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Is Artificial Intelligence a Threat to Radiologists? Perception of Radiologists in Saudi Arabia

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Abstract **Background:** The integration of Artificial Intelligence (AI) into radiology is rapidly transforming diagnostic workflows, image interpretation and clinical decision-making. While AI holds the potential to augment radiological practices, concerns about its impact on professional roles persist. This study aimed to assess the knowledge, attitudes and perceptions of radiologists in Saudi Arabia regarding the implementation of AI in their field and to explore their readiness for AI integration. **Methods:** A cross-sectional study was conducted at the College of Medicine, Northern Border University, Arar, Saudi Arabia, from March 2024 to February 2025. A validated, structured questionnaire was distributed via digital platforms to 103 practicing radiologists across various regions. The survey assessed demographic details, awareness, training exposure, attitudes and perceived impact of AI. Data were analyzed using IBM SPSS Statistics v20, with chi-square and t-tests applied. A p-value <0.05 was considered statistically significant. **Results:** Among the respondents, 85.4% had heard of AI and 72.8% reported a basic understanding of its principles. Only 9.7% feared that AI might replace radiologists, while a substantial majority (70%) expressed a strong interest in pursuing professional development in AI. Notably, awareness and knowledge were significantly higher among younger and less-experienced radiologists (p<0.001). **Conclusions:** Radiologists in Saudi Arabia generally perceive AI as an opportunity rather than a threat. While most have basic awareness, there is a critical need for structured educational programs to enhance their understanding and practical skills. Integrating AI-focused training into continuous professional development and national radiology curricula is essential to ensure successful adoption and optimal patient care.

Key Words Artificial Intelligence, Radiology, Perception, Professional Development, Saudi Arabia

INTRODUCTION

Artificial Intelligence (AI), described as any program, mechanism or tool capable of identifying modifications in its environment to accomplish specific objectives, has profoundly influenced not only medicine but also multiple facets of modern life [1]. The foundational concept, introduced by Alan Turing in 1950, proposed that computers could emulate human intelligence [2]. In healthcare, AI has demonstrated promising utility across various specialties by predicting prognoses, supporting clinical decision-making and performing complex image analyses-particularly in radiation oncology.

In radiology, AI applications are increasingly being integrated into workflows for tasks such as mammography

screening, report generation, cancer staging and detection of incidental findings [3]. These tools enhance efficiency by reducing radiologists' workload and improving reporting accuracy and turnaround time [4,5].

Several international studies have evaluated radiologists' awareness and perceptions of AI. For example, a study from the United Arab Emirates highlighted a lack of knowledge and underappreciation of AI's potential, which may have limited its utility [6]. Similarly, research in Ghana revealed that although 97% of radiologists had heard of AI, their knowledge remained generally average [7]. In Saudi Arabia, a previous study reported that 69% of radiologists had basic knowledge of AI and only 29% viewed it as a potential threat [8]. In contrast, 90% of Indian radiologists expressed concern about job loss due to AI integration [9]. Nonetheless, a promising trend has emerged: a majority of radiologists, including 97% in one study, are interested in learning about and integrating AI into their practice [10].

Despite global interest, the local context in Saudi Arabia remains underexplored. Understanding the current knowledge, attitudes and training needs of Saudi radiologists is crucial, especially given the rapid technological evolution in medical imaging. This study addresses that gap by assessing radiologists' perceptions of AI across various regions in the Kingdom.

The objective of this study is to evaluate the perception of AI among radiologists in Saudi Arabia, contribute to national data and support the formulation of guidelines for structured in-service training. Such training can enhance radiologists' ability to leverage AI technologies for improved reporting efficiency, diagnostic accuracy and patient management.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional study was conducted from March 2024 to February 2025 after obtaining ethical approval from the Local Committee of Bioethics at Northern Border University, Arar, Saudi Arabia (approval letter no. 5/24/H, dated 31/01/2024). The study aimed to assess the perceptions, knowledge and training needs related to Artificial Intelligence (AI) among radiologists practicing in Saudi Arabia.

