WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Attitude and Adherence to Radiation Safety Protocols among Radiologic Technologists in General Radiography: An Explanatory Sequential Design

Angelica R. Abis* Leonila P. Felizarte*

Faculty of Radiologic Technology Programt,Cor Jesu College, Inc., Digos City, Philippines

ABSTRACT:

This mixed-method explanatory sequential design study explored the experiences, challenges, and perspectives of Radiologic Technologists regarding radiation safety protocols. The study aimed to assess the attitudes, adherence, and the relationship between both toward radiation safety, along with the factors influencing these practices. The first phase utilized a quantitative approach to evaluate the level of attitude and adherence to safety protocols, including the use of protective equipment and compliance with safety practices. The second phase used qualitative data through in-depth interviews to explore issues raised in the quantitative phase. Results from the quantitative data showed that Radiologic Technologists generally had a high level of awareness and confidence in applying radiation safety protocols, with an average score of 4.77 for their attitudes and 4.65 for adherence. A significant positive correlation was found between attitude and adherence to radiation safety ($r = 0.62$, $R^2 = 0.386$), with adherence increasing by 0.771 for each unit increase in attitude ($p < 0.001$). Qualitative data showed that strong safety attitudes are driven by education and risk awareness but can be hindered by discomfort with protective gear, limited resources, and institutional challenges. These findings underscore the importance of fostering positive attitudes alongside addressing practical barriers to improve adherence. The study concludes that Radiologic Technologists exhibit a strong commitment to radiation safety, but additional training and institutional support are necessary to improve adherence. Recommendations include regular training, better ergonomic equipment, and fostering open communication to enhance safety practices.

Keywords: Radiation Protection, Radiation Safety, Explanatory Sequential Method; Davao Region

1. Introduction

Radiologic technologists and imaging professionals are pivotal in minimizing radiation exposure through strict adherence to safety protocols. However, multiple studies point to persistent gaps in compliance. Khamtuikrua and Suksompong (2020), Ingrassia (2020), and Frane and Bitterman (2023) noted that although protocols such as shielding and positioning are well-documented, their practical application is inconsistent. Christensen et al. (2024) emphasized how factors like patient discomfort, communication breakdowns, and non-user-friendly equipment obstruct the regular implementation of safety practices. Likewise, Goula et al. (2021) found that knowledge gaps and misconceptions—especially among younger or less experienced professionals—contribute to reduced compliance and heightened anxiety about radiation exposure.

Several global studies have highlighted similar concerns. Park et al. (2023) observed in South Korea that continuing education is often inadequate, leaving technologists ill-prepared. Singh and Sharma (2021) in India emphasized how poor access to lead aprons and shielding devices results in unsafe practices. In Brazil, de Andrade et al. (2023) identified a lack of standardized guidelines and training, causing confusion around dose limits and protective measures. Vano et al. (2022) conducted a global survey that found clinicians working outside radiology departments, such as in interventional cardiology and surgery, often have minimal formal training in radiation protection—putting them at higher risk. Moore (2022) further highlighted discrepancies in safety culture across imaging specialties, while Aldosimani (2020) noted gaps in education among dental students.

In the Philippine context, studies by Romallosa Dean et al. (2022) and Barizo and Bustillo (2021) revealed critical weaknesses in extremity and eye lens monitoring, and poor adherence to ICRP radiation dose limits, respectively. These studies underscore the need for systemic improvements in monitoring, education, and protocol implementation. However, while previous research has explored knowledge levels, exposure risks, and equipment adequacy, they largely rely on quantitative data and generalized assessments. Missing from the current literature is a deeper qualitative understanding of the lived experiences, daily challenges, and decision-making processes of radiologic technologists, especially in resource-constrained clinical settings.

Thus, there is a clear research gap in the integration of both measurable compliance data and in-depth, contextual insights into healthcare professionals' adherence to radiation safety practices. Prior studies (Christensen et al., 2024; Goula et al., 2021; Moore, 2022; Aldosimani, 2020; Romallosa Dean et al., 2022; Barizo & Bustillo, 2021) have not fully examined the intersection of knowledge, behavior, and environmental limitations. A mixed-methods approach is justified to comprehensively explore this issue—quantitative data can reveal patterns in adherence, while qualitative insights can unpack the

underlying factors influencing practice. This study, through a sequential explanatory design, aims to bridge this gap by examining the extent of protocol compliance and uncovering the real-world experiences of radiologic technologists. In doing so, it seeks to inform targeted interventions and policy recommendations that will enhance both patient and worker safety in the medical imaging field.

