds the recommended limit. Therefore, it is recommended that staff working in the radiation scatter zone should be encouraged to wear thyroid shields to mitigate the risk of radiation exposure to the thyroid gland.

However, shielding the gonads, which are the reproductive organs, is crucial in reducing the radiation dose. The gonads typically absorb about 20% of the overall radiation dose received by the body. This indicates that these organs are highly sensitive to radiation and protecting them is essential to prevent the hereditary effects of ionizing radiation. To achieve this, routine use of gonad shielding in radiology labs is necessary, as emphasized by (Hohl et al. in 2020). By employing gonad shielding, the radiation dose to these organs can be significantly minimized, contributing to the overall safety and well-being of patients. Lead aprons of 0.5 mm thickness have been shown to shield approximately 99% of potential radiation dose (Singer G, 2019).

According to the Department of Nuclear Safety of Iran Atomic Energy Organization (DNSIAO), when performing any type of radiography, it is important to select a radiation field size that does not exceed the size of the organ being examined. By reducing the radiation field size from 8×10 to 6×6 in spinal radiography, there is a 50% decrease in the radiation dose. This decrease in dose is achieved by limiting the radiation field to the area of the organ being radiographed. This information is supported by the findings of Christensens in 2010. Radiation safety is vital in healthcare, impacting patients, physicians, and staff in departments like radiology, interventional cardiology, and surgery. Fluoroscopic procedures expose medical staff to the highest radiation dose. Diagnostic imaging methods like CT, mammography, and nuclear imaging contribute minimally to staff radiation exposure due to shorter radiation bursts. Despite varying exposure levels, all radiation poses risks to patients and healthcare workers. Strict safety protocols are crucial to minimize and monitor radiation exposure, ensuring everyone's safety and well-being in healthcare settings. Comprehensive radiation safety practices are essential given the potential risks associated with any radiation exposure (Mitchell EL, Furey P., 2011). The current literature mainly focuses on shielding in high-dose imaging environments such as fluoroscopy and operating rooms. While there is a trend towards discontinuing lead shielding for patients, it is essential to thoroughly evaluate all aspects for safety before deciding not to use it. This is crucial, especially if beliefs about shielding affect staff compliance with protective measures in various radiographic settings lacking strong scientific evidence. Medical radiation practitioners need to understand the risks and benefits before moving away from lead shielding in their practices (Cheon BK, 2018). Recent study conducted by (Munoz C et al, 2021), concluded that staff should not abandon lead shielding in low-dose settings of mobile and plain film radiography. Further research is needed to achieve a consensus on this matter. Studies suggest that the use of lead protection for staff in mobile radiography settings should not be abandoned based on existing radiobiological knowledge and risk estimation models. The Linear No-Threshold (LNT) model is considered appropriate for estimating low-dose risks, until a better understanding of low-dose exposures is attained, staff shielding in low-dose settings should not be abandoned.

METHODOLOGY

A cross-sectional descriptive correlational study design was employed to evaluate the compliance of radiographers with radiation protection standards, focusing on factors such as their knowledge of radiation dose optimization during examinations and adherence to radiation safety precautions. By examining these aspects in conjunction with the demographic profiles of the respondents, the research aimed to detect any significant correlations that may be present. The investigation centered on the Health Cluster hospitals in the Makkah region to conduct a comprehensive assessment of the radiation protection practices practiced by Radiographers.

Materials and methods

This study was conducted over three months starting in late December of 2023. The survey was carried out online using Microsoft Forms adopting the instrument from the instrument used in this study was adopted from Lakhwani, et.al (2019) entitled Radiation Protection and Standardization. The first part of the questionnaire consisted of information regarding the respondent’s demographic profile including age, academic qualifications, and work experience. The second part is structured questions that investigated the respondents’ radiation protection practices. The instrument is further divided into three constructs: a.) personal protection practice; b.) patient protection practice and c.) protection with environment. A four-point Likert scale was used to score the responses: 4= always, 3=often, 2=sometimes and 1= never.

Study Population

The study sample specifically included dedicated and skilled radiographers from these hospitals, forming a vital part of the research participants. This selection aimed to capture the valuable insights and experiences of these healthcare professionals in the context of the research objectives.

