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Assessment of Radiation Protection Knowledge Among Radiology Students

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ABSTRACT

Objective: This study aimed to assess the knowledge and awareness of radiation protection among radiology students from the 1st year up to the 4th year and beyond.
Methodology: An online questionnaire was distributed to radiology students, collecting responses on their understanding of radiation safety principles, use of protective measures, and adherence to safety protocols.
Findings: The findings of this study indicate that while many radiology students are aware of radiation protection concepts, there are still gaps in formal training and practical application. Although most students recognize fundamental principles such as ALARA, not all consistently use protective equipment like lead aprons and thyroid shields, which are essential for minimizing radiation exposure. Personal safety was identified as the primary motivation for adhering to radiation protection protocols, followed by patient safety and institutional guidelines. Additionally, a significant portion of the participants were early-year students, emphasizing the need for continuous radiation protection training throughout their academic journey to ensure long-term adherence to safety measures.
Conclusion: To improve radiation safety awareness, institutions should implement structured training programs, hands-on workshops, and regular assessments. Enhancing radiation protection education will help radiology students develop essential safety habits, ensuring a safer environment for healthcare professionals and patients.
Keywords: Radiation protection, radiology students, radiation

INTRODUCTION

Radiation is a form of energy that travels as waves or particles and can pass through objects and even the human body. There are two types of radiation: ionizing and non-ionizing. Ionizing radiation has high energy that can change molecules in body tissues, causing damage to DNA and genetic material. Computed tomography (CT) scans, which use X-rays, are the most common medical tests that rely on ionizing radiation. CT scans provide more detailed images than regular X-rays. In the United States, the use of CT scans has grown to 70 million per year since 1993[1]. International organizations like the International Commission on Radiological Protection (ICRP), the World Health Organization (WHO), and the International Atomic Energy Agency (IAEA), as well as guidelines from the European Commission

(EC), all agree that education and training in radiation protection are very important [2].
Radiation protection helps keep people safe from harmful effect of radiation without reducing its useful benefits. Different types of personal protective equipment (PPE), like aprons, thyroid shields, glasses, and gloves, have been created to protect workers from radiation during interventional radiology procedures. During fluoroscopy, everyone in the operating room must wear PPE unless they are behind a protective screen. Lead-based protective gear can block radiation as effectively as lead that is 0.25 to 1 mm thick. Most rules require at least 0.5mm of lead-equivalent thickness because it can block over 90% of scattered radiation [3]. However, studies have shown that while healthcare workers understand the dangers of radiation exposure, they do not know enough about radiation safety and protection practices. This is why ongoing education in radiation protection is necessary for healthcare workers.
This study aims to assess the levelofradiationprotectionknowledgeamongt hird-yearradiologystudents, identifying strengths and areas for improvement in their understanding of safety practices. By evaluating their awareness of radiation risks and protective measures, this research seeks to highlight the need for enhanced educational strategies that can better prepare future radiologists to practice safely and responsibly.

METHODOLOGY

Study Design:
This study utilizes a descriptive cross-sectional design to assess the level of radiation protection knowledge among radiology students at a specific point in time. This design was chosen for its effectiveness in providing a snapshot of the participants' understanding of radiation safety practices without the influence of time-related factors.

Study Population:
A total of 155 students participated in the study, providing a sufficient sample size to draw meaningful conclusions about their knowledge of radiation protection.

Inclusion and Exclusion Criteria:
The inclusion criteria for this study comprised radiology students from 1st year up to 4th year and above who provided informed consent to participate and had access to the internet to complete the online questionnaire. On the other hand, the exclusion criteria included students who did not consent to participate as well as those who submitted incomplete or inconsistent questionnaire responses.

Sampling Method:
A convenience sampling method was used to recruit participants. This approach was chosen for its practicality and ease of access to the target population, allowing the study to gather responses quickly from students who were willing and available to participate.

Data Collection Method:
Data were collected using a structured online questionnaire developed specifically for this study. The questionnaire consisted of multiple-choice and true-or-false questions designed to assess various aspects of radiation protection knowledge, including safety principles, protective measures, health risks, and guidelines recommended by international organizations.
To ensure the validity and clarity of the questionnaire, it was reviewed by experts in radiology and radiation protection before distribution. After incorporating their feedback, the questionnaire was forwarded online to the participants using a secure survey platform. Participation was voluntary and anonymous, with confidentiality of responses strictly maintained to encourage honest and accurate answers.