Questionnaire Development

The survey instrument was adapted from a previously validated study by Alghamdi and Alashban [8] and further refined based on an extensive review of relevant literature obtained from databases such as Google Scholar, PubMed and ScienceDirect. The questionnaire was translated into an online format using Google Forms for ease of distribution and completion.

To ensure content validity, the revised tool was reviewed and validated by two experts in community medicine following a pilot study. The finalized questionnaire consisted of six sections with a total of 31 questions, covering the following domains:

- Demographics (e.g., age, gender, specialization, years of experience, workplace and region)
- AI Education History (binary yes/no questions)
- Knowledge of AI Concepts (e.g., machine learning, deep learning)
- Attitudes toward AI in Radiology (measured via Likert scale)
- AI-related Practices in the Workplace
- Open-ended Comments and Suggestions

Sample Size and Sampling Technique

The required sample size was calculated as 103 radiologists based on a 90% confidence level, 7.5% margin of error and an expected prevalence of 69% having basic knowledge of AI [8]. The formula used was:

$$n = \frac{Z^2 1-\alpha}{2} \times \frac{P(1-P)}{d^2}$$

A non-probability consecutive sampling method was employed. All radiologists currently practicing in Saudi Arabia who provided informed consent were eligible for inclusion. Those not in active service or who declined to participate were excluded. Consent was implied by the voluntary completion of the online survey.

Data Collection Procedure

The survey link was disseminated through professional radiology WhatsApp groups and email lists across all regions of Saudi Arabia. The principal investigator actively promoted participation using professional networks to enhance reach and ensure regional representation. Participation was voluntary and no incentives were provided.

Ethical Considerations

Ethical approval was secured prior to data collection. While explicit written consent was not obtained due to the online nature of the survey, informed consent was implied through the act of completing the questionnaire. Anonymity and confidentiality of all responses were assured. No identifying information was collected. Ethical aspects related to the use of online platforms and data protection were considered during the design of the study.

Data Analysis

Data were entered and analyzed using IBM SPSS Statistics for Windows, Version 20 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize demographic and categorical variables in terms of

frequencies and percentages. Continuous variables were presented as Means±standard deviation.

Comparative analyses were conducted using chi-square tests for categorical variables and independent-samples t-tests for continuous variables. A p-value ≤0.05 was considered statistically significant. Stratification techniques were applied to control for potential confounding variables, such as age, experience and type of institution.

RESULTS

The online survey was completed by 103 radiologists from all over the Kingdom of Saudi Arabia. Males constituted 59.2% (n = 61) while 40.8% (n = 42) were female radiologists. The majority of the radiologists, 43.7% (n = 45) belonged to the age group 30 to 40 years. The majority of the participants (58%, n = 60) were FCPS, the rest had other forms of specialization. The maximum number 79.6% (n = 82) were working in public hospitals. The majority 66% (n = 68) had less than 5 years of experience. The maximum number of radiologists responded from the western region (52.4%, n = 54) (Table 1).

The radiologists who had heard about AI were 85.4% (n = 88). Out of all, 72.8% (n = 75) had basic information about AI. More than three-quarters of the radiologists knew about deep learning and machine learning. Ninety-four percent (n = 97) of the participants did not receive any education about AI during their degree and 79.6% (n = 82) did not receive any professional training in AI use. The 69.9% (n = 72) radiologists demanded that AI should be taught as continuous professional development (Table 2).

