

Original Research Article

KNOWLEDGE, ATTITUDE AND PRACTICE REGARDING MAGNETIC RESONANCE IMAGING SAFETY AMONG HEALTHCARE PROVIDERS OF THE DEPARTMENT OF RADIO-DIAGNOSIS IN A RURAL TERTIARY CARE HOSPITAL – A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Objective: To assess the knowledge, attitude, and practice (KAP) of MRI safety among healthcare providers in the Department of Radiodiagnosis at a rural tertiary care hospital.

Materials and Methods: A cross-sectional survey was conducted among 72 healthcare providers in department of Radiodiagnosis at a tertiary care hospital. A structured questionnaire (20 items each on knowledge, attitude, and practice) was used. Scores in each domain ranged 0–20 and were categorized as good, moderate, or poor. Descriptive statistics and ANOVA were used to summarize KAP levels and examine differences by work experience.

Results: Participants showed moderately high MRI safety knowledge (mean = 14.0 ± 4.1), strong attitudes (mean = 16.3 ± 2.8), and reasonable safety practices (mean = 15.0 ± 3.6). Good scores were seen in 66.7% (knowledge), 61.1% (attitude), and 69.4% (practice) of participants. ANOVA revealed significant differences in KAP scores by job role and experience (p < 0.05), with radiologists and senior residents performing best. Knowledge–practice gaps were evident, especially under time constraints or staffing limitations. Notably, interns had significantly lower scores across all domains, highlighting the need for targeted training.

Conclusion: While department of radiodiagnosis health care providers in this rural setting demonstrated positive attitudes and moderately good MRI safety knowledge, actual safety practices were inconsistent, with notable knowledge– practice gaps. Structured training, periodic assessments, and system-level reinforcements are essential to enhance MRI safety compliance, especially for junior staff and interns.

Keywords: MRI safety, knowledge, attitude, practice, healthcare providers

INTRODUCTION

Magnetic Resonance Imaging (MRI) offers highresolution imaging without ionizing radiation but poses unique safety risks due to its powerful magnetic fields. Ferromagnetic objects can become projectiles, conductive materials may cause burns, and implants can malfunction if safety protocols are not followed. A review reported that 7.5% of all diagnostic incidents were MRI-related, highlighting the need for strict adherence to safety measures and regular staff training.^[1]

To address these risks, professional bodies such as the American College of Radiology (ACR) have issued comprehensive MRI safety guidelines. The most recent 2024 update reinforces safety zoning, personnel screening, and equipment compliance, underscoring the need for well-informed and consistently trained personnel.^[2]

Nevertheless, gaps in MRI safety awareness persist. Multiple studies have demonstrated that nurses and non-radiology staff often lack sufficient knowledge about MRI safety and display only moderate adherence to safety practices.^[3]

Prior studies have revealed gaps in MRI safety awareness among healthcare workers.

A recent study shows, healthcare workers scored an average of 60% on MRI safety knowledge and 71% on attitude assessments, reflecting a significant need for improved education.^[4]

Similarly, radiology students and recent graduates have shown limited awareness of critical MRI safety measures.^[5]

Technologists who operate MRI scanners are expected to be well-versed in safety, yet surveys reveal specific areas of weak knowledge. A study done shows 34% of MRI technologists did not recognize the standard symbols used to designate the MRI safety zones, and 27% were unaware of the dangers associated with quenching of the magnet.^[6]

These findings underscore the need for ongoing education and assessment of MRI safety practices. In high-resource centers, regular safety trainings are often conducted, but in rural tertiary care settings, access to continuous professional development may be limited. Consequently, evaluating the knowledge, attitude, and practice (KAP) regarding MRI safety among health care providers in depatrment of radiodiagnosis in such settings is important to identify gaps and inform targeted interventions.

Objectives

This study aims to assess the knowledge, attitude, and practice regarding MRI safety among healthcare providers in department of radiodiagnosis, identify areas for improvement in existing safety protocols, and recognize gaps to implement remedial measures that enhance overall safety compliance.