RESULTS

The survey included a total of 155 radiology students, with a majority of participants being female (58.1%) compared to male (41.9%) (Table no1). Regarding the year of

study, 1st and 2nd-year students each comprised 36.8% of the respondents, followed by 4th year and above (15.5%) and 3rd year (11.0%) (Table no 2). This distribution indicates a significant representation of early-year students in the study.

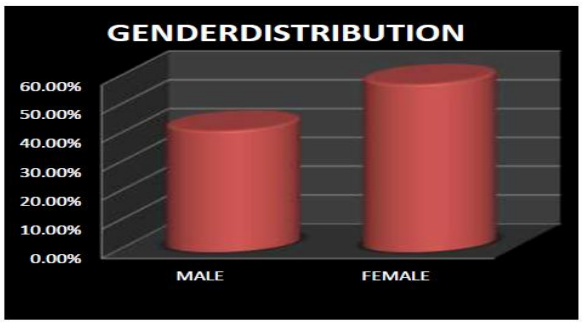
Training on radiation protection was reported by 52.3% of the students, while 47.7% had not received any formal training. This highlights a notable portion of students who lack structured education on radiation safety practices.

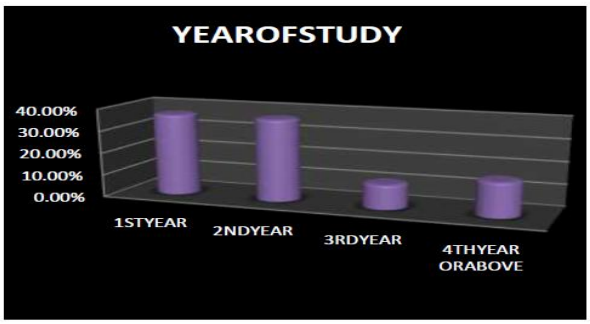
The understanding of radiation protection principles appeared strong, with 85.8% correctly identifying all key principles (Tableno3). Similarly, 90.8% of students knew that a dosimeter issued to monitor radiation exposure, and an overwhelming 98.1% understood the ALARA (As Low as Reasonably Achievable) principle (Table no 4).

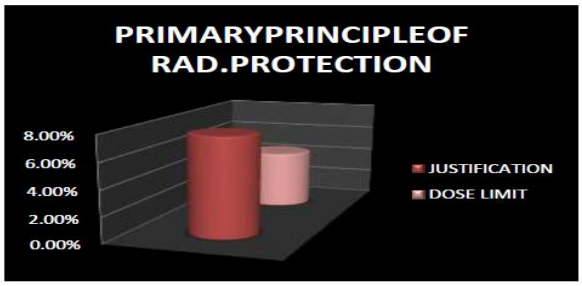
In terms of practical safety measures, 84.4% of respondents reported that they always use protective gear such as lead aprons and thyroid shields during procedures. However, 15.6% indicated less consistent use of protective measures, suggesting a need for reinforcing safety protocols (Table no 5).

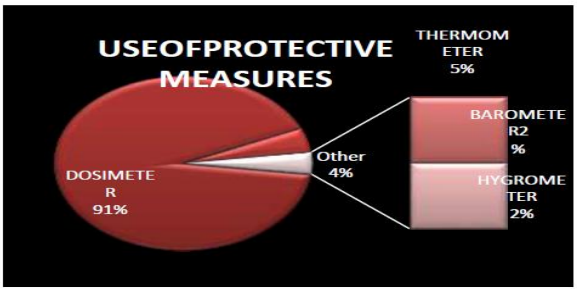
Motivation for adhering to radiation safety protocols was primarily driven by personal safety (59.2%), followed by patient safety (21.7%) and institutional rules (12.5%). A smaller fraction (6.6%) cited fear of penalties as a motivator, indicating that intrinsic factors like safety concerns play a more significant role (Table no 6).

