International Journal of Education Humanities and Social Science

ISSN: 2582-0745
Vol. 8, No. 02; 2025

KNOWLEDGE, ATTITUDE, AND PRACTICES OF RADIOLOGIC TECHNOLOGISTS ON RADIATION PROTECTION AND THEIR IMPACT ON PATIENT CARE IN SELECTED MILITARY HOSPITALS IN THE NATIONAL CAPITAL REGION

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https://doi.org/10.54922/IJEHSS.2025.0951

ABSTRACT

This study explores the knowledge, attitudes, and practices (KAP) of radiologic technologists regarding radiation protection and how these factors influence patient care in selected military hospitals within the National Capital Region. Given the health risks associated with ionizing radiation, the research emphasizes the importance of ensuring that radiologic technologists are well-informed and compliant with safety standards to minimize exposure for both patients and healthcare personnel. Using a descriptive-correlational research design, the study surveyed 61 radiologic technologists across four military hospitals. The results showed that respondents demonstrated a very high level of knowledge (Mean =3.83), a very positive attitude (Mean = 3.81), and strong agreement in applying radiation protection practices (Mean = 3.81). Statistical analysis revealed significant correlations between knowledge and attitude, knowledge and practice, and attitude and practice, all with Pearson r values of 1.000 and p-values of 0.000 indicating perfect positive relationships among the variables. The findings highlight that higher levels of knowledge contribute to more positive attitudes and improved safety practices, which in turn enhance patient care. The study concludes that continuous training and strict adherence to radiation protection principles such as the ALARA (As Low as Reasonably Achievable) principle are essential. These results can inform action plans and policies aimed at strengthening radiation safety protocols in both military and civilian healthcare institutions.

Keywords: Knowledge, Attitude, And Practices Of Radiologic Technologists; Radiation Protection; Patient Care; Military Hospitals; National Capital Region; Alara Principle; Radiation Safety.

1. INTRODUCTION

The discovery of X-rays in 1895 marked a pivotal advancement in medical imaging, offering significant diagnostic and therapeutic benefits. However, limited understanding of the harmful effects of ionizing radiation during its early adoption led to unregulated use and exposure. Over time, as awareness of radiation-related health risks increased, safety protocols were introduced—most notably the ALARA (As Low as Reasonably Achievable) principle, which emphasizes justification, optimization, and dose limitation to ensure patient and worker safety.

The rise in medical radiation use has underscored the necessity for healthcare professionals, particularly radiologic technologists, to have a strong foundation in radiation protection. Despite improvements in training and technology, studies suggest there is still a critical gap between

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theoretical knowledge and its practical application in clinical settings. This gap affects not only the safety of medical personnel but also the quality of patient care. The present study focuses on radiologic technologists working in selected military hospitals in the National Capital Region (NCR) of the Philippines. It seeks to evaluate their levels of knowledge, attitudes, and practices (KAP) regarding radiation protection and assess how these factors impact patient care. By identifying existing strengths and weaknesses in their radiation safety behaviors, the study aims to support the development of action plans to enhance compliance, reduce risks, and improve healthcare outcomes.

2. METHODS

The study utilized a descriptive-correlational research design. The target population consisted of 75 radiologic technologists, with a sample size of radiologic technologists working in four selected military hospitals in the National Capital Region. determined through the Raosoft calculator at a 95% confidence level and a 5% margin of error.

A structured questionnaire was used to gather data on knowledge, attitudes, and practices regarding radiation protection. The questionnaire was divided into three parts: Part I measures the level of knowledge of Radiologic Technologists on radiation protection, Part II measures the attitude of Radiologic Technologists on radiation protection, and Part III measures the practices of Radiologic Technologists on radiation protection in selected Military hospital in National Capital Region.

The instrument's reliability was confirmed using Cronbach's Alpha with Knowledge (.998), Attitude (.999), and Practice (.999) all achieving acceptable reliability.

Data analysis was conducted using weighted means for descriptive analysis and Pearson's r for correlational analysis. Ethical considerations were observed by obtaining informed consent from participants and ensuring confidentiality.