MATERIALS AND METHODS

Study Design and Setting: A cross-sectional survey was conducted in the Department of Radiodiagnosis at a rural tertiary care teaching hospital located in Tamaka, Kolar.

Ethical approval was obtained from the Central Ethics Committee of Sri Devaraj Urs Academy of Higher Education and Research (SDUAHER), and written informed consent was obtained from all participants prior to data collection.

Participants: The study involved 72 healthcare providers from the MRI unit, including radiologists, residents, and technologists. Participants were selected through convenience sampling. Confidentiality and voluntary participation were maintained.

Sample Size Calculation: The required sample size was determined as > 60 using Cochran's formula with finite population correction, assuming 60% prevalence, 10% margin of error, 95% confidence level, and a population size of 150.

Questionnaire: A validated questionnaire assessed MRI safety knowledge, attitudes, and practices with each domain included 20 questions: knowledge items were multiple-choice; attitude items used a yes and no type questions; practice items measured the frequency of safety behaviors. Two senior radiologists reviewed the tool for content validity, followed by a pilot test.

Scoring: Responses were scored out of 20 per domain. Knowledge and practice items were scored as 1 (correct/safe) or 0 (incorrect/unsafe). Attitude responses were dichotomized into positive (1) and negative (0). Scores were classified as poor (<10), moderate (10–14), or good (\geq 15).

Data Analysis: Data were entered in Excel and analyzed using SPSS v25. Descriptive statistics summarized demographic and KAP scores. Oneway ANOVA and independent t-tests evaluated differences across experience levels (<1 year, 1–5 years, 5–10 years, >10 years) and gender. A p-value <0.05 indicated statistical significance.

RESULTS

Participant Demographics: A total of 72 health care providers in department of radiodiagnosis participated in the study. The demographic breakdown is summarized in Table 1.

Table 1: Demographic characteristics of participants (N = 72)			
Characteristic	Category	N (%)	
Gender	Male	42 (58.33%)	
	Female	30 (41.67%)	
Work group in department	Radiologists & Residents	32 (44.44%)	
	Technician and nurses	16 (22.22%)	
	Support staff and Training interns	24 (33.33%)	
Years of work experience	< 1 year	12 (17%)	
	1–5 years	20 (27.78%)	
	5–10 years	25 (34.72%)	
	> 10 years	15 (20.83%)	

Knowledge, Attitude and Practice Scores:

Overall KAP performance is presented in Table 2. The mean knowledge, attitude, and practice scores were 14.0 ± 4.1 , 16.3 ± 2.8 , and 15.0 ± 3.6 , respectively. A majority of participants

demonstrated good scores across all domains: 66.7% in knowledge, 61.1% in attitude, and 69.4% in practice. One-way ANOVA revealed statistically significant differences in all domains based on work experience (p < 0.05).

Table 2: MRI safety knowledge, attitude, and practice (KAP) scores among participants (N = 72). "Good" = score \geq 75% of items correct; "Moderate" = 50–74%; "Poor" < 50%.

Domain	Mean Score ± SD	Good n (%)	Moderate n (%)	Poor n (%)	P value
Knowledge	14.0 ± 4.1	48 (66.7 %)	18 (25.0 %)	8 (11.1 %)	0.016
Attitude	16.3 ± 2.8	44 (61.1 %)	20 (27.8 %)	10 (13.9 %)	0.024
Practice	15.0 ± 3.6	50 (69.4 %)	15 (20.8 %)	9 (12.5 %)	0.016

Knowledge deficits were evident in specific areas; for instance, only 50% of respondents were aware of the significance of the 5 and 9 Gauss lines in MRI safety, and 30% were unaware of the risk of radiofrequency (RF) burns associated with metallic tattoos during MRI scanning.

On a positive note, nearly all staff (95%) recognized that ferromagnetic objects (like oxygen cylinders or stretchers) can turn into dangerous projectiles in the MRI suite, and 90% knew the correct safety steps to take if a patient has a cardiac pacemaker.