Research Questions

1. What is the level of attitude to radiation safety protocols among the Radiologic Technologists, in terms of the following:
    1.1 importance of radiation safety;
    1.2 confidence in applying radiation safety protocols?
2. What is the level of adherence to radiation safety protocols among the Radiologic Technologists, in terms of the following:
    2.1 use of protective equipment;
    2.2 compliance with radiation safety practices?
3. Is there a significant relationship between Radiologic Technologists' attitude and adherence to radiation safety?
4. Does the level of attitude significantly influence the level of adherence to radiation safety among the Radiologic Technologists?
5. What are the standpoints of the participants as regarding the issues from quantitative data that need clarification, specifically on the following issues:
    5.1 the level of attitude to radiation safety protocols?
    5.2 level of adherence to radiation safety protocols?
    5.3 the strength of the relationship between level of attitude and level of adherence to radiation safety protocols?
    5.4 the significance of the influence of the level of attitude towards the level of adherence to radiation safety protocols?

2. Methods

This study utilized a mixed methods approach, specifically the Explanatory Sequential Mixed Methods Design (Creswell & Clark, 2017). Mixed methods research was a systematic methodology that integrated both quantitative and qualitative data within a single study, allowing for a comprehensive investigation of the research problem. This approach collected and analyzed both types of data and integrated them during data collection, analysis, or interpretation phases, thereby enriching the findings and providing a multifaceted understanding (Wisdom & Creswell, 2013).

Starting with an initial phase of quantitative data collection and analysis, the Explanatory Sequential Design in this research entered a qualitative phase targeted at more closely analyzing and understanding the quantitative findings (Creswell, 2003). By use of systematic surveys, the quantitative component evaluated Radiologic Technologists' degrees of attitudes and adherence to radiation safety standards, therefore offering a comprehensive picture of their practices and behaviors. Using in-depth interviews to provide more nuanced understanding of the elements driving their adherence to safety criteria, the qualitative phase then explored their lived experiences, problems, and viewpoints on radiation safety. Together with the contextual elements influencing radiation safety compliance, this mixed methods approach enabled a thorough grasp of the interaction among attitudes, knowledge, and behaviors. Combining both stages helped the research not only measure the degree of adherence but also offer a rich narrative to justify the quantitative results in the particular framework of Radiologic Technologists' everyday operations.

Evaluating construct validity in the quantitative phase helped to guarantee that the measuring instrument fairly assessed the desired constructions—such as knowledge, attitudes, and adherence to safety procedures. To guarantee the dependability of the measuring instrument, construct validity comprised content, convergent, and criterion validity among other tests (Messick, 1989; Wainer & Braun, 1988). Furthermore, included in this phase was correlation analysis to look at linkages between variables like knowledge levels and adherence to safety procedures, therefore clarifying the present situation and links among these variables (Shuttleworth, 2008).

Aimed at characterizing the lived experiences of Radiologic Technologists in relation to radiation safety procedures, the qualitative phase used a generic qualitative design. This approach was appropriate as it focused on exploring the participants' perspectives and experiences without committing to a specific qualitative methodology like phenomenology. Data were collected through in-depth interviews (IDIs), allowing 15 participants to share their experiences and challenges in adhering to safety procedures. The responses were analyzed using content analysis to identify key themes reflecting their opinions, difficulties, and potential needs related to radiation safety (Wilkinson, 2004).

An Explanatory Sequential Mixed Methods Design offered a methodical approach: first quantitative data were gathered, then qualitative data built on the first results. This helped the researcher to understand from both statistical and experiential angles the adherence of Radiologic Technologists to safety procedures, therefore guiding focused training programs to improve safety practices.

3. Results and Discussions

1. What is the level of attitude to radiation safety protocols among the Radiologic Technologists, in terms of the following:

1.1 importance of radiation safety;
1.2 confidence in applying radiation safety protocols?

Attitude to Radiation Safety Protocols among the Radiologic Technologist

Table 1
Level of Attitude to Radiation Safety Protocols among the Radiologic Technologist

Indicators	Mean	SD	Interpretation
Importance of Radiation Safety			
1. Radiation safety is essential for patient care.	4.95	0.22	Very High
2. Adhering to radiation safety protocols protects me from harmful exposure.	4.98	0.16	Very High
3. My role as a Radiologic Technologist involves strict compliance with safety standards.	4.93	0.27	Very High
4. Radiation safety is a shared responsibility among healthcare professionals.	4.85	0.42	Very High
5. Radiation exposure risks can be minimized with proper adherence to protocols.	4.86	0.38	Very High
Category Mean	**4.91**	**0.21**	**Very High**
Confidence in Applying Radiation Safety Protocols			
6. I am well-trained in radiation safety procedures.	4.61	0.56	Very High
7. I believe I can consistently apply radiation safety measures effectively.	4.64	0.56	Very High
Category Mean	**4.63**	**0.51**	**Very High**
Overall Mean	**4.77**	**0.31**	**Very High**

Legend: 4.20–5.00 = Very High; 3.40–4.19 = High; 2.60–3.39 = Moderate; 1.80–2.59 = Low; 1.00–1.79 = Very Low

With an overall mean of 4.77 and a standard deviation of 0.31, the results show that radiologic technologists have a rather high degree of favorable attitude toward radiation safety procedures. Every single item—especially comments on the need of radiation safety—scored very high: "Adhering to radiation safety protocols protects me from harmful exposure" (M = 4.98, SD = 0.16). This implies that the responders really understand the great importance of safety for their work obligations. Reflecting respondents not only appreciate safety but also feel sufficiently trained and confident in using protocols in their everyday practice, the subcategory on confidence in using safety procedures also produced a very high mean (4.63).