Inclusion: Radiographers working in MOH cluster hospitals in Makkah region

Exclusion: Radiographers working in non- MOH cluster hospitals in Makkah region. Facility with less than 3 responses were also excluded from the study.

Online survey was sent to selected MOH (Ministry of Health) cluster hospitals in the Makkah region of the Kingdom of Saudi Arabia. A total of 50 radiographers (n = 51) consented to participate in the study.

The distribution of participants across different hospitals in the Makkah region was as follows: 40% of the participants were from KAMC (King Abdulla Medical City), 12% of the participants were from the Maternity and Children Hospital, 24% of the participants were from Al Noor Specialist Hospital, 8% of the participants were from Khulais Hospital, 6% of the participants were from Hera Hospital and Ibn Sina respectively, while 2% from Ajyad Hospital and King Faisal hospital respectively; these percentages represent the proportion of participants from each hospital who took part in the study. By including participants from various MOH cluster hospitals in Makkah, the study aims to gather a diverse range of perspectives and experiences from radiographers in the Makkah region.

Ethical Considerations

In this research study, the protocol received an approval from the Institutional Research Body at King Abdullah Medical City with IRB **number 23-1175**, Prior to commencing the study, informed consent was obtained from all participants, ensuring that they voluntarily agreed to take part. The study objectives were clearly communicated to the participants, and measures were taken to ensure the privacy and confidentiality of their information throughout the research process. Additionally, participants were informed of their right to withdraw from the study at any point during the data collection phase, emphasizing their autonomy and freedom to discontinue participation if they so choose.

RESULTS and DISCUSSIONS

Fifty (50) radiographers voluntarily participated in the survey from eight (8) Ministry of Health (MOH) cluster healthcare facilities in the Western Region of Saudi Arabia. The data collected indicated that many of the respondents were male, comprising 64% of the total participants. The years of experience, a variable that is also surveyed in this study, were categorized into 1-3 years, 4-8 years, 9-11 years, 12-15 years, and above 16 years respectively. Most of the respondents have clinical experience of 4-8 years, while 16% of the respondents have clinical experience between 9-11 years.

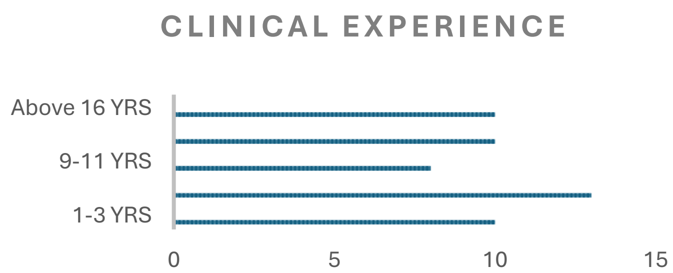

Fig. 1. Distribution of clinical experience between respondents

The concepts surveyed in this study are grouped into a.) Personal radiation protection practices, b.) Patient radiation protection practices and c.) Radiation protection practices to safeguard the other members of the public. Personal radiation practices involve how the radiologic technologists protect themselves from unnecessary radiation exposure including the guidelines set by the National Commission on Radiation Protection and Measurements (NCRP). The NCRP aims to advocate for the safe and efficient utilization of radiation while minimizing potential hazards to both human health and the environment. Patient radiation practices describe how the radiologic technologist protects the patient from radiation exposure when under their care. It is the responsibility of the technologist to ensure that proper shielding is applied to the patient when necessary. Furthermore, this study also investigated the radiation protection practices for the general public that are sometimes overlooked and underestimated.

Table 1. A. Distribution of Personal Radiation Protection Practices

FACTORS	ALWAYS	OFTEN	SOMETIMES	NEVER
1. Wearing a thermoluminescent dosimeter during work	94%	4%	2%	0%
2. Wearing of personal dosimeter next to the chest as recommended	94%	0%	4%	2%
3. Wearing lead gloves during fluoroscopy	72%	14%	4%	6%
4. Wearing a lead apron during portable radiography	64%	10%	14%	12%
5. Wearing of thyroid collar in the operating theater	66%	10%	10%	12%
6. Regular testing of radiation protection aprons and thyroid and gonad shields for staff and patients	72%	14%	8%	6%
7. Standing as far as possible from the source of radiation. Shielding of patients, themselves, patient companions, and other staff is essential	90%	10%	0%	0%
8. During use of mobile x-ray equipment stand at least 6 feet away from the patient and wear lead apron.	76%	18%	4%	2%
9. Adjust collimation to target specific areas of interest to minimize the risk of excessive exposure and scattered radiation	84%	14%	0%	0%
10. Avoid holding of infirm patient by staff, provide protective apron to the attendant while holding such patients	28%	22%	34%	16%