Out of all the respondents, 97(94.2%) described themselves as people who enjoy technology. The majority of the participants (69.9%, n = 72) were rather comfortable in explaining an algorithm. More than three-quarters (78.6%, n = 81) radiologists were of ready to adapt to the novel technology of AI in their field. Only 15.5% (n = 16) of radiologists were confident enough to explain the difference between AI, machine learning and deep learning. Only 29.3% (n = 30) of radiologists were apprehensive about the introduction of AI into radiology. About 73% (n = 75) of radiologists were excited about the introduction of AI into radiology. About 66% (n = 68) of radiologists thought that AI already played a role in radiology. About 82% of radiologists disagreed with the notion that AI will replace them. About 65% of radiologists thought that AI played an important role in radiology (Table 3).

A significant relationship was found between age and experience with the knowledge of AI.

Table 1: Demographics of participants

Demographic variables		Frequency (n)	Percentage (%)
Age	30-40	45	43.7%
	41-50	34	33%
	51-60	13	12.6%
	>60	11	10.7%
Experience	<5 Years	68	66%
	6-10	13	12.6%
	11-15 Years	12	11.7%
	>15 Years	10	9.7%
Designation	Registrar	49	47.6%
	Senior Registrar	43	41.7%
	Consultant	11	10.7%
Gender	Male	61	59.2%
	Female	42	40.8%
Education	PhD	10	9.7%
	Research Fellowship	13	12.6%
	MS	5	4.9%
	FCPS	60	58.3%
	FRCR	15	14.6%
Hospital	Public	82	79.6%
	Private	21	20.4%
Region	Western	54	52.4%
	Eastern	24	23.3%
	Northern	18	17.5%
	Southern	7	6.8%
City	Alhasa	12	11.7%
	Aljouf	4	3.9%
	Arar	4	3.9%
	Damam	12	11.7%
	Hail	5	4.9%
	Jeddah	29	28.2%
	Madinah	13	12.6%
	Makkah	12	11.7%
	Najran	7	6.8%
	Tabuk	5	4.9%

Table 2: Knowledge about artificial intelligence

Knowledge about Artificial Intelligence	Categories	Frequency (n)	Percentage (%)
Heard about AI?	Yes	88	85.4%
	No	15	14.6%
Heard about deep learning?	Yes	78	75.7%
	No	25	24.3%
Heard about machine learning?	Yes	82	79.6%
	No	21	20.4%
Rate your knowledge about “deep learning”/AI	Basic	75	72.8%
	Intermediate	18	17.5%
	Advance	10	9.7%
Received education on AI during a primary degree in radiology?	Yes	6	5.8%
	No	97	94.2%
Received training in AI at the workplace?	Yes	21	20.4%
	No	82	79.6%
Noticed increase in articles related to AI in radiology?	Yes	80	77.7%
	No	20	19.4%
	Don’t Know	3	2.9%
Interested in continuous professional development program on use of AI in radiology	Yes	72	69.9%
	No	27	26.2%
	Don’t Know	4	3.9%
Think radiology educational programs are regularly reviewed to develop AI skills in professionals	Strongly disagree	17	16.50%
	Disagree	2	1.9%
	Neutral	10	9.7%
	Agree	52	50.5%
	Strongly agree	22	21.4%

Table 3: Attitude and practices towards AI

Domain	Questions	Categories	Frequency (n)	Percentage (%)
Knowledge	Would you describe yourselfas someone who enjoys technology?	Yes	97	94.2%
		No	3	2.9%
		Don’t Know	3	2.9%
	Would you feelcomfortableexplaining what an algorithm is?	Yes	72	69.9%
		No	20	19.4%
		Don’t Know	11	10.7%
	Do you feel radiologists shouldembrace AI?	Yes	81	78.6%
		No	12	11.7%
		Don’t Know	10	9.7%
	Do you understanddifferencebetweenmachine learning, deep learning and AI?	Yes	16	15.5%
		No	83	80.6%
		Don’t Know	4	3.9%
Attitude	I am apprehensive about theintroduction of AI into radiology	Strongly disagree	20	19.40%
		Disagree	3	2.90%
		Neutral	50	48.50%
		Agree	20	19.40%
		Strongly agree	10	9.70%
	I am excited about the introduction of AI into radiology	Strongly disagree	6	5.80%
		Disagree	2	1.90%
		Neutral	20	19.40%
		Agree	65	63.10%
		Strongly agree	10	9.70%
	I think AI already plays a rolein radiology?	Strongly disagree	10	9.70%
		Disagree	5	4.90%
		Neutral	20	19.40%
		Agree	60	58.30%
		Strongly agree	8	7.80%
	I think the patient experiencewill be improved with AI in radiology	Strongly disagree	12	11.70%
		Disagree	10	9.70%
		Neutral	15	14.60%
		Agree	54	52.40%
		Strongly agree	12	11.70%
	I think AI is going to replace radiologist	Strongly disagree	11	10.70%
		Disagree	74	71.80%
		Neutral	8	7.80%
		Agree	7	6.80%
		Strongly agree	3	2.90%