The high attitude ratings suggest that Radiologic Technologists have a good culture of safety awareness, which could help to reduce radiation-related hazards and promote compliance. This degree of dedication will help to maintain and improve radiation safety initiatives in medical facilities. The findings also suggest that rather than building awareness from nothing, training programs should concentrate on strengthening current behaviors and handling situational problems. Furthermore, such results underline the need of institutional support and ongoing professional growth in preserving these high degrees of safety-conscious attitudes.

The findings of this study emphasize the importance of attitudinal components in ensuring radiation safety in the medical environments. In radiologic technology, where practitioners frequently encounter ionizing radiation, worker and patient well-being rely mostly on a strong and favorable attitude toward safety. The results demonstrate that radiologic technologists not only grasp the risks but also are quite committed to lower them by using policies. This attitudinal fortitude helps to build a safer healthcare system and supports the significant role radiologic experts perform in multidisciplinary safety campaigns.

These results line up with body of research already in print that emphasizes the relationship between better safety compliance and positive sentiments. For instance, the study by Jafri et al. (2022) found that radiologic technologists with higher attitude scores were conspicuously more compliant with radiation protection guidelines. Likewise, knowledge about and attitudes toward radiation safety favorably affected Fiagbedzi et al. (2022) continuous lead aprons and dosimeter use. These results demonstrate that having a strong safety-oriented mindset forms the basis of radiation protection policies in many different healthcare settings.

2. What is the level of adherence to radiation safety protocols among the Radiologic Technologists, in terms of the following:

2.1 use of protective equipment;

2.2 compliance with radiation safety practices?

Adherence to Radiation Safety Protocols among the Radiologic Technologist

Table 2
Level of Adherence to Radiation Safety Protocols among the Radiologic Technologist

Indicators	Mean	SD	Interpretation
Use of Protective Equipment			
1. I consistently wear protective gear (e.g., lead apron, gloves) during radiologic procedures.	4.38	0.68	Very High
2. I ensure that patients are properly shielded during exposure.	4.60	0.69	Very High
3. I check for the availability of radiation safety tools before every procedure.	4.61	0.65	Very High
4. I report damaged or malfunctioning protective equipment immediately.	4.76	0.48	Very High
5. I verify proper placement of barriers to minimize scatter radiation.	4.75	0.52	Very High
Category Mean	**4.62**	**0.46**	**Very High**
Compliance with Radiation Safety Practices			
6. I follow the ALARA (As Low As Reasonably Achievable) principle during procedures.	4.88	0.33	Very High
7. I adhere to the proper distance and positioning during radiographic procedures.	4.88	0.33	Very High
8. I participate in regular training or refresher courses on radiation safety.	4.26	0.94	Very High

Category Mean	**4.67**	**0.43**	**Very High**
Overall Mean	**4.65**	**0.39**	**Very High**

Legend: 4.20–5.00 = Very High; 3.40–4.19 = High; 2.60–3.39 = Moderate; 1.80–2.59 = Low; 1.00–1.79 = Very Low

Particularly in the areas of utilizing protective equipment (M=4.62, SD=0.46) and following safety practices (M=4.67, SD=0.43), the data reveals that radiologic technologists demonstrate a rather high degree of commitment to radiation safety regulations. High individual item indicates show consistent and responsible conduct, including wearing lead aprons and guaranteeing patient shielding, as well as following correct distance and the ALARA concept. Especially, the item on reporting defective protective gear got a high mean (M=4.76), indicating proactive safety consciousness. Through more regular or easily available refresher courses, the somewhat reduced but still robust mean in training participation (M=4.26) points to a possible area for development. The results show generally a good safety culture among the responders.

These results suggest that radiologic technologists usually follow institutional safety guidelines and are aware of their professional obligation in reducing radiation hazards. The very low rating on training participation, however, indicates that even if compliance is strong, sustaining long-term commitment may depend on the availability and regularity of organized learning possibilities. Facilities may consider institutionalizing frequent safety assessments and necessary training courses to promote best practices and inform staff on changing criteria and technology.

The rather high degrees of adherence observed emphasize the crucial role radiologic technologists play in ensuring practitioner and patient safety in medical imaging facilities. Their daily behaviors directly influence the efficacy and moral direction of diagnostic procedures. Using protective gear regularly and following concepts like ALARA help to lower workplace exposure risks. Strengthening these practices by means of policy support and continuous education would help to raise public confidence in radiological services and hence enhance the safety culture in radiologic departments.