Table 1 presents the distribution of responses from the 4-point Likert scale data on personal radiation protection practices. It is well noted that most respondents are aware of the importance of wearing a radiation detector device and where to place it in the body. A few of the respondents (12%) never wear lead aprons during mobile radiography and thyroid shields in their operating theater procedures. According to Lakhawi, et al, (2019), wearing of thyroid shield can reduce the effective dose by 2.5 times and almost 50% of the total exposure. Ninety percent of the respondents understand that standing, as far from the source of radiation is essential. Moreover, 16% of the respondents still allow staff to hold infirm patients without protective aprons, which by principle under NCRP guidelines should not be allowed.

Table 2. B. Distribution of Patient Protection Practices

FACTORS	ALWAYS	OFTEN	SOMETIMES	NEVER
1. Ensure an appropriate distance between the patient and the X-ray tube during imaging	86%	14%	0%	0%
2. Avoid cropping the image after it has been exposed	42%	40%	14%	4%
3. Ensure the proper use of collimation during X-ray imaging with portable equipment	68%	28%	2%	2%
4. Regularly monitor radiation indicators and doses, such as DAP (dose area product), DLP (dose length product), and exposure index, and maintain records of them	52%	22%	18%	8%
5. Adjust the imaging parameters and technique based on factors such as the patient's gender, age, and other relevant characteristics	64%	34%	0%	2%
6. Frequently use protective shielding, such as gonad shielding, to safeguard the patient's reproductive organs	68%	36%	18%	12%
7. Determine the appropriate circumstances for using lead shield	68%	14%	14%	4%

The distribution of patient protection practices is presented in Table 2. There are 7 factors evaluated in the context of patient protection practices. Data suggests that 86% of the respondents ensure that an appropriate distance is observed between the patient and the x-ray tube which is the source of radiation, this practice is aligned to the Inverse Square Law as coined by the ALARA (As Low As Reasonably) principle of radiation protection. In this law, a double increase in the distance, will reduce radiation dose to one-fourth of its original value (Erica Dennis, 2019). Although 68% of respondents frequently use protective shielding to safeguard patient’s reproductive organs, there is still 12% of them who never use it. Further, it is also observed in the data presented that there are still 18% who only monitor their radiation exposures “sometimes”.

Table 3. C. Distribution of Radiation Protection Practices to Members of the Public

FACTORS	ALWAYS	OFTEN	SOMETIMES	NEVER
1. Prevent unnecessary radiation exposure to other patients when using a mobile x-ray machine in an unshielded room	30%	22%	20%	28%
2. Establish a minimum duration for radiation exposure during imaging	58%	26%	8%	8%

procedures such as fluoroscopy, interventional radiology, and endoscopy				
3. Provide lead aprons for all co-patients or co-staff members	48%	20%	18%	14%
4. The automatic red light exposure warning system installed turns on when performing X-Ray procedures inside the room	94%	6%	0%	0%
5. Radiation and pregnancy signs are visibly posted in all corners of the radiology department	94%	6%	0%	0%
6. Ensure that the door is closed during radiography	94%	4%	2%	0%
7. The person accompanying the patient stays in the control room unnecessarily	18%	4%	20%	58%

The distribution of radiation protection practices to other members of the public is presented in Table 3. There are 7 factors evaluated in this context including: prevention of unnecessary radiation exposure to other patients during mobile radiography; establishing minimum exposure time, providing lead aprons to other individuals present in the room during x-ray exposure; application of exposure warning system; posting of radiation signage in the Radiology department; ensuring doors are closed during radiation exposure; and not allowing anyone inside the room during radiation exposure. It is noted that 94% of respondents practiced the application of radiation warning systems and signage, as well as closing the doors during procedures. However, it is also evident that 28% of them answered never" to the question related to the prevention of unnecessary radiation exposure to other patients. In hospital wards, it is inevitable that other patients will be exposed. Moreover, 58% of respondents answered "never" on the question related to allowing an accompanying person to be inside the control room unnecessarily.

