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PUBLIC PERCEPTION AND KNOWLEDGE OF RADIATION RISKS FROM DIAGNOSTIC IMAGING

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ABSTRACT

Background: Diagnostic imaging plays a crucial role in modern medicine but exposes patients to varying levels of ionizing radiation, which can increase long-term health risks if not properly managed. **Aim and Objective:** To assess public knowledge, perception, and practices regarding radiation risks from diagnostic imaging, and to identify socio-demographic factors influencing awareness and safety behaviors. **Patients and Methods:** A cross-sectional study was conducted at Ibn Sena Teaching Hospital, Mosul, Nineveh Governorate, from 5 July 2025 to 5 November 2025. A total of 100 participants were randomly selected from outpatient clinics. Data were analyzed using SPSS version 27, with frequencies and percentages reported, and associations assessed using Chi square tests ($p < 0.05$). **Results:** The study included participants with a balanced gender distribution (48% male, 52% female) and predominantly urban residence (70%). Overall, 55% demonstrated moderate knowledge of radiation risks, 30% had good knowledge, and 15% had poor knowledge. Awareness of device-specific radiation varied, with 90–95% correctly identifying that MRI and ultrasound do not involve ionizing radiation, while 60–65% recognized higher risks from CT scans and sensitivity in children. Attitudes were generally cautious, with 75–80% agreeing that patients should be informed and awareness improves safety. **Conclusion:** The study revealed that the public demonstrates moderate knowledge and generally cautious attitudes toward radiation risks VIII from diagnostic imaging, with higher awareness among educated and younger participants.

KEYWORDS: Radiation exposure; Diagnostic imaging; CT scan; X-ray; MRI; Ultrasound; Radiation risk awareness; Protective measures; Patient knowledge; Public perception.

INTRODUCTION

Radiation is a form of energy that exists naturally in the environment and is also widely used in medicine for diagnostic and therapeutic purposes. Diagnostic imaging modalities, including X-ray, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound, have revolutionized clinical practice by allowing non-invasive visualization of internal body structures. Among these, X-rays and CT scans are the most commonly used techniques that involve exposure to ionizing radiation, which has the potential to cause cellular and molecular damage.[1-4] Ionizing radiation carries enough energy to remove tightly bound electrons from atoms, creating ions and free radicals that can interact with DNA, proteins, and other cellular components. These interactions may result in mutations, chromosomal aberrations, or cellular apoptosis. The cumulative effect of repeated radiation exposure is a concern, as it increases the lifetime risk of developing malignancies, particularly in radiosensitive tissues such as bone marrow, thyroid, and breast tissue.[5-7]

Medical imaging is essential for diagnosing a wide range of conditions, including fractures, infections, tumors, cardiovascular abnormalities, and internal bleeding. However, the increased utilization of imaging procedures over the past decades has raised concerns regarding the potential long-term health effects of radiation exposure.

Public awareness of these risks remains limited in many regions, contributing to both overuse and underuse of diagnostic imaging.[8]

CT scans, while providing high-resolution images and detailed anatomical information, expose patients to higher radiation doses compared to conventional X-rays. For example, a single abdominal CT scan may deliver a dose equivalent to several hundred chest X-rays, emphasizing the importance of judicious use. MRI and ultrasound, on the other hand, do not involve ionizing radiation, making them safer alternatives for repeated or pediatric imaging. Despite this, misconceptions persist among the general population, with some individuals believing that all imaging modalities carry similar risks.[9] Children are particularly susceptible to radiation-induced damage due to their rapidly dividing cells and longer expected lifespan.