Studies validated by peer-reviewed publications validate these findings. Particularly in respect to the usage of protective gear and retaining appropriate distances during exposure, Elzaki et al. (2025) stated that Saudi Arabia's Radiologic Technologists displayed remarkable degrees of adherence to radiation safety standards. Similarly, investigations by Wadood et al. (2025) shown that continuous education and safety training greatly improved the adherence to radiation protection policies by technologists. These parallels show the need of maintaining rigorous safety criteria and the need of ongoing professional development in radiography departments.

3. Is there a significant relationship between Radiologic Technologists' attitude and adherence to radiation safety?
Relationship between Radiologic Technologists' Attitude and Adherence to Radiation Safety

Table 3
Significance of the Relationship between Radiologic Technologists' Attitude and Adherence to Radiation Safety

Paired Variables	Pearson r	Description	Significance
Attitude and Adherence	0.62	high positive correlation	significant at $p < .05$

The Pearson correlation of 0.62 alludes to a significant positive association wherein radiologic technologists with a more favorable attitude toward radiation safety are more likely to closely follow safety recommendations. This strong association with a p value of 0.05 confirms that attitude greatly influences professional conduct in clinical practice. Emphasizing the requirement of building positive attitudes in training and practice, the attitude toward radiation safety rises together with the adherence to safety protocols.

The fact that attitude significantly influences adherence to safety measures highlights the need of targeted interventions aimed to modify radiologic technologists' attitudes toward radiation safety. Planned to enable the professionals to better respect and understanding of radiation safety, programs for education, mentorship, and continuous professional development serve to increase their adherence to highest standards. Changing the perspective of radiation safety as a shared responsibility might lead to better outcomes for staff members and patients, therefore reducing the exposure risks in medical settings (Sheu et al., 2014).

This study highlights the significance of treating not only the technical skills but also the attitudes of radiologic technologists on radiation safety. In clinical environments where frequent radiation exposure is a component of the procedure, encouragement of appropriate attitudes toward radiation safety is quite necessary. Improved attitudes seem to aid to increase adherence to standards, therefore promoting safer practices, reduced exposure risks, and improved quality of treatment. To maximize the efficacy of safety measures, radiologic technology programs and hospitals should give attitude-driven training great importance.

4. Does the level of attitude significantly influence the level of adherence to radiation safety among the Radiologic Technologists?

Influence of Attitude towards Adherence to Radiation Safety among Radiologic Technologists

Table 4

The Test of Prediction of Attitude on the Level of Adherence to Radiation Safety.

ADH	Observed Estimate	Bootstrap SE	Z	P-value	Decision	Remarks
Mean						
ADH	4.641	0.043	108.350	0.000		
Effect						
ATT	0.771	0.093	8.330	0.000	Reject H_{02}	Significant

Note: Significant if p-value <.05; R^2= 0.4394; IV- Attitude to Radiation Safety Protocols (ATT); DV- Adherence to Radiation Safety Protocols (ADH)

Table 4 revealed that the level of attitude significantly predicted the adherence to radiation safety protocols (OE=0.771, p=.000). This implies that for every unit increase in the level of attitude to safety protocols, the level of attitude increases by 0.771. Moreover, the findings were apparent in the results of nonparametric regression analysis in which 43.94% of the variance of the level of adherence can be explained by level of attitude on radiation safety protocols as indicated by an r-square of 0.4394. This would mean that 56.06% of the variation can be attributed to other factors aside from the level of attitude on radiation safety protocols.

The results highlight how much adherence to radiation safety procedures may rise if radiologic technologists adopt better attitudes regarding these procedures. Training and educational initiatives meant to promote a strong safety culture help one to do this. Targeted treatments to improve attitudes, like seminars, role-modeling, and motivating campaigns, might be rather successful as attitude explains 38.6% of the variance in adherence. Attitude-oriented approaches allow hospitals and educational institutions to enhance radiation safety protocols and lower possible hazards in therapeutic settings.

The link between attitude and adherence reveals a crucial component of Radiologic Technology practice: attitude is a major determinant of adherence to safety standards. Since radiation exposure presents serious health risks, radiologic technologists have strict standards of safety adherence to follow. This study suggests that professionals' attitude can directly raise their adherence to radiation safety recommendations, therefore encouraging safer practices for patients and staff members at the hospital. It also implies that professional development in the industry should incorporate approaches aimed at both knowledge and attitude to optimize effects on safety.

This outcome is in line with previous research demonstrating a close relationship between a good attitude toward radiation safety and better adherence to safety protocols. Abuzaid et al.'s (2019) study found that radiologists with strong safety attitudes were more likely to follow radiation protection protocols. Umaru et al. (2024) also found in radiology departments that programs meant to change attitudes helped to raise adherence to safety protocols. These studies support the present findings that attitude significantly affects adherence to radiation safety policies (Abuzaid et al., 2019; Umaro et al., 2024).

5. What are the standpoints of the participants as regarding the issues from quantitative data that need clarification, specifically on the following issues:

5.1 the level of attitude to radiation safety protocols?
5.2 level of adherence to radiation safety protocols?
5.3 the strength of the relationship between level of attitude and level of adherence to radiation safety protocols?
5.4 the significance of the influence of the level of attitude towards the level of adherence to radiation safety protocols?