Table 4. Overall comparison of the radiation protection practices.

FACTORS	**AVERAGE WMEAN**	**DESCRIPTION**
Personal Radiation Protection	3.37	Compliant
Patient Radiation Protection	3.27	Compliant
Radiation Protection Practices to Safeguard the Other Members of the Public	3.16	Compliant

Description: 1.0 – 1.75 – Non-compliant; 1.78- 2.25 -Poorly compliant; 2.26- 3.0 – Moderately compliant;
3.01 – 3.49- Compliant; 3.5-4. Highly compliant

Table 4 presents in comparison the three listed elements being surveyed. It is evident that all the elements exhibit compliance in the radiation protection practices with average weighted means of 3.37, 3.27 and 3.16 respectively. A slightly higher weighted mean is noted in the context of personal radiation protection at 3.37.

Another objective of this study is to determine the compliance of the different health facilities under the Ministry of Health-Saudi Arabia cluster. Eight (8) facilities participated in the study, but only 6 will be further assessed due to the limited number of responses received from the other 2 facilities.

Table 5. Distribution of health facilities on A. Personal Radiation Practices

FACILITY	(AWM)	DESCRIPTION
A	3.19	Compliant
B	3.4	Compliant
C	3.63	Highly compliant
D	3.4	Compliant
E	3.65	Highly compliant
F	3.83	Highly compliant

Description: 1.0 – 1.75 – Non-compliant; 1.78- 2.25 -Poorly compliant; 2.26- 3.0 – Moderately compliant;
3.01 – 3.49- Compliant; 3.5-4. Highly compliant

As shown in Table 5, facilities C, E, and F present a high compliance with average weighted means of 3.63, 3.65, and 3.83 respectively, on the variable personal radiation protection practices, with facility F having a slightly higher compliance between the three. It also suggests that the remaining health facilities are compliant in this area. High compliance will indicate that all the important aspects of personal radiation protection are regularly applied in their daily radiography procedures.

Table 6. Distribution of health facilities on B. Patient Radiation Protection

FACILITY	(AWM)	DESCRIPTION
A	3.35	Compliant
B	3.36	Compliant
C	3.52	Highly compliant
D	2.76	Moderately compliant
E	3.5	Highly compliant
F	3.86	Highly compliant

Description: 1.0 – 1.75 – Non-compliant; 1.78- 2.25 -Poorly compliant; 2.26- 3.0 – Moderately compliant;
3.01 – 3.49- Compliant; 3.5-4. Highly compliant

In the area of patient radiation practices, facilities C, E, and F are "highly compliant" as shown in Table 6. However, facility D is noted to be "moderately compliant". Based on the data collected, facility D seldom provides shielding to patients and maintains a record of their patient's radiation index. Facility A scores a weighted mean of 2.75 on the factor of "Avoid cropping the image after it has been exposed", wherein respondents assert that they often cropped images after exposure. Inadequate collimation and post-exposure cropping exposed the larger part of the body to unwanted radiation. On the other hand, only 50% of respondents from facility B maintain a record of their patient's radiation index. Stochastic effects are discovered many years after radiation exposure and include the development of cancer and the likelihood of a stochastic effect rises with the quantity of x-rays a patient is exposed to (ICRP, 2007).

Table 7. Distribution of health facilities on C. Radiation Protection Practices to Safeguard the Environment

FACILITY	(AWM)	DESCRIPTION
A	3.57	Highly compliant
B	3.3	Compliant
C	3.55	Highly compliant
D	3.24	Compliant
E	2.57	Moderately compliant
F	3.48	Highly compliant

Description: 1.0 – 1.75 – Non-compliant; 1.78- 2.25 -Poorly compliant; 2.26- 3.0 – Moderately compliant; 3.01 – 3.49- Compliant; 3.5-4. Highly compliant

The application of minimizing risks to members of the public by each facility is presented in Table 7. As shown in the table, facilities A, C and F are "highly compliant" in this area, indicating that these facilities always provide exposure warning systems. Moreover, facility E is rated "moderately compliant", and 75% of their respondents never allow non-essential individuals to be inside the exposure room during x-ray procedures.