	I think it will take some time for AI to affect role of radiologists.	Strongly disagree	10	9.70%
		Disagree	8	7.80%
		Neutral	9	8.70%
		Agree	60	58.30%
		Strongly agree	16	15.50%
Practice	AI will affect the patient scheduling	Strongly disagree	10	9.7%
		Disagree	3	2.9%
		Neutral	7	6.8%
		Agree	74	71.8%
		Strongly agree	9	8.7%
	AI will affect the communication and patient care AI will affect the image interpretation	Strongly disagree	9	8.7%
		Disagree	7	6.8%
		Neutral	3	2.9%
		Agree	75	72.8%
		Strongly agree	9	8.7%
		Strongly disagree	10	9.7%
	AI will affect the image interpretation	Disagree	2	1.9%
		Neutral	13	12.6%
		Agree	70	68.0%
		Strongly agree	8	7.8%
	I think AI already plays an important role in radiology	Strongly disagree	15	14.6%
		Disagree	6	5.8%
		Neutral	15	14.6%
		Agree	60	58.3%
		Strongly agree	7	6.8%

Table 4: Association of Knowledge of AI with age

Knowledge of AI		Age								p-value
		30-40		41-50		51-60		>60		
		45		34		13		11		
		n	%	n	%	n	%	n	%	
Heard about AI?	Yes	42	93.3%	34	100%	6	46.2%	6	54.5%	<0.001*
	No	3	6.7%	0	0%	7	53.8%	5	45.5%	
Heard about deep learning?	Yes	39	86.7%	29	85.3%	6	46.2%	4	36.4%	<0.001*
	No	6	13.3%	5	14.7%	7	53.8%	7	63.6%	
Heard about machine learning?	Yes	40	88.9%	30	88.2%	6	46.2%	6	54.5%	0.001*
	No	5	11.1%	4	11.8%	7	53.8%	5	45.5%	
Rate your knowledge about “deep learning”/AI	Basic	32	71.1%	24	70.6%	8	61.5%	11	100%	0.135
	Intermediate	7	15.6%	6	17.6%	5	38.5%	0	0%	
	Advance	6	13.3%	4	11.8%	0	0%	0	0%	
Received education on AI during the primary degree?	Yes	2	4.4%	0	0%	4	30.8%	0	0%	0.001*
	No	43	95.6%	34	100%	9	69.2%	11	100%	
Received training in AI at the workplace?	Yes	5	11.1%	4	11.8%	8	61.5%	4	36.4%	<0.001*
	No	40	88.9%	30	88.2%	5	38.5%	7	63.6%	