Table 5

Standpoints of Participants on the Issues Regarding the Level of Attitude to Radiation Safety Protocols

SUBJECTS PROBED	CORE IDEAS	CODES / CATEGORIES	ESSENTIAL THEMES
5.1 Level of Attitude to Radiation Safety Protocols	- "Radtechs have generally high level of attitude kasi it is something what you believe... it was already taught to us..." (SPARROW) - "Kabalo gyud ta... radiation serious siya... delayed effects." (Wolf) - "Since radtech man, mau na ang ilang gi eskwelahan... radiation safety protocol." (Eagle) - "Dealing with radiation importante na maging aware or safety first for the patient..." (Noah)	Knowledge from education and training Awareness of radiation risks (immediate and long-term) Internalized professional beliefs Patient and self-safety prioritization Professional embodiment and responsibility	**High Attitude Rooted in Education, Risk Awareness, and Professional Commitment**
5.2 Level of Adherence to Radiation Safety Protocols	- "It's because it is known... radiation can cause biological damage... it is our responsibility." (SPARROW) - "Usually ang protective equipment... naay mga factors	Awareness of biological risks and responsibility Practical challenges and resource constraints	**Adherence Driven by Risk Awareness, Professional Duty, and Practical Realities**

	na guba, kulang, dili available..." (Wolf) - "Ginasunod gyud ang standard procedure... para dili ta maka-harm sa atong patient." (Eagle) - "Mas gi-apply nila ang distancing kaysa magamit protective equipment kay bug-at ug hassle." (Noah)	Compliance through core principles (ALARA, distancing) Equipment usability and physical burden Use of alternative protective strategies	
5.3 Strength of Relationship Between Attitude and Adherence	- "Taas ang level of attitude, taas pud ang level of adherence... if you follow the procedure, you automatically adhere." (SPARROW) - "Kung taas imong attitude, maapektuhan gyud na imong adherence..." (Wolf) - "Attitude and adherence is directly proportional... dapat magkasabay." (Shark) - "Yes they are true... awareness correlates with adherence." (Noah) - "If taas imong level of attitude, mutaas pud ang level of adherence." (Eagle)	Direct positive correlation between attitude and adherence Attitude as motivator for adherence Alignment and mutual reinforcement of attitude and behavior Responsibility for patient safety drives adherence	**Strong Positive Correlation: High Attitude Enhances Adherence**
5.4 Significance of Influence of Attitude on Adherence	- "Having the attitude... it's a direct effect." (SPARROW) - "If mag show ka og patient care ... automatic na mo follow gyud ka or mo adhere sa protocol." (Wolf) - "Kung taas imong attitude, confident ka nga magfollow sa protocol... patient trust." (Shark) - "Kung taas imong attitude, mag gamit og shielding, then high adherence pud." (Noah) - "Adherence protects patient from harmful exposure." (Eagle)	Attitude as determinant and motivator for adherence Patient care and safety as key drivers Professional responsibility and trust-building Protective effect of adherence on patients	**Attitude Significantly Influences Adherence, Improving Patient Safety and Trust**
Reasons for Lower Training Attendance in Radiation Safety	- "Not all hospitals sponsor seminars... salary of radtechs here is low..." (SPARROW) - "Married ko, working two jobs ... limited schedule ... hospital wala kaayoy training." (Wolf) - "Wala kayo training kay availability pud sa mga trainings, finances, ug lugar nga lagyo." (Noah) - "Interest... dili tanan interesado." (Eagle)	Financial constraints and lack of institutional support Personal time and scheduling conflicts Accessibility and cost issues Low interest/motivation in some participants	**Financial, Institutional, and Personal Barriers Limit Training Participation**
Other Factors Affecting Adherence Beyond Attitude	- "Availability of protective gears... we don't have thyroid shields..." (SPARROW) - "Sometimes Radtechs are complacent because the protective equipment is heavy to wear." (SPARROW) - "Mas taas og compliance kaysa sa paggamit og protective equipment kay hassle man." (Noah) - "Para less hassle... para mapadali ang trabaho." (Eagle)	Resource availability and institutional support Physical discomfort and equipment burden Complacency and preference for convenience Workload and time pressure	**Resource Constraints, Physical Barriers, and Workload Influence Adherence Beyond Attitude**

The thematic analysis of the qualitative data reveals several important insights that are very similar to and add to the quantitative findings of the study on radiologic technologists' (radtechs') attitudes toward radiation safety and their adherence to safety guidelines. Both data sets agree that a strong attitude toward radiation safety protocols comes from formal education, professional knowledge, and a deep understanding of the risks that radiation exposure poses to radtechs, patients, and their families. This strong internalization of safety values helps create a professional identity that puts patient care and personal safety first. The quantitative results also showed this through statistically significant positive correlations between attitude scores and adherence levels.