3. RESULT AND DISCUSSION

Table 1. Respondents' Level of Knowledge in Radiation Protection

Indicators	Weighted Mean	Verbal Interpretation	Rank
1. Radiation protection safeguards individuals from ionizing radiation.	3.81	Very High	6
2. The cardinal principle of time, distance, and shielding is used to minimize occupational radiation exposure.	3.81	Very High	6
3. Regularly calibrating radiologic equipment minimizes unnecessary radiation exposure to patients and staff.	3.81	Very High	6

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4. The shorter the exposure time, the lower the dose received	3.81	Very High	6
5. Lead apron, thyroid, and gonadal shielding protect against unnecessary exposure to sensitive organs.	3.81	Very High	6
6. ALARA principle emphasizes reducing exposure to the minimum to achieve the necessary diagnostic and therapeutic effect.	3.81	Very High	6
7. Valuable tool in ensuring the beneficial effect of ionizing radiation in medicine.	4.00	Very High	1
8. Establish patient safety through information training and education.	3.81	Very High	6
9. Properly positioned patients during imaging procedures can minimize the need for repeat exposure	3.81	Very High	6
10. monitor the radiation dose using OSL.	3.81	Very High	6
Overall weighted mean	**3.83**	**Very High**	

As shown in Table 1, indicator 7 states that radiologic technologist “Valuable tool in ensuring the beneficial effect of ionizing radiation in medicine" ranked 1 with the highest weighted mean of 4.00 and interpreted as Very High Indicator 1,2,38,9 and 10 has the same weighted mean 3.83 and interpreted as Very High. Indicator 1: Radiation protection safeguards individuals from ionizing radiation weighted mean 3.81. Indicator 2 and 3 “applies the three protective measures of time, distance, and shielding in occupational exposure”, and regularly calibrating equipment minimizes unnecessary radiation exposure to patients and staff having a weighted mean of 3.81. Indicator 4 The shorter the exposure time, the lower the dose received having a weighted mean of 3.81.” Indicator 5 Lead apron, thyroid, and gonadal shielding protect against unnecessary exposure to sensitive organs having a weighted mean of 3.81. Indicator 6 ALARA principle emphasizes reducing exposure to the minimum to achieve the necessary diagnostic and therapeutic effect having a weighted mean of 3.81 indicator 8 “Establish patient safety through information training and education. Indicator 9 “Properly positioned patients during imaging procedures can minimize the need for repeat exposure having a weighted mean of 3.81 and indicator 10 “monitor the radiation dose using OSL having a weighted mean of 3.81.”

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In summary, the obtained weighted mean of 3.83 indicates a very high level of knowledge among radiologic technologists regarding radiation protection and impact in patient care. This signifies a strong understanding of the fundamental principles of safeguarding individuals from ionizing radiation, minimizing occupational exposure through time, distance, and shielding, and regularly calibrating equipment for safety. They also demonstrate a deep understanding of the ALARA principle, emphasizing the need to keep exposure as low as reasonably achievable while still achieving the desired medical outcome. Furthermore, their knowledge of using lead aprons and other shielding, as well as monitoring radiation dose using OSL, highlights their commitment to patient safety and responsible radiation practices. This high level of knowledge is crucial for ensuring the safe and effective application of ionizing radiation in medical diagnostics and treatment.

A study conducted by Williams et al. (2021) found that higher knowledge levels among radiation doses and improved adherence to safety protocols. This finding further supports the obtained weighted mean of 3.83, indicating that the high radiologic technologists directly contribute to better patient safety practices and lower radiation exposure. Patient-centered care requires technologists to not only optimize image quality but also prioritize minimizing patient exposure through appropriate technique selection and shielding.