Table 5: Association of knowledge of AI with experience

Knowledge of AI		Experience								p-value
		<5		6-10		11-15		>15		
		68		13		12		10		
		n	%	n	%	n	%	n	%	
Heard about AI?	Yes	65	95.6%	11	84.6%	7	58.3%	5	50%	<0.001*
	No	3	4.4%	2	15.4%	5	41.7%	5	50%	
Heard about deep learning?	Yes	59	86.8%	9	69.2%	5	41.7%	5	50%	0.001*
	No	9	13.2%	4	30.8%	7	58.3%	5	50%	
Heard about machine learning?	Yes	59	86.8%	11	84.6%	7	58.3%	5	50%	0.011*
	No	9	13.2%	2	15.4%	5	41.7%	5	50%	
Rate your knowledge about “deep learning”/AI	Basic	47	69.1%	10	76.9%	12	100%	6	60%	0.138
	Intermediate	12	17.6%	2	15.4%	0	0%	4	40%	
	Advance	9	13.2%	1	7.7%	0	0%	0	0%	
Received education on AI during the primary degree?	Yes	1	1.5%	2	15.4%	0	0%	3	30%	0.001*
	No	67	98.5%	11	84.6%	12	100%	7	70%	
Received training in AI at the workplace?	Yes	6	8.8%	6	46.2%	4	33.3%	5	50%	0.001*
	No	62	91.2%	7	53.8%	8	66.7%	5	50%	

Almost 93% (n = 42) of the radiologists less than 40 years of age had heard of AI (p<0.001). However, 55% of radiologists above 60 years of age had heard of AI. Similarly, the younger radiologists having lesser experience had more heard of AI than their seniors (p<0.001) (Table 4, 5).

DISCUSSION

The integration of artificial intelligence (AI) into medical imaging has significantly enhanced diagnostic accuracy and operational efficiency. However, the effective utilization of AI tools in radiology hinges on the professionals' comprehension of its functions and clinical applications [11]. As AI continues to evolve, discussions around its potential to disrupt or replace radiologists have intensified [12]. These ongoing debates underline the importance of understanding radiologists' perceptions, particularly within specific local contexts such as Saudi Arabia.

In this study, 85.4% of radiologists reported having heard of AI and 72.8% acknowledged having basic knowledge of its use in radiology. This level of awareness is considerably higher than that reported in several previous international studies. For instance, Huisman *et al.* [13] found that only 21% of surveyed radiologists had prior exposure to AI and just 30% had basic knowledge of its applications. Similarly, a French study reported that only 23% of radiologists had foundational knowledge of AI [14]. When compared to earlier local data from Saudi Arabia, which showed that 69% of radiologists had basic knowledge [8], our study demonstrates a positive upward trend.

Despite this improvement, advanced understanding remains limited-only 9.7% of respondents in our study reported having advanced knowledge of AI, a figure closely aligned with Huisman *et al.* [13] finding of 11%. This indicates an urgent need for structured education and training initiatives to deepen radiologists' understanding of AI's practical uses in clinical workflows [16].

Interestingly, only 9.7% of our respondents expressed concern about AI replacing radiologists, a stark contrast to findings by Tajaldeen and Alghamdi [17], where 73% reported such fears. This shift may reflect increasing familiarity with AI and a growing realization that it is more likely to augment radiological practice rather than replace professionals. A recent international study also supports this perspective, showing that 88.9% of radiologists believe their roles will remain essential despite AI advancements [18]. As the technology matures, continuous professional education and evidence-based communication will be crucial in dispelling myths and reinforcing AI's role as a collaborative tool in radiology.

The enthusiasm for learning AI was another key highlight. Approximately 70% of the participants expressed interest in participating in continuous professional development programs focused on AI. This is consistent with another study, which showed that up to 90% of radiologists favored in-service education on AI [19]. This strong interest underscores the need for national and institutional strategies to introduce AI into radiology curricula, professional workshops and certification programs. Such steps are particularly relevant in a rapidly developing healthcare system like Saudi Arabia, which aims to remain aligned with international technological standards [20].

Subgroup Differences: Age and Experience

Our findings revealed significant associations between AI knowledge and both age and experience. Radiologists under 40 years of age (93%) and those aged 41-50 years (100%) were significantly more likely to have heard of AI than their older counterparts ($p<0.001$). While 71% of radiologists under 40 years and 70% of those aged 41-50 reported basic knowledge of AI, this proportion dropped in the older age groups ($p = 0.135$). Similar trends were noted in studies assessing information and communication technology (ICT) knowledge, where younger professionals demonstrated better proficiency [21]. This generational divide likely reflects differences in training exposure and technological engagement, with newer residency programs increasingly incorporating AI-related content.