Similarly, pregnant women are considered a high-risk group, as fetal exposure to ionizing radiation can lead to developmental abnormalities or increased cancer risk. Protective measures, such as lead shielding and minimizing unnecessary scans, are crucial strategies to mitigate these risks.[10-13]

The role of healthcare providers is essential in communicating these risks effectively. Physicians, radiologists, and technologists must ensure that patients understand the benefits and potential harms of imaging procedures, promoting informed decision-making. However, studies have shown that explanations are often inadequate or inconsistent, resulting in patient anxiety or reluctance to undergo necessary investigations.[14]

Public perception of radiation risks is influenced by various factors, including media coverage, personal experiences, social networks, and educational background. Access to reliable information from physicians or credible online sources can improve knowledge and promote safe practices. Conversely, misinformation or lack of awareness may lead to either excessive fear or complacency, affecting adherence to recommended 3 imaging guidelines.[15] Assessing public knowledge and practices regarding radiation exposure is critical for designing effective educational interventions and health policies. Studies have reported varying levels of awareness, with a significant proportion of the population unable to distinguish between safe and high-risk imaging modalities. This knowledge gap can result in both unnecessary exposure and avoidance of essential diagnostic procedures.[16]

The aim of this study was to assess public knowledge, perception, and practices regarding radiation risks from diagnostic imaging, and to identify socio-demographic factors influencing awareness and safety behaviors.

OBJECTIVES

1. To assess participants' level of knowledge regarding radiation risks associated with diagnostic imaging procedures.
2. To explore participants' perceptions and attitudes toward radiation exposure and related health concerns.
3. To identify participants' practices and precautionary measures used to reduce radiation exposure.
4. To examine the association between socio-demographic characteristics (age, gender, educational level, and place of residence) and levels of knowledge about radiation risks.
5. To determine the main sources of information about medical radiation among the study population.
6. To identify knowledge gaps and common misconceptions that may require targeted educational interventions to improve radiation safety awareness.

PATIENTS AND METHODS

Study Design

This cross-sectional study was conducted to evaluate public knowledge and practices regarding radiation risks from diagnostic imaging. The study aimed to assess socio-demographic characteristics, sources of information, exposure frequency, precautionary behaviors, and the association of these factors with participants' overall knowledge regarding radiation safety.

Study Population and Sample Size

A total of 100 participants were recruited from outpatient clinics at Ibn Sena Teaching Hospital, Mosul, Nineveh Governorate. Both males and females across different age groups were included to ensure a representative sample. The sample size was calculated based on previous regional studies estimating public knowledge and perception of radiation exposure, with a 95% confidence level and a 5% margin of error, ensuring sufficient statistical power to detect significant associations between sociodemographic factors and knowledge levels.

Inclusion and Exclusion Criteria

Inclusion criteria included adults aged 18 years and above who provided written informed consent and were able to understand the questionnaire, while exclusion criteria were healthcare professionals with specialized knowledge in radiology, individuals with incomplete responses, or those unwilling to participate.

Data Collection and Classification

Participants were recruited using a random selection method from outpatient clinics to ensure a representative population sample. Data were collected using a structured, face-to-face questionnaire, supplemented by interviews when necessary. The questionnaire included sections on demographic characteristics (age, gender, education level, and residence), knowledge of radiation risks (20 questions on exposure, device-specific hazards, protective measures, and vulnerable populations such as children and pregnant women), practices (frequency of diagnostic imaging, use of protective measures, and refusal of imaging due to radiation concerns), and sources of information (physician, internet/social media, TV/radio, and friends/family). The research questions focused on assessing the level of public knowledge regarding radiation risks, precautionary practices, sources of information, and associations between socio-demographic factors and knowledge and practices. Knowledge classification[7] was defined as poor (≤50% correct responses), moderate (51–75%), and good (>75%).

Operational definitions included: radiation exposure as exposure from diagnostic imaging devices such as X-ray, CT scan, MRI, and ultrasound, and protective measures as the use of lead aprons, shields, or minimizing repeated exposure. The questionnaire was pre-tested on 10 participants to ensure clarity and reliability, and necessary modifications were made prior to the main study. Incomplete responses were excluded from analysis.