Table 2. Respondents' Attitude Towards Radiation Protection

Indicators	Weighted Mean	Verbal Interpretation	Rank
1.I maintain empathy and compassion as integral components of patient care while ensuring radiation protection during imaging.	3.81	(Very Positive	5.5
2.l am confident that maintaining a positive attitude toward radiation protection leads to better patient outcomes.	3.81	(Very Positive)	5.5
3. I am resolute in my commitment to upholding rigorous radiation protection standards as a cornerstone of quality patient care.	3.81	(Very Positive)	5.5
4. I am committed to maintaining a high level of professionalism when discussing radiation risks with patient.	3.81	(Very Positive)	5.5
5. I believe that clear communication and collaboration with healthcare professionals are vital for optimal radiation safety and patient care.	3.81	(Very Positive)	5.5

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6. I approach radiation protection with unwavering diligence, professionalism, and a steadfast dedication to upholding the highest standards of patient care.	3.81	(Very Positive)	5.5
7. I am committed to strictly adhering to radiation protection protocols to ensure the safety of patients and healthcare staff.	3.81	(Very Positive)	5.5
8 I approach radiation protection with unwavering diligence, professionalism, and a steadfast dedication to upholding the highest standards of patient care.	3.81	(Very Positive)	5.5
9.I am concerned about the potential harm caused by unnecessary radiation exposure to patients.	3.81	(Very Positive)	5.5
10.I approach radiation protection with unwavering diligence, professionalism, and a steadfast dedication to upholding the highest standards of patient care	3.81	(Very Positive)	5.5
Overall weighted mean		**(Very Positive)**	

The results presented in Table 2 demonstrate a strong commitment to radiation protection among Radiologic Technologists. A weighted mean of 3.8I across all ten (1-10) indicators, interpreted as "Very Positive. and compassion as integral components of patient care while ensuring radiation protection during imaging. Indicator 1: "Radiologic Technologist maintain empathy and compassion as integral components of patient care while ensuring radiation protection during imaging. Indicator 2: "Radiologic Technologist confident that maintaining a positive attitude toward radiation protection leads to better patient outcomes. Indicator 3: " Radiologic Technologist resolute in commitment to upholding rigorous radiation protection standards as a cornerstone of quality patient care Indicator 4: " Radiologic Technologist committed to maintaining a high level of radiation risks with patients. Indicator 5: " Radiologic Technologist believe that clear communication and collaboration with healthcare professionals are vital for optimal radiation safety and patient care. 6: " Radiologic Technologist I approach radiation protection with unwavering diligence, professionalism, and a steadfast dedication to upholding the highest standards of patient care. Indicator 7 " Radiologic Technologist committed to strictly adhering to radiation protection protocols to ensure the safety of patients and healthcare staff. Indicator 8: " Radiologic Technologist approach radiation protection with unwavering diligence, professionalism, and a steadfast dedication to upholding the highest standards of patient care. Indicator 9: " Radiologic Technologist concerned about the potential harm caused by unnecessary radiation exposure to patients. and Indicator 10 " Radiologic Technologist approach radiation

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protection with unwavering diligence, professionalism, and a steadfast dedication to upholding the highest standards of patient care.

In summary, the obtained weighted mean of 3.81 revealed that the Radiologic Technologists have a Very Positive attitude toward radiation protection in patient care. This means that they had a positive attitude toward, establishing the pregnancy status before exposure, maintaining visible radiation warning signs, visually inspecting lead gowns and other PPE, safeguarding the use of upright gonadal shielding when warranted, supporting the implementation of radiation safety programs and procedures, updating of appropriate record of OSL and equipment, and ensuring that the warning light is properly working.

The results were supported by the study conducted by Ndumbaro Joseph and Isaya Frank (2022) investigated the awareness and attitude of radiographers towards radiation protection and dose reduction in Tanzania. A total of 64 radiographers participated in the study, and data were collected through a well- choice questionnaire administered between April and May 2022. The results indicated that all participants (100%) had attended radiation protection courses, demonstrating a sufficient awareness and positive attitude towards radiation protection. This suggests that the level of awareness regarding radiation protection among operating room uate, with participants showing a strong commitment to adhering to radiation protection principles. The study's findings reflect a high percentage of awareness and positive attitudes towards radiation protection among the radiographers surveyed.