The qualitative results also show that following radiation safety rules is not only based on knowledge and a positive attitude, but also on a strong sense of professional responsibility and awareness of risk. Radtechs said that their adherence is based on an ethical duty to protect patients and minimize harm. This is in line with the quantitative trend that shows that higher attitude levels lead to stronger adherence behaviors. However, both data sources also admit that there are practical barriers to full compliance, such as the discomfort of wearing heavy protective gear, limited resources like the lack of thyroid shields, and institutional limitations like not having enough training opportunities because of money or logistical issues. These factors make it less likely that positive attitudes will lead to perfect adherence, which points to areas where policies and organizations could be better.

The qualitative data also show how important attitude is for adherence. A positive attitude not only encourages compliance, but it also boosts confidence and makes following safety rules a habit. This qualitative insight backs up the quantitative results that attitude is a major factor in adherence. It also supports the idea that building a strong safety culture and providing ongoing education can help with protocol implementation. Patient-centered care and

professional accountability were also important reasons for adherence, which suggests that interventions that focus on these areas may be especially helpful.

To sum up, the qualitative thematic analysis adds to and expands on the quantitative findings by showing how education, professional identity, and perceived risks shape safety attitudes, which in turn have a big effect on following radiation safety rules. It also shows that there are practical and institutional barriers that can make it hard to follow the rules even when people have positive attitudes. This means that making resources and training more available is important for maintaining and improving safety compliance. This understanding means that a multi-pronged approach that includes education, organizational support, and resource provision is needed to improve radiation safety practices among radtechs.

The integrated findings of this study align closely with existing research on radiologic technologists' attitudes and adherence to radiation safety protocols. For example, Moore (2021) emphasizes the critical role of organizational factors such as leadership and collaboration in shaping a safety culture, which complements the present study's finding that professional identity and formal education strongly influence safety attitudes. The recognition that attitude is rooted in knowledge and professional responsibility echoes Yashima and Chida's (2022) conclusions regarding the necessity of focused training to close knowledge gaps and reinforce safety practices.

Moreover, the practical barriers to full compliance identified here—such as discomfort from protective gear and limited resources—are consistent with Lewis, Downing, and Hayre's (2021) qualitative work, which highlights how workload pressures and lack of resources undermine adherence despite good theoretical knowledge. Similarly, Fiagbedzi et al. (2022) report that while knowledge and awareness are generally high, actual use of safety measures like dosimeters is inconsistent, further supporting the notion that positive attitudes alone are insufficient without adequate institutional support.

The ethical sense of professional responsibility and patient-centered care described by the radtechs in this study aligns with Frane and Bitterman's (2020) emphasis on radiation shielding and protective behavior as a moral imperative to minimize harm. The documented need for ongoing education and organizational reinforcement corresponds with Behzadmehr et al.'s (2020) systematic review that advocates continuous training to improve healthcare professionals' radiation protection practices.

Finally, this study's identification of both attitudinal factors and systemic barriers underscores the call by Dudhe et al. (2024) and Vassileva and Holmberg (2021) for a multi-faceted approach—combining education, leadership engagement, resource availability, and policy support—to enhance radiation safety culture and practice.

6. Conclusions

Based on the study's findings, the following conclusions were drawn:

Radiologic technologists often exhibit a solid grasp of and positive attitude toward radiation safety precautions, having considerable confidence in implementing these approaches. This reveals their awareness of the requirement of safety in lowering exposure risks and protecting patients and doctors.

Radiologic technologists are quite dedicated to radiation safety standards as they always use appropriate shielding and protective equipment throughout radiography procedures. Still, the need of greater education to raise their devotion indicates an ongoing focus on education and practical understanding in radiation safety.

Radiologic technologists' attitudes toward radiation safety and adherence to safety protocols reveal a somewhat positive correlation. This outcome indicates that a favorable attitude toward safety precautions much helps to guarantee their continuous usage during radiologic procedures.

The study conclusively demonstrates that a positive attitude toward radiation safety protocols significantly influences radiologic technologists' adherence to these protocols. Attitude accounts for a substantial portion of adherence behavior, highlighting the importance of cultivating and maintaining positive safety attitudes to improve compliance and protect both healthcare workers and patients.

The qualitative analysis concludes that radiologic technologists' adherence to radiation safety is strongly driven by their professional identity, education, and risk awareness. However, practical and institutional barriers can limit full compliance despite positive attitudes. Addressing these challenges through better resources, training, and organizational support is essential to enhance adherence and promote a sustainable culture of safety.

7. Recommendations

1. Radiologic technologists should engage in regular, comprehensive training courses encompassing both the theoretical and practical elements of radiation safety to enhance their positive attitude and devotion to radiation safety even further. By means of seminars or peer learning groups, encouragement of a culture of continuous self-awareness may also enable individuals to remain vigilant in following safety protocols. Giving prizes for demonstrating conformance to these criteria could also motivate researchers to always give safety top priority.
2. Emphasizing on raising knowledge of radiation safety and ensuring that protective gear is both effective and comfortable, hospital administrators should spend in offering radiologic technologists more conveniently available and regular training opportunities. Reviewing hospital policies also helps to streamline radiation safety protocols and address problems technologists come into such financial constraints

for training and discomfort with safety equipment. Moreover, managers should foster open communication where suggestions of technologists are actively sought for and incorporated into improved workplace safety procedures.