However, not all literature supports this trend. A Norwegian study found that older radiologists could possess knowledge levels comparable to their junior colleagues, with 70% of those above 50 years and 24% below 50 showing average AI knowledge ($p = 0.077$) [22]. These discrepancies highlight the need for universal training initiatives, regardless of experience level.

Experience-wise, radiologists with fewer than five years in practice had significantly higher levels of AI awareness-95.6% had heard of AI, compared to only 50% of those with over 15 years of experience ($p<0.001$). Knowledge appeared to decline progressively with years of experience. This pattern may be due to the fact that recently trained radiologists are more likely to have been exposed to AI during their medical education. In line with our findings, a study across Arab countries also reported that professionals with less experience had significantly greater AI knowledge ($p = 0.024$), attributing this to more current academic exposure (1.486 ± 0.5).

In summary, while the perception of AI among radiologists in Saudi Arabia is generally positive-with low levels of fear and high levels of interest in further learning-there are clear disparities in knowledge based on age and experience. Addressing these gaps through structured training and curriculum reforms is essential to ensure equitable AI adoption across all levels of practice.

Future Research and Recommendation

Given the rapidly evolving nature of AI in medicine, future research should prioritize multi-centric, larger-scale studies to strengthen generalizability. Equal regional representation is essential to understand localized barriers and facilitators of AI integration. Comparative international studies could also offer valuable global insights.

Subsequent investigations should evaluate the practical, clinical, ethical and legal aspects of AI use in radiology, as these remain underexplored [23]. There is also a pressing need for randomized controlled trials to assess the effectiveness of structured, in-service AI training programs and their impact on clinical outcomes.

In addition, research should extend beyond radiology to include other medical specialties such as surgery, pathology

and emergency medicine**,** as AI is increasingly becoming relevant across various disciplines. Cross-specialty research can help identify common challenges and interdisciplinary strategies for AI adoption. Finally, studies should also investigate ethical considerations, including patient data protection, bias in algorithms and transparency of AI decision-making processes, to ensure responsible and equitable use of AI in healthcare [24].

CONCLUSION

This study concludes that radiologists in Saudi Arabia largely view artificial intelligence not as a threat but as an evolving tool that can enhance their professional roles. While the majority of respondents reported basic awareness of AI, advanced knowledge remains limited, particularly among more experienced practitioners. Encouragingly, a substantial proportion of radiologists expressed strong interest in continuous education on AI.

These findings underscore the urgent need for structured national guidelines and training programs to equip radiologists with the skills necessary to engage meaningfully with AI technologies. As radiology continues to evolve in the age of digital transformation, proactive efforts in education and policy-making are essential to ensure that professionals are prepared to leverage AI safely and effectively.

Limitations

This study has several limitations that should be acknowledged. First, the sample size was relatively small and may not fully represent the diversity of radiologists across Saudi Arabia. Second, the use of a non-probability sampling method and reliance on digital platforms such as WhatsApp may have introduced selection bias, potentially excluding radiologists with limited access to technology or those in rural areas. Additionally, although participants were drawn from multiple regions, regional representation was unequal. Future studies should aim for balanced geographic sampling to identify region-specific variations in AI adoption and preparedness.

Moreover, this study focused primarily on perceptions, knowledge and self-reported practices. It did not assess the practical application, clinical integration or real-world use of AI tools. Furthermore, critical domains such as ethical concerns, data privacy, legal implications and algorithmic accountability were not explored in depth. These areas are crucial for the safe and effective deployment of AI in radiology and warrant inclusion in future research designs.

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Conflicts of Interest

The authors declare no conflict of interest related to this study.

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