Table 3. Respondents' Practices Toward Radiation Protection

Indicators	Weighted Mean	Categorial Interpretation	Rank
1.I ensure the safe operation of equipment before use.	3.81	Strongly Agree	5.5
2. I evaluate the patient's clinical history and ensure compliance with protocols.	3.81	Strongly Agree	5.5
3.I adhere to the 10-day rule for females of reproductive age.	3.81	Strongly Agree	5.5
4.I use gonadal shielding to protect the patient's reproductive organs.	3.81	Strongly Agree	5.5
5.I provide a lead gown for family members assisting patients during exposure.	3.81	Strongly Agree	5.5
6.I give clear positioning instructions to patients before and during exposure.	3.81	Strongly Agree	5.5

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7.I wear a dosimeter (OSL) during occupational exposure.	3.81	Strongly Agree	5.5
8.I use protective equipment when assisting patients and physicians.	3.81	Strongly Agree	5.5
9.I maintain a safe distance from the radiation source during mobile procedures.	3.81	Strongly Agree	5.5
10. I store the lead gown by hanging it vertically when not in use	3.81	Strongly Agree	5.5
Overall weighted mean	**3.81**	**Strongly Agree**	

As can be seen from Table 3, demonstrate a strong radiation protection among Radiologic Technologists. A weighted mean of 3.8I across all ten (1-10) indicators, interpreted as "Strongly agree. Indicator 1 "Radiologic Technologist ensure the safe operation of equipment before use. Indicator 2 "Radiologic Technologist evaluate the patient's clinical history and ensure compliance with protocols. Indicator 3"Radiologic Technologist adhere to the 10-day rule for females of reproductive age. Indicator 4 "Radiologic Technologist use gonadal shielding to protect the patient's reproductive organs. Indicator 5 "Radiologic Technologist provide a lead gown for family members assisting patients during exposure. Indicator 6 "Radiologic Technologist give clear positioning instructions to patients before and during exposure." Indicator 7 "Radiologic Technologist wear a dosimeter (OSL) during exposure. Indicator 8 "Radiologic Technologist use protective equipment when assisting patients and physicians. Indicator 9 "Radiologic Technologist maintain a safe distance from the radiation source during mobile procedures and Indicator 10 "Radiologic Technologist store the lead gown by hanging it vertically when not in use."

In summary, the obtained weighted mean of 3.81 revealed that the Radiologic Technologists Strongly Agreed with the practices of Radiologic Technologists in radiation protection in doing exceptionally well at assessing the patient's clinical history and compliance, positioning away from the source of exposure during the mobile procedure, vertically hanging a lead gown when not in use, wearing of dosemeter (OSL) during occupational exposure, following the safe practice of equipment before use, putting on the lead gown for the family member assisting during exposure, giving positioning instruction to the patient before and during exposure, and wearing of protective equipment when assisting patient and doctors.
The results were supported by the study conducted by Behzadmehr et al., (2020), results revealed that out of forty-one studies conducted on 11050 HCWs, which were performed from different studies which was 14.3-99%. In most studies, HCWs had an average practice of radiation protection.

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Table 4. Relationship between the Respondents' Level of Knowledge and Attitude in Radiation Protection

Variables	Statistical Treatment (Pearson's)	p-value	Decision	Interpretation
Knowledge and attitude	r=1.000 (perfect) correlation)	.000*	H_0 rejected	Significant
				*Significant @ 0.01

For the relationship between the respondents' level of knowledge and attitude towards radiation protection in patient care, a Pearson's r value of 1.000 was obtained indicating a perfect correlation. Meanwhile, a probability value of .000 which was lower than the test of significance at .01 showed that there is sufficient statistical evidence to reject the null hypothesis, suggesting a significant the level of knowledge on radiation protection, the more positive the attitude toward radiation protection.

The result was supported by the study of Alkhayal et al. (2023), as it investigated the knowledge and attitudes of healthcare workers regarding radiation safety and protective measures in a tertiary center. The findings revealed that a significant number of participants lacked formal education on radiation safety, which was linked to lower radiation protection. Although many participants were aware of specific radiation risks, the absence of structured training contributed to inadequate application of safety protocols. The study highlights the importance of formal education and continuous training with radiation protection measures among healthcare workers.