Attitudes towards MRI safety were generally very positive. For instance, almost all staff agreed that strict screening of patients and personnel before MRI is essential, and 85% expressed willingness to attend regular MRI safety training sessions.

A small number (13.9 %) had a poor attitude score, often corresponding to some complacency or disagreement with certain safety measures (e.g., a few felt that emergency responders entering MRI do not need special precautions and scan could be done – an attitude that could be risky).

Practice of MRI safety protocols:

The mean practice score was 15.0 (\pm 3.6). About 50 participants (69.4 %) were classified as having good MRI safety practices (consistently performing the recommended safety steps), while 15 (20.8 %) had moderate practice and 9 (12.5%) had poor practice levels (frequently skipping or inconsistently performing safety measures).

Common lapses in practice included incomplete screening (e.g., only patients were screened, but not every accompanying person was properly screened in a few emergency cases. Notably, even some participants with high knowledge acknowledged that in practice they occasionally bypass certain precautions due to time pressures or understaffing. This points to a gap between knowledge/attitude and actual practice.

Table 3: Mean KAP scores by work role with one-way ANOVA analysis				
Domain	Work Group Mean ± SD		F-value	P-value
	Radiologists & Residents 15.8 ± 2.5		12.34	< 0.001
Knowledge	Technicians/Nurses/Support Staff 14.0 ± 2.6			
	Interns 11.5 ± 2.8			
Attitude	Radiologists & Residents 17.6 ± 2.4		7.8	0.001
	Technicians/Nurses/Support Staff 16.8 ± 2.8			
	Interns	13.0 ± 3.2		
Practice	Radiologists & Residents	16.5 ± 2.4		
	Technicians/Nurses/Support Staff 14.6 ± 3.5		5.7	0.005
	Interns	13.1 ± 4.0		

Comparison by role of work

One-way ANOVA revealed significant differences in Knowledge (F = 12.34, p < 0.001), Attitude (F = 7.8, p = 0.001), and Practice (F = 5.7, p = 0.005) scores across work groups. Radiologists & Residents consistently scored highest across all domains, followed by Technicians/Nurses/Support Staff, with Interns scoring the lowest. Post hoc analysis confirmed that Interns had significantly lower scores than Radiologists & Residents, particularly in Knowledge and Attitude domains. These findings highlight the need for targeted training to improve MRI safety awareness and practices, especially among interns and junior staff. Post hoc analysis showed that interns scored significantly lower than radiologists and residents in all domains, especially knowledge and attitude. No significant differences were observed between interns and technicians, though a downward trend was noted. The overall differences across groups were statistically significant, underscoring the need for focused training interventions for interns and junior staff.

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Domains	Mean scores ± standard deviation			E Voluo	Dualua	
	< 1 year	1–5 years	5-10 years	> 10 years	F -value	r -value
Knowledge	12 ± 3.6	14.2 ± 2.1	15.7 ± 2.6	17.2 ± 2.5	17.5	< 0.001
Attitude	15.2 ± 3.0	15.4 ± 2.5	15.8 ± 3.0	15.4 ± 2.1	0.11	0.95
Practice	12.1 ± 4.0	14.6 ± 2.7	16.5 ± 2.4	17.4 ± 2.2	9.76	< 0.001

Comparison by Experience Table 4: Mean KAP scores by work experience category with ANOVA analysis

ANOVA results show that Knowledge and Practice scores significantly increased with years of experience (p < 0.001), indicating that greater experience is associated with better understanding and implementation of MRI safety protocols. In contrast, Attitude scores remained consistent across all experience groups (p = 0.956), suggesting a uniformly positive outlook toward MRI safety irrespective of experience.

Post hoc analysis revealed that participants with less than 5 years of experience had significantly lower Knowledge and Practice scores compared to those with more than 5 years. Notably, the most pronounced differences were between the <1 year and 5–10 or >10 years groups. However, no significant differences were observed in the 5–10 years and >10 years groups, suggesting a plateau in scores with increasing experience. These findings highlight the need for focused training in early career stages to enhance MRI safety knowledge and practice.