Further, this study also explores the radiation practices of respondents concerning their years of clinical experience and analyzes if it has an impact on their practices. On the aspect of clinical experience, respondents were categorized into 1-3 years; 4-8 yrs; 9-11 yrs; 12-15 yrs and above 16 years respectively.

Table 8. Distribution of clinical experience on A. Personal Radiation Protection Practices

YEARS OF EXPERIENCE	AWM	DESCRIPTION
1-3	3.29	Compliant
4-8	2.84	Moderately compliant
9-11	3.46	Compliant
12-15	3.3	Compliant
Above 16	3.57	Highly compliant

Description: 1.0 -1.75 – Non-compliant; 1.78- 2.25 -Poorly compliant; 2.26- 3.0 – Moderately compliant; 3.01 – 3.49- Compliant; 3.5-4. Highly compliant

Table 8 presents the responses of different clinical experience groups on the concept of personal radiation protection. Data suggests that respondents above 16 years of clinical experience are highly compliant in this area, with excellent ratings on factors 1,2, 8,9, and 10 respectively. Responses for 4-8 years however presented a "moderately compliant' rating, with 46% claiming they seldom practice "factor 3" (Wearing lead gloves during fluoroscopy), as well as group 1-3 years at 50%. Responses from group 4-8 years, on the other hand, indicate that 36% of them rarely practice "factor 4" (Wearing a lead apron during portable radiography).

Table 9. Distribution of clinical experience on B. Patient Radiation Protection Practices

YEARS OF EXPERIENCE	AWM	DESCRIPTION
1-3	3.24	Compliant
4-8	2.8	Moderately compliant

9-11	3.2	Compliant
12-15	3.46	Compliant
Above 16	3.36	Compliant

Description: 1.0 -1.75 – Non-compliant; 1.78- 2.25 -Poorly compliant; 2.26- 3.0 – Moderately compliant; 3.01 – 3.49- Compliant; 3.5-4. Highly compliant

Group 4-8 years suggests moderate compliance with the concept of patient radiation protection practices as indicated in Table 9. Data further indicates that 54% of the responses in this group rarely practiced "factor 1" (Ensuring an appropriate distance between the patient and the X-ray tube during imaging). All other groups exhibited high compliance, particularly on "factor 2"(Avoid cropping the image after it has been exposed). Additionally, the above 16-years group exhibited poor compliance on "factor 7" (Determine the appropriate circumstances for using lead shield) at a weighted mean of 1.89.

Table 10. Distribution of clinical experience on C. Patient Radiation Protection Practices

YEARS OF EXPERIENCE	AWM	DESCRIPTION
1-3	3.24	Compliant
4-8	2.92	Moderately compliant
9-11	3.16	Compliant
12-15	3.3	Compliant
Above 16	3.25	Highly compliant

Description: 1.0 -1.75 – Non-compliant; 1.78- 2.25 -Poorly compliant; 2.26- 3.0 – Moderately compliant; 3.01 – 3.49- Compliant; 3.5-4. Highly compliant

The distribution of clinical experience on patient radiation protection practices is presented in Table 10. Respondents with above 16 years of experience indicate high compliance, having an excellent mean of 4.0 in terms of "factor 6" (Ensure that the door is closed during radiography). Respondents from 4-8 years group were rated as "moderately compliant", being non-compliant on factors "2 (Establish a minimum duration for radiation exposure during imaging procedures such as fluoroscopy, interventional radiology, and endoscopy) and 6 (Ensure that the door is closed during radiography) " respectively.

CONCLUSION

The study reveals practices that need to be enhanced, particularly on some factors given in the three concepts. It is important to identify non-essential individuals, and never allow them inside the exposure rooms during procedures. Further, as one of the guidelines of NCRP, radiologic technologists are not allowed to hold any patient during radiation exposures. Patient and healthcare worker safety and the safety of the members of the public is always the top priority, it is imperative that healthcare facilities review and update their radiation protection policies. Implement quality assurance protocols to verify correct patient positioning and alignment before exposure. Regular training and ongoing education for radiographers can help improve positioning skills and reduce the likelihood of needing to crop images post-exposure. Protocols should be kept current with the most recent safety standards and guidelines; this lowers the possibility of unwarranted radiation exposure. To guarantee patient and healthcare worker safety, regulatory compliance, and the best possible imaging procedures in healthcare facilities, it is crucial that radiation protection protocols are reviewed and updated regularly.

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