Table 5. Relationship between the Respondents' Level of Knowledge and Practices in Radiation Protection

Variables	Statistical Treatment (Pearson's)	p-value	Decision	Interpretation
Knowledge and practices	r=1.000 (perfect) correlation)	.000*	H_0 rejected	Significant

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*Significant @ 0.01

The study aimed to determine if there is a significant relationship between the Radiologic Technologists' Level of Knowledge and Practices in Radiation Protection. As shown in Table 5, the relationship between the respondents' level of knowledge and practices in radiation protection, a Pearson's r value of 1.000 was obtained indicating a perfect correlation. Meanwhile, a probability value of .000 which was lower than the test of significance at .01 showed that there is sufficient statistical evidence to reject the null hypothesis, suggesting a significant relationship between the variables. This means that the higher the level of knowledge on radiation protection, the better their practices in radiation protection are observed.

Based on a study by Fatemeh Rezaei Kahkhaei, et al.,, (2020) A study, Iran, highlighted a significant correlation between the participants' training in radiation protection and their levels of awareness and performance regarding safe practices. The findings of this study underscore the critical role that education and training play in enhancing knowledge and practices in radiation protection. By demonstrating that those who received formal training exhibited better awareness and adherence to safety protocols, the study supports the notion that comprehensive education is essential for improving the implementation of radiation safety measures. This reinforces the argument that increasing the level of knowledge among radiologic technologists can lead to more effective practices, aligning with the results of the current study that found a perfect correlation between in radiation protection.

Table 6. Relationship Between the Respondents' Attitude and Practices in Radiation Protection

Variables	**Statistical Treatment** (Pearson's)	**p-value**	**Decision**	**Interpretation**
Attitude and practices	r=1.000 (perfect) correlation)	.000*	H_0 rejected	Significant
				*Significant @ .01

Table between the-respondents' attitudes and practices regarding radiation protection. As shown in table 6, the relationship between the respondents' attitude towards and practices in radiation protection, a Pearson's r value of 1.000 was obtained indicating a perfect correlation. Meanwhile, a probability value of .000 which was lower than the test of significance at .01 showed that there is sufficient statistical evidence to reject the null hypothesis, suggesting a significant relationship between the variables. This means that the more positive the attitude towards radiation protection, the better their practices in radiation protection are observed.

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The result was supported by the study of Choi (2023), on an empirical analysis of the relationship between radiation-Focusing on the population eligible for the South Korean National Health Insurance Service Examination. The results revealed that the understanding, attitudes, and behavior scores of healthcare practitioners were all significantly higher. The fact that those with prior knowledge of radiation were more active in their attitudes and practices to protect against radiation damage than those with no prior knowledge suggests the need for radiation education.

Proposed Action Plan to Sustain the Knowledge, Attitude, and Practices of Radiologic Technologists in Radiation Protection

Rationale:

The relationship between radiologic technologists' knowledge, attitude, and practices regarding radiation protection suggests that a strong understanding of radiation protection principles, combined with a positive attitude, leads to effective implementation of safety measures. This, in turn, helps minimize unnecessary radiation exposure for patients, healthcare staff, and the general public. To address this, an action plan should emphasize continuous education through training sessions and seminars. Additionally, the development and enforcement of specific guidelines, policies, and safety protocols are essential for maintaining and enhancing radiation protection practices. By implementing these strategies, radiologic technologists in selected military hospitals within the National Capital Region can strengthen their knowledge, attitudes, and overall adherence to radiation safety in patient care.

Proposed Action Plan to Sustain the Knowledge, Attitude, and Practices of Radiologic Technologists in Radiation Protection

Areas of Concern	Strategy/ Tasks	Person(s) Responsible	Time Frame	Resources	Success Indicator
1.Maintain the knowledge of Radiologic Technologists in radiation protection	1. Strengthen radiation protection education and training of health professionals	1.Head of Training, Radiology Department	Bi-Annually	SOP Manual	100 percent updated policies and procedures
	2. Integrate radiation protection into the curricula of students during internship	Head of Training/ Clinical Coordinator Radiology Department	Bi-Annually	Training Manual	100 percent integration into the curricula of interns
	3. Strengthen collaboration about education and training to other healthcare members	Head of Training, Radiology Department	Bi-Annually	Training Manual	100 percent updated manual after a series of consultative meetings