DISCUSSION

This study assessed the knowledge, attitudes, and self-reported practices related to MRI safety among healthcare providers in the Department of Radiodiagnosis at a rural tertiary care hospital. The findings reveal moderately good knowledge (mean 14.0 ± 4.1), strongly positive attitudes (mean 16.3 ± 2.8), and reasonably good safety practices (mean 15.0 ± 3.6), with good performance in 66.7%, 61.1%, and 69.4% of participants, respectively.

Encouragingly, the majority were aware of core MRI safety risks, such as the projectile effect of ferromagnetic objects, and expressed a willingness to comply with safety protocols. This foundational awareness and positive attitude are essential for cultivating a culture of safety.

Our findings are comparable to those of Alelyani et al., who reported average MRI safety knowledge of ~60% among healthcare workers, and Alhazmi et al., who found positive safety attitudes among medical students.^[4,5]

The slightly higher scores in our study (~70% good knowledge/practice) may reflect the benefit of regular exposure to MRI protocols in a radiology department setting. However, as seen in previous studies, even within radiology, knowledge was not uniformly high. Some staff lacked awareness of specific safety guidelines, including the significance of the 5 and 9 Gauss lines or risks from metallic tattoos.

A concerning finding was the knowledge–practice gap. Although 66.7% demonstrated good knowledge, only 69.4% consistently followed safety protocols, and specific safety lapses were reported (e.g., incomplete screening of attendants in emergencies). This disconnect is consistent with prior literature by Asiri et al.^[6] Which shows that knowledge does not always translate into practice, especially under time constraints, understaffing, or routine complacency.

Work experience had a statistically significant impact on knowledge and practice (p < 0.001), with those having >10 years of experience scoring highest. This aligns with expectations that prolonged exposure and accumulated training improve awareness. However, attitude scores did not vary significantly across experience levels (p = 0.956), indicating that even junior staff possess a commendable outlook toward MRI safety—possibly influenced by departmental emphasis or current educational curricula.

Differences by job role also revealed important trends. Radiologists and residents had significantly higher KAP scores compared to interns (p < 0.001), mirroring other studies that showed radiology-trained staff outperforming general nursing or allied staff in safety knowledge.^[3,5] Nevertheless, even among trained staff, knowledge gaps remained, suggesting the need for periodic reinforcement.

These results emphasize that MRI safety training should not be limited to radiology staff. Several MRI-related incidents in hospitals involve personnel from other departments. As such, broad institutional MRI safety orientation programs for emergency teams, anesthesia staff, and patient escorts are warranted.

Implications for Practice

The observed knowledge–practice gap underscores the need for:

- Annual mandatory MRI safety training for all MRI suite personnel.
- Structured pre-scan checklists to ensure protocol compliance under pressure.
- A non-hierarchical safety culture where all staff feel empowered to raise concerns.
- Adequate staffing and scheduling that allow sufficient time for safety protocols.
- Ensuring that both junior and senior staff remain updated on evolving MRI safety recommendations (e.g., updated implant guidelines, device safety) is also crucial.

Strengths and Limitations

A key strength of this study is its focus on a rural tertiary care setting, where such data are sparse. It

captures diverse roles and experience levels within the MRI workflow. However, limitations include:

A modest sample size (N = 72), limiting generalizability.

Reliance on self-reported practices, which may be influenced by social desirability bias.

The binary scoring of attitude and practice from Likert responses may reduce granularity.

Future research incorporating direct observational assessments or multi-center sampling could address these gaps.

CONCLUSION

Healthcare providers in the department of radiodiagnosis department exhibited moderately high MRI safety knowledge and strong attitudes, but only a propotion demonstrated full adherence to safe practices. While experience correlated positively with knowledge and practice, attitude was uniformly high across all groups. These findings highlight the need for targeted, regular MRI safety training and system-level enforcements-such as checklists and safety audits-to ensure that awareness and intent translate behavior. into consistent safe Strengthening education, accountability, and crossdisciplinary safety culture can significantly reduce avoidable MRI-related incidents and enhance overall safety in imaging environments.

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