Section: Radiology

Original Research Article

RADIOLOGISTS UNPLUGGED: EXPLORING KNOWLEDGE, ATTITUDE, AND PRACTICE AROUND AI IN MEDICAL IMAGING FOR A SMARTER FUTURE!

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Abstract

The integration of Artificial Intelligence (AI) in medical imaging can enhance diagnostic accuracy and streamline workflows in radiology, leading to improved patient outcomes. A study involving 74 radiologists across various Indian medical colleges and hospitals assessed their knowledge, attitudes, and practices regarding AI. Most respondents (80%) had only a basic understanding of AI, with 5% unaware of its applications. However, a significant majority believe that AI is essential for radiology and should be part of a radiologist's knowledge base. The study highlighted the importance of transparency in AI algorithms, the need for rigorous validation with diverse datasets, and ethical considerations like bias and patient privacy. Collaboration between AI developers and medical professionals is crucial for aligning