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Areas of Concern	Strategy/ Tasks	Person(s) Responsible	Time Frame	Resources	Success Indicator
2.Maintain the attitude of Radiologic Technologists toward radiation protection	1. Foster closer cooperation between radiation regulatory authorities, health authorities and professional societies	Chief, Radiologic Technologist or Head of Training	Montly	Funding for attending conferences	100 percent attendance at conferences
	2. Fostering ethical standards in the radiology department	Radiologic Technologists	Every day or every patient	SOP Manual	100 percent compliance
	3.Strengthen cooperation and communication between patients and Radiologic Technologists	Radiologic Technologist	Everyday	Radiology form	100 percent compliance
Areas of Concern	Strategy/ Tasks	Person(s) Responsible	Time Frame	Resources	Success Indicator
3.Maintain the practices of Radiologic Technologists toward radiation protection	1.Radiology referral guidelines	Radiologic Technologist	Every day or every patient	Radiologic Procedure request form	100 percent compliance
	2. Strengthen the quality assurance programs for medical exposures	Radiation Safety Officer	Everyday	QAQC tools and form	95 percent less repeat exposure due to machine malfunction

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	3.Maintain information exchange on radiation protection and safety-related issues to females of reproductive potential.	Radiologic Technologist	Every day	SOP Manual	100 percent no radiation-related accident to utero.

4. CONCLUSIONS

Based on the findings of the study, the following conclusions were drawn:

1. Radiologic Technologists demonstrated a very high level of knowledge regarding radiation protection, particularly in the application of the ALARA principle, the use of protective devices such as lead aprons and thyroid shields, and the implementation of standard safety procedures. This high level of knowledge indicates that they are well-informed and capable of ensuring both patient and occupational safety when using ionizing radiation.

2. The respondents also exhibited a very positive attitude toward radiation protection. This is evident in their empathy and concern for patients' well-being, their confidence in radiation safety practices, and their willingness to communicate effectively about radiation risks. Their attitude reflects a strong professional commitment to upholding patient care standards while minimizing exposure to harmful radiation.

3. The respondents are exceptional regarding radiation protection safety practices, and particularly evident in communication and assessment of patients' clinical history and compliance.

4. The higher the Radiologic Technologists' level of knowledge the more positive their attitude in radiation protection.
5. The higher the Radiologic Technologists' level of knowledge, the better their practices in radiation protection.
6. The more positive the Radiologic Technologist's attitude, the better their practices in radiation protection.
7. A Proposed Action Plan was made to Sustain the Knowledge, Attitude, and Practices of Radiologic Technologists in Radiation Protection in selected Military Hospital in National Capital Region.

5. RECOMMENDATION

1. Radiologic Technologists: should actively pursue continuous professional development to remain up-to-date with advancements in radiation safety, emerging technologies, clinical protocols, equipment handling, and patient care. Collaboration with medical device manufacturers is also essential to enhance the safety and usability of radiologic equipment.

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2. Patients: should be empowered to ask questions regarding radiation exposure and should be reassured about the safety of diagnostic procedures. Radiation protection information should be made readily accessible through various platforms such as brochures, digital media, and educational campaigns.
3.Radiation Safety Officers: are responsible for implementing quality assurance programs, including monitoring the use of gonadal shielding and adherence to the 10-day rule. They should also provide continuous training to ensure compliance with these safety measures.
4. Healthcare Providers: must foster a culture of safety by encouraging open communication, reporting of safety concerns, and promoting interdisciplinary collaboration. Comprehensive training programs should emphasize the integration of radiation safety into everyday clinical practice.
5. Board of Radiologic Technologists: should oversee the professional environment, establish clear guidelines for device usage, and disseminate standardized practices to ensure consistency and quality across the profession.

6. Professional Organizations: ought to partner with regulatory agencies to improve the design of radiologic equipment, strengthen training initiatives, and ensure compliance with radiation safety standards. Public education campaigns should also be launched to raise awareness of radiation safety principles
7. Implementation, Monitoring, and Evaluation: of the proposed action plan should be carried out to assess its impact and ensure its effectiveness over time
8. Future Researchers: are encouraged to explore topics such as the implementation of the 10- day rule, cases of accidental embryo exposure, and the implications of the Bonn Call for Action. Further studies involving larger sample sizes or broader geographical coverage are recommended for more comprehensive insights.

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