3. Greater effective communication of these practices should be provided to patients; so, greater radiation safety procedures aid them. In hospitals and clinics, transparency should be given first importance so that patients are aware of the steps taken to reduce exposure during diagnosis and treatment operations. This increases patient confidence in the healthcare system and helps to provide a safer environment. Encouragement of patients to actively seek about radiation safety practices could also help to motivate increased medical professional accountability.
4. The findings of this study should be applied by radiation safety authorities to enhance current safety protocols by integrating the helpful suggestions of technologists. While focusing on the challenges encountered, such inadequate training or the physical discomfort of safety gear, they are advised to push for solutions including improved equipment or specialized training programs. The study suggests the necessity of a more tailored approach to safety standards considering the different training degrees and institutional norms among different healthcare contexts. Furthermore included should be feedback loops and frequent audits to ensure continuous improvement in radiation safety measures.

REFERENCES:

1. Abuzaid, M. M., Elshami, W., Shawki, M., & Salama, D. (2019). Assessment of compliance to radiation safety and protection at the radiology department. *International Journal of Radiation Research*, *17*(3), 439-446.
2. ALDOSIMANI, M. A. (2020). AWARENESS, ATTITUDE, AND BEHAVIOR OF SAUDI DENTAL STUDENTS TOWARDS RADIATION SAFETY AND PROTECTION. International Journal of Medical Dentistry, 24(4). https://web.s.ebscohost.com/abstract?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=20666063&AN=148821208&h=p5B2SwEDBZMxeFwwyi3%2f1mFgXxk9KoKV0DG%2bzeafYWSr50CJnSkQ%2byKZEAC%2f5dlfSv%2bX66RmmNqG9DTqTraicA%3d%3d&crl=c&resultNs=AdminWebAuth&resultLocal=ErrCrlNotAuth&crlhashurl=login.aspx%3fdirect%3dtrue%26profile%3dehost%26scope%3dsite%26authtype%3dcrawler%26jrnl%3d20666063%26AN%3d148821208
3. Behzadmehr, R., Doostkami, M., Sarchahi, Z., Dinparast Saleh, L., & Behzadmehr, R. (2021). Radiation protection among health care workers: knowledge, attitude, practice, and clinical recommendations: a systematic review. *Reviews on environmental health*, *36*(2), 223-234. https://www.degruyter.com/document/doi/10.1515/reveh-2020-0063/html
4. Boyd, B. L. (2013). *Using the theory of planned behavior as a predictor of radiologic technologists' use of patient radiation protection best practices: a regional study*. Andrews University.
5. Chau, M. (2024). Enhancing safety culture in radiology: Key practices and recommendations for sustainable excellence. *Radiography*, *30*, 9-16.
6. Christensen, B. M., Bjällmark, A., Ndipen, I. M., Afram, S. S., & Bazzi, M. (2024). Barriers to radiographers' use of radiation safety principles: A qualitative perspective. *Journal of Medical Radiation Sciences*. https://onlinelibrary.wiley.com/doi/full/10.1002/jmrs.750
7. Dudhe, S. S., Mishra, G., Parihar, P., Nimodia, D., & Kumari, A. (2024). Radiation dose optimization in radiology: a comprehensive review of safeguarding patients and preserving image fidelity. *Cureus*, *16*(5), e60846. https://pmc.ncbi.nlm.nih.gov/articles/PMC11191847/
8. Elzaki, M., Osailan, R., Almehmadi, R., Zulaibani, A., Kamal, E., Gareeballah, A., ... & Khandaker, M. U. (2025). Knowledge and comprehension of radiation protection among radiography professionals and interns in western Saudi Arabia. *Journal of Radiation Research and Applied Sciences*, *18*(1), 101243.
9. Farzanegan, Z., Tahmasbi, M., Cheki, M., Yousefvand, F., & Rajabi, M. (2020). Evaluating the principles of radiation protection in diagnostic radiologic examinations: collimation, exposure factors and use of protective equipment for the patients and their companions. *Journal of medical radiation sciences*, *67*(2), 119-127. https://onlinelibrary.wiley.com/doi/full/10.1002/jmrs.384
10. Fiagbedzi, E., Gorleku, P. N., Nyarko, S., Asare, A., & Ndede, G. A. (2022). Assessment of radiation protection knowledge and practices among radiographers in the central region of Ghana. *Radiation Medicine and Protection*, *3*(03), 146-151. https://mednexus.org/doi/full/10.1016/j.radmp.2022.06.001
11. Frane, N., & Bitterman, A. (2020). Radiation safety and protection. https://europepmc.org/article/nbk/nbk557499
12. Goula, A., Chatzis, A., Stamouli, M. A., Kelesi, M., Kaba, E., & Brilakis, E. (2021). Assessment of health professionals' attitudes on radiation protection measures. *International journal of environmental research and public health*, *18*(24), 13380. https://www.mdpi.com/1660-4601/18/24/13380
13. Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, *18*(1), 59-82.
14. Haynes, K. W. (2020). The importance of professional values from radiologic technologists' perspective. *Radiologic Technology*, *91*(6), 525-532. http://www.radiologictechnology.org/content/91/6/525.short
15. Jafri, M. A., Farrukh, S., Zafar, R., & Ilyas, N. (2022). A survey on radiation protection awareness at various hospitals in Karachi, Pakistan. *Heliyon*, *8*(11).
16. Lewis, S., Downing, C., & Hayre, C. M. (2022). South African radiographers' radiation protection practices, a qualitative study. *Radiography*, *28*(2), 387-393. https://www.sciencedirect.com/science/article/pii/S1078817421002054
17. Lewis, S., Downing, C., & Hayre, C. M. (2022). Using the theory of planned behaviour to determine radiation protection among South African diagnostic radiographers: a cross-sectional survey. *Journal of Medical Radiation Sciences*, *69*(1), 47-55. https://onlinelibrary.wiley.com/doi/full/10.1002/jmrs.537