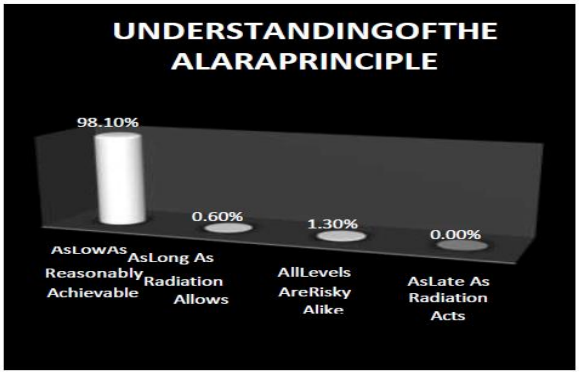
Overall, the results demonstrate a good understanding of radiation safety principles among radiology students but highlight the need for broader training coverage and improved consistency in the use of protective measures.











DISCUSSION

The findings of this study provide valuable insights into the level of radiation protection knowledge among radiology students from 1st year up to the 4th year and beyond. The results indicate that while most students have a fundamental understanding of radiation safety principles, there are notable gaps in formal training and adherence to protective measures.

One significant finding is that just over half of the participants (52.3%) reported receiving formal training in radiation protection. This suggests that while some students have been adequately educated on radiation safety, a considerable proportion still lacks structured exposures to these essential concepts. Given the risks associated with ionizing radiation, it is crucial to enhance radiation protection training as a part of the radiology curriculum to ensure all students are well-equipped with the necessary knowledge and skills.

The study also revealed that the ALARA (As Low as Reasonably Achievable) principle is well understood, with 98.1% of students recognizing its importance. This high level of awareness is promising as ALARA is the foundation of radiation protection. However, understanding the principle does not necessarily translate into consistent application. While 84.4% of students reported always using protective measures such as a lead aprons and thyroid shields, the remaining 15.6% demonstrated inconsistent use. This highlights the need for stronger reinforcement of safety protocols, possibly through practical workshops and stricter supervision during clinical training. Another key aspect examined in this study was the motivation behind compliance with radiation safety protocols. The institutional regulations (12.5%). Interestingly, only a small percentage (6.6%) were motivated by fear of penalties. This suggests that most students recognize the direct benefits of radiation protection rather than simply following rule out of obligation. Nevertheless, educational initiatives should emphasize both personal and patient safety to reinforcement a culture of responsibility.

The distribution of students across different academic years also provides insight into how radiation protection knowledge evolves with experience. The study found that 1st and 2nd year students each comprised 36.8% of respondents, with fewer participants from the later years. This indicated that a large portion of respondents were in the early stage of the training, which could influence the overall findings. It is essential for educators to ensure that students receive continuous radiation protection training throughout their academic journey rather than relying on early-year exposure alone. Overall, this study underscores the need for improved formal training, stricter adherence to safety measures, and continuous reinforcement of radiation protection principles among radiology students. Institutions should focus on integrating hands-on training, increasing awareness campaigns, and implementing regular assessments to ensure that students not only understand radiation safety but also apply it consistently in clinical practice. Future research could explore how knowledge and compliance change after implementing targeted educational interventions

CONCLUSION

The study assessed the knowledge of radiation protection among radiology students from the 1st year up to the 4th year and beyond. The finding indicates that while many students have a basic understanding of radiation safety, a significant number lack formal training, with only about half having attended structured courses. This highlights the need for improved education and training programs to ensure all students are well – prepared to handle radiation exposure safely. Most students demonstrated a good understanding of the ALARA principle, which is essential for minimizing radiation risks. However, knowledge alone is not enough consistent application of safety

measures, such as using protective equipment, remains a challenge.

The study also revealed that not all students regularly use protective gear like lead aprons and thyroid shields, despite their importance in reducing radiation exposure. Personal safety was found to be the primary motivation for following radiation protection protocols, followed by patient safety and institutional regulations. This suggests that while students recognize the risks of radiation exposure, more emphasis should be placed on reinforcing the importance of safety measures through awareness programs and strict enforcement of guidelines. Additionally, study showed that a large portion of the participants were early year students, emphasizing the need for continuous radiation protection training throughout their academic journey, not just in the initial years.

To enhance radiation safety awareness, radiology programs should incorporate more hands-on training, workshops, and regular assessments. By ensuring that students not only understand but also consistently apply radiation protection measures, institutions can help create a safer learning and working environment for future radiology professionals. Strengthening these efforts will contribute to better compliance with radiation safety protocols, ultimately benefiting both health care workers and patients.

Declaration by Authors

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