Study Procedure

Participants were approached and interviewed in outpatient clinics at Ibn Sena Teaching Hospital using the structured questionnaire. Responses were immediately reviewed for completeness, and incomplete forms were excluded from analysis to maintain data quality.

Confounding Variables

Potential confounders such as age, gender, education level, and place of residence were recorded and adjusted for during statistical analysis to ensure valid associations with knowledge and preventive practices.

Study Period and Setting

The study was conducted at Ibn Sena Teaching Hospital, Mosul, Nineveh Governorate, from 5 July 2025 to 5 November 2025.

Ethical Approval

Ethical approval was obtained from the Mosul Health Directorate – Ibn Sena Teaching Hospital (approval number 27623, dated 3 July 2025). Written informed consent was obtained from all participants, and confidentiality was maintained according to the principles of the Declaration of Helsinki.

Data Management and Statistical Analysis

Data were coded and entered into SPSS version 27 and Excel 2013, with double-checking to minimize entry errors. Categorical variables were expressed as frequencies and percentages. Associations between socio7 demographic factors, knowledge levels, and preventive practices were evaluated using Chi-square tests, with statistical significance set at $p < 0.05$.

RESULTS

The age distribution shows that the largest proportion of participants were aged 31–45 years (40%), followed by those aged 18–30 years (35%), while individuals older than 45 years constituted 25% of the sample.

Regarding gender, females slightly predominated (52%) compared with males (48%). In terms of educational level, more than half of the participants held a bachelor’s degree (55%), whereas 20% had completed primary school and 25% had postgraduate education. With respect to place of residence, the majority of participants were from urban areas (70%), while 30% resided in rural areas, reflecting a predominantly urban study population, as shown in table 1.

Table 1: Socio-Demographic Characteristics of the Study Participants.

Variable	Category	N	Percentage (%)
Age (years)	**18–30**	35	35%
	31–45	40	40%
	>45	25	25%
Gender	**Male**	48	48%
	Female	52	52%
Education Level	**Primary school**	20	20%
	Bachelor	55	55%
	Postgraduate	25	25%
Residence	**Rural**	30	30%
	Urban	70	70%

Most participants correctly recognized that diagnostic imaging exposes patients to radiation (85%) and that MRI does not use ionizing radiation (90%), while ultrasound is also radiation-free (95%). A majority understood that CT scans involve higher radiation than X-rays (60%) and that repeated X-rays can increase lifetime cancer risk (55%). Awareness of vulnerable populations was moderate, with 65% acknowledging that children are more sensitive to radiation and 75% understanding that radiation risk is not uniform across all imaging types. Protective measures, such as shields, were correctly identified by 80% of respondents, and 85% agreed that pregnant women should avoid unnecessary imaging. Knowledge of cumulative effects was recognized by 60%, while misconceptions such as X-ray machines emitting radiation after being turned off (correctly answered by 90%) and lead aprons not completely eliminating risk (70%) were addressed. The role of radiologists in minimizing exposure was acknowledged by 75%, and 67% correctly identified which devices contain radiation. Awareness of side effects and carcinogenic potential varied, with 46% correctly noting side effects from ordinary X-rays, 65% from CT scans, and 74% acknowledging carcinogenic effects. Lastly, 75% correctly identified that radiation poses higher risks to pregnant women, ***as shown in table 2***.

Table 2: Public Knowledge Regarding Radiation Risks from Diagnostic Imaging.

No	Knowledge Question	Correct Answer	N	%
1.	Diagnostic imaging exposes patients to radiation	Yes	85	85%
2.	CT scan has higher radiation than Xray	Yes	60	60%
3.	MRI uses ionizing radiation	No	90	90%
4.	Ultrasound exposes to radiation	No	95	95%
5.	Repeated X-rays increase lifetime cancer risk	Yes	55	55%
6.	Children are more sensitive to radiation	Yes	65	65%
7.	Dental X-rays are harmless	No	70	70%
8.	Radiation risk is the same in all imaging modalities	No	75	75%
9.	Protective shields reduce exposure	Yes	80	80%
10.	Pregnant women should avoid unnecessary imaging	Yes	85	85%
11.	Radiation exposure is cumulative over lifetime	Yes	60	60%
12.	X-ray machines emit no radiation after being turned off	No	90	90%
13.	Lead aprons completely eliminate risk	No	70	70%
14.	CT scans are recommended for everyone regularly	No	80	80%
15.	Radiologists are trained to minimize patient radiation	Yes	75	75%
16.	Diagnostic devices contain radiation	Ct Scan + X-Ray and Bone Densitometry		67%
17.	Side effects from X-ray (ordinary)	Yes		46%
18.	Side effects from CT scan	Yes		65%
19.	Diagnostic imaging has carcinogenic effects	Yes		74%
20.	Radiation is more harmful to pregnant women	Yes		75%

The results indicate that more than half of the participants demonstrated a moderate level of knowledge (55%), while 30% achieved a good knowledge level, reflecting a solid understanding of radiation safety and exposure. Conversely, 15% of participants exhibited poor knowledge, suggesting gaps that may require targeted educational interventions to improve public awareness and promote safer imaging practices. as shown in table 3.

Table 3: Knowledge Levels of Participants Regarding Radiation Risks.

Level	N	Percentage (%)
Poor	15	15%
Moderate	55	55%
Good	30	30%

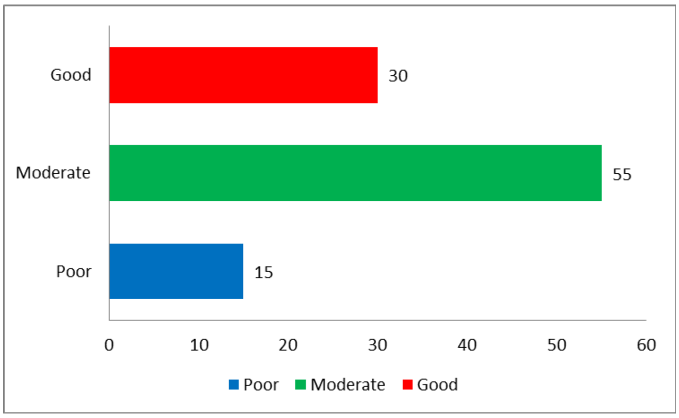

Figure 1: Knowledge Levels of Participants Regarding Radiation Risks.

Analysis by age revealed a statistically significant association (p =0.043), with participants aged 31–45 years showing a slightly higher proportion of good knowledge (30%) compared to other age groups. Gender did not significantly influence knowledge levels (p = 0.941), as males and females demonstrated similar distributions across poor, moderate, and good categories. Educational attainment showed a significant effect (p = 0.049); participants with postgraduate education had the highest proportion of good knowledge (44%), whereas those with primary school education had the highest proportion of poor knowledge (25%). Residence exhibited a nonsignificant trend (p = 0.075), with rural participants displaying a higher proportion of good knowledge (43.3%) compared to urban participants (24.3%), as shown in table 4.

Table 3: Association Between Socio-Demographic Factors and Participants' Knowledge Levels.

Variable	Category	Poor n (%)	Moderate n (%)	Good n (%)	pvalue
Age (years)	**18–30**	5(14.3%)	20 (57.1%)	10 (28.6%)	0.043
	31–45	6 (15%)	22 (55%)	12 (30%)	
	>45	4 (16%)	13 (52%)	8 (32%)	
Gender	**Male**	7 (14.6%)	26 (54.2%)	15 (31.2%)	0.941
	Female	8 (15.4%)	29 (55.8%)	15 (28.8%)	
Education Level	**Primary school**	5 (25%)	12 (60%)	3 (15%)	0.049
	Bachelor	7 (12.7%)	32 (58.2%)	16 (29.1%)	
	Postgraduate	3 (12%)	11 (44%)	11 (44%)	
Residence	**Rural**	2 (6.7%)	15 (50%)	13 (43.3%)	0.075
	Urban	13 (18.6%)	40 (57.1%)	17 (24.3%)	

Half of the participants (50%) reported being concerned about radiation, while 30% were neutral and 20% disagreed. Only 40% agreed that doctors adequately explain the risks, with 35% neutral and 25% disagreeing, indicating some gaps in patient–physician communication. A majority (60%) disagreed with avoiding imaging due to perceived risk, suggesting that most participants rely on professional guidance rather than fear. Regarding risk perception, 50% felt the risk is exaggerated, whereas 20% agreed and 30% were neutral. Trust in doctors was relatively high, with 60% agreeing, and 35% reported that radiation causes anxiety. About 30% actively read about radiation risks, 75% believed patients should be informed, and 80% agreed that awareness improves safety, highlighting the importance of education and communication. Preferences for alternative imaging modalities were lower, with 25% agreeing, 35% neutral, and 40% disagreeing. as shown in table 5.

Table 5: Participants' Perceptions and Attitudes Toward Radiation Risks from Diagnostic Imaging.

No	Statement	Agree (n,%)	Neutral (n,%)	Disagree (n,%)
1.	Concerned about radiation	50 (50%)	30 (30%)	20 (20%)
2.	Doctors explain risks properly	40 (40%)	35 (35%)	25 (25%)
3.	Avoid imaging due to risk	15 (15%)	25 (25%)	60 (60%)
4.	Risk is exaggerated	20 (20%)	30 (30%)	50 (50%)
5.	Trust doctors	60 (60%)	25 (25%)	15 (15%)
6.	Radiation causes anxiety	35 (35%)	30 (30%)	35 (35%)
7.	Read about risks	30 (30%)	40 (40%)	30 (30%)
8.	Patients should be informed	75 (75%)	20 (20%)	5 (5%)
9.	Prefer alternatives	25 (25%)	35 (35%)	40 (40%)
10.	Awareness improves safety	80 (80%)	15 (15%)	5 (5%)

Most participants reported not being worried about radiologic tests (64.3%), while 32.2% were worried and 3.5% were very worried. Despite these concerns, the vast majority (94.4%) had never refused a test due to worry about radiation, indicating high compliance with medical advice. Use of protective measures varied: 25% always used them, 40% sometimes, and 35% never, reflecting inconsistent adherence to safety protocols. Regarding perceived harmfulness of imaging devices, most participants considered CT scans as the most harmful (65%), followed by Xrays (25.2%) and bone densitometry (9.8%). ***as shown in table 6.***

Table 6: Participants' Practices and Precautionary Measures Regarding Radiation Exposure.

Question	Response	No.	%
Worry about radiologic tests	**Worried**	46	32.2%
	Very worried	5	3.5%
	Not worried	92	64.3%
Refused test due to worry	**No**	135	94.4%
	Yes	8	5.6%
Use protective	**Always**	25	25%

measures	**Sometimes**	40	40%
	Never	35	35%
Most harmful device	**X-ray**	36	25.2%
	CT scan	93	65%
	Bone densitometry	14	9.8%

Physicians were the primary source of information for 70% of participants, followed by the internet and social media (50%), TV/radio (20%), and friends or family (15%), highlighting the critical role of healthcare professionals in educating the public. Regarding exposure frequency, 40% of participants reported undergoing imaging 1–3 times, 25% 4–6 times, 15% more than 6 times, and 20% had never undergone any imaging. When asked about perceived long-term risks of radiation, 60% considered the risk to be high, 30% moderate, and 10% low, reflecting a generally cautious perception among the population., as shown in table 7.

Table 7: Sources of Information, Exposure Frequency, and Perceived Long-Term Risks of Radiation.

Question	Response	No.	%
Source of information	**Physician**	70	70%
	Internet / social media	50	50%
	TV / Radio	20	20%
	Friends /Family	15	15%
Exposure frequency	**1–3 times**	40	40%
	4–6 times	25	25%
	>6 times	15	15%
	Never	20	20%
Perceived longterm risk	**High**	60	60%
	Moderate	30	30%
	Low	10	10%

DISCUSSION

The current study evaluated public knowledge, perceptions, and practices regarding radiation risks from diagnostic imaging. Understanding these factors is essential for developing effective educational interventions, improving patient compliance, and ensuring the safe use of imaging modalities. Public awareness about radiation exposure is influenced by socio-demographic factors, educational background, source of information, and access to healthcare resources. Proper comprehension of radiation hazards can reduce unnecessary anxiety, improve adherence to safety measures, and promote informed decision-making regarding diagnostic procedures.

The socio-demographic characteristics of the study population revealed a predominance of middle-aged adults, slightly more females, and participants with higher education and urban residency. This profile is consistent with the findings of Evans et al. (2025)[17] who reported that urban residents and individuals with higher education tend to have greater exposure to health-related information, including radiation safety. Similarly, Bahakeem et al. (2024)[18] emphasized that education and urban residence are significant determinants of public awareness about radiation hazards. The observed alignment is likely due to the availability of educational resources, access to healthcare facilities, and literacy levels, which facilitate the comprehension of complex health-related topics such as radiation safety. Urban populations also have more frequent interactions with healthcare providers, which may increase opportunities for learning about imagingrelated risks.[17,18]

Analysis of public knowledge regarding radiation risks demonstrated a generally high awareness of device-specific hazards, protective measures, and vulnerable populations. This aligns with Lee et al. (2024)[19] who found that patients and healthcare providers exhibit moderate to high awareness of the radiation doses associated with X-rays and CT scans. Khamtuikrua et al. ***(2020)***[20] also reported that healthcare personnel possess considerable knowledge about radiation risks, reflecting the dissemination of professional guidelines. The concordance can be explained by the cumulative effect of public health campaigns, professional counseling, and media coverage, which have increased familiarity with imaging modalities and associated risks. This suggests that exposure to reliable sources of information plays a crucial role in shaping understanding of radiation hazards.[19,20]

Regarding knowledge levels, the majority of participants achieved moderate to good knowledge, with a smaller proportion showing poor knowledge. This observation aligns with Bahakeem et al. (2024)[18] who reported similar levels of knowledge among the general population. In contrast, ***Salih et al. (2023)***[21] found lower awareness among nursing students, highlighting that structured training significantly enhances comprehension of radiation risks compared to general population exposure.

The agreement in findings suggests that public education is effective in increasing knowledge, whereas the discrepancy with student populations indicates that the extent and format of exposure to radiation safety information critically affect understanding.[18,21]

The association between socio-demographic factors and knowledge revealed significant effects of age and education, while gender and residence had weaker influence. Slovic (2020)[22] emphasized that perception and comprehension of risk information are strongly affected by cognitive abilities and educational attainment. Similarly, Flynn et al. (2022)[23]

Demonstrated that age and educational background significantly influence environmental health risk awareness. The alignment is biologically and psychologically plausible, as higher education equips individuals with critical thinking and analytical skills that facilitate understanding of abstract health concepts. Middle-aged adults may also have accumulated more life experience and exposure to health information, enhancing their ability to interpret and apply knowledge related to radiation safety.[22,23]

Participants' perceptions and attitudes reflected moderate concern about radiation, a strong trust in physicians, and recognition of the importance of being informed. ***Hunt et al. (2020)***[24] reported that trust in professional sources is a major determinant of accurate risk perception, which aligns with the findings of the present study. Additionally, ***Slovic (2020)***[22] emphasized that individuals' perception of risk is influenced by prior knowledge, social context, and the credibility of information sources.

The concordance can be explained scientifically by cognitive and social mechanisms: trusted sources reduce uncertainty, lower anxiety, and facilitate adherence to recommended safety practices, highlighting the interplay between knowledge, trust, and behavior in risk perception.[22,24]

Assessment of participants' practices revealed variable adherence to protective measures, high compliance with imaging recommendations, and cautious perceptions regarding the harmfulness of certain devices. Alkhayal et al. (2023)[25] observed similar inconsistencies in protective practices among healthcare workers, while Bahakeem et al. (2024)[18] noted uneven precautionary behavior in the general population despite awareness of risks.

This alignment may be explained by practical constraints, perceived necessity of imaging, and habitual behaviors that influence whether safety measures are consistently applied. Psychologically, knowledge alone may not guarantee compliance, as behavioral decisions are affected by convenience, perceived benefits, and personal risk assessment.[16,25] Sources of information were primarily physicians, followed by digital media, with participants showing generally cautious perceptions of long-term radiation risks. This finding aligns with ***Hunt et al. (2020)***[24] who highlighted the influence of trusted sources on public perception and behavior regarding radiation. ***Sung et al. (2022)***[26] also reported that residents relying on credible sources exhibit more accurate understanding and appropriate safety behaviors. The concordance can be explained scientifically by the theory of risk communication, where credible and repeated messages enhance awareness, reduce misconceptions, and encourage precautionary behaviors. Media exposure complements professional advice, reinforcing knowledge and shaping consistent practices across different population segments.[24,26]

\Overall, the study findings suggest that public knowledge of radiation risks is moderate to high, positively influenced by education, age, and access to professional guidance. Attitudes and practices are generally aligned with knowledge, although gaps remain in consistent application of protective measures. The agreement with multiple previous studies underscores the universality of factors such as education, trust in healthcare providers, and access to information in shaping knowledge and behavior. Differences observed in certain populations, such as students or rural residents, highlight the need for tailored interventions that address specific barriers to understanding and safe practices.

CONCLUSION

The present study evaluated public perception, knowledge, and practices regarding radiation risks from diagnostic imaging. The findings indicate that while the majority of participants have moderate to good knowledge of radiation exposure, significant gaps still exist, particularly among those with lower educational levels. Awareness of specific risks, such as cumulative exposure, device-specific hazards, and the heightened sensitivity of children and pregnant women, was variable. Participants generally trusted healthcare providers and recognized the importance of being informed, yet actual precautionary practices, including the consistent use of protective measures, were inconsistent. Age and education were identified as the main socio-demographic factors associated with knowledge levels, while gender and residence had minimal influence.

Recommendations

1. Enhance public education campaigns focusing on radiation risks, safety measures, and device-specific hazards.
2. Encourage healthcare providers to consistently explain risks and protective strategies before imaging procedures.

3. Integrate radiation safety topics into school curricula and community health programs to improve baseline knowledge.
4. Promote the use of protective measures, such as lead aprons and shields, especially for vulnerable populations.
5. Develop and maintain accessible online resources and social media campaigns to provide reliable information.
6. Conduct longitudinal and multicenter studies to evaluate changes in public knowledge and practices over time.
7. Investigate the effectiveness of targeted interventions in increasing knowledge and improving protective behaviors.
8. Assess the perception and behavior of specific high-risk groups, such as pregnant women, children, and frequent imaging patients.

Limitations

1. The study relied on self-reported data, which may introduce recall or reporting bias.
2. The sample may not fully represent the entire population, particularly rural or underserved communities.
3. Cross-sectional design limits the ability to establish causality between knowledge and behavior.
4. Some knowledge and practice questions were subject to participant interpretation, which could affect accuracy.
5. The study did not assess the impact of prior medical experiences or specific physician counseling on knowledge levels.
6. Limited exploration of cultural, socioeconomic, or language barriers that may influence understanding of radiation risks.

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