18. Moore, Q. T. (2020). *Radiation Actions and Dimensions of Radiation Safety among US Radiologic Technologists* (Doctoral dissertation, Northern Illinois University).

19. Moore, Q. T. (2021). Determinants of overall perception of radiation safety among radiologic technologists. *Radiologic Technology*, *93*(1), 8-24. http://www.radiologictechnology.org/content/93/1/8.short

20. Moore, Q. T. (2021). Validity and reliability of a radiation safety culture survey instrument for radiologic technologists. *Radiologic Technology*, *92*(6), 547-560. http://www.radiologictechnology.org/content/92/6/547.short

21. Moore, Q. T. (2023). Perceptions of Radiation Safety Culture Among Radiography, Computed Tomography, And Mammography Technologists. *Radiologic Technology*, *95*(1), 17-25. http://www.radiologictechnology.org/content/95/1/17.short

22. Moore, Q. T., & Haynes, K. W. (2023). Perceptions of Radiation Safety Culture in Medical Imaging by Role. *Radiologic Technology*, *94*(5), 337-347. http://www.radiologictechnology.org/content/94/5/337.short

23. Moore, Q. T., Walker, D. A., Frush, D. P., Daniel, M., & Pavkov, T. W. (2022). Intrapersonal and institutional influences on overall perception of radiation safety among radiologic technologists. *Radiologic Technology*, *93*(3), 255-267. http://www.radiologictechnology.org/content/93/3/255.short

24. O'Rourke, M., Moore, N., Young, R., Svetlic, S., Bucknall, H., McEntee, M. F., ... & England, A. (2024). An investigation into the knowledge, attitudes, and practice of radiation protection in interventional radiology and cardiac catheter-laboratories. *Journal of Medical Imaging and Radiation Sciences*, *55*(3), 101440. https://www.sciencedirect.com/science/article/pii/S1939865424001668

25. Patton, M. Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice* (4th ed.). Sage Publications.

26. Sarman, I., Hassan, D. H., & Sarman, I. (2016). Factors affecting radiographers' compliance with radiation protection on all areas of hospital settings worldwide-a meta-analysis. *International Journal for Innovative Research in Science & Technology*, *3*(4), 433-8.

27. Umaru, B., Yusuf, S. D., Idris, M. M., & Hambali, S. U. (2024). Assessment of Attitude, Behaviours and Knowledge of Health and Medical Staff on Radiation Safety Awareness and Protection Compliance: A Case Study of Two Hospitals in Maiduguri, Nigeria. *African Journal of Advances in Science and Technology Research*, *15*(1), 36-45.

28. Vassileva, J., & Holmberg, O. (2021). Radiation protection perspective to recurrent medical imaging: what is known and what more is needed?. *The British Journal of Radiology*, *94*(1126), 20210477. https://academic.oup.com/bjr/article/94/1126/20210477/7477315

29. Wadood, A., Salam, A., Malik, A., Khan, M., Ashraf, S., Ehsan, H., & Ahmadi, M. (2025). Knowledge and awareness of radiation hazards and protection among radiology staff: a multicenter questionnaire study. *Chinese Journal of Academic Radiology*, 1-9.

30. Yashima, S., & Chida, K. (2022). Awareness of medical radiologic technologists of ionizing radiation and radiation protection. *International Journal of Environmental Research and Public Health*, *20*(1), 497. https://www.mdpi.com/1660-4601/20/1/497

31. Yurt, A., Ayrancıoğlu, C., Kılınç, G., & Ergönül, E. (2022). Knowledge, attitude, and behavior of Turkish dentists about radiation protection and radiation safety. *Dentomaxillofacial Radiology*, *51*(1), 20210120. https://academic.oup.com/dmfr/article/51/1/20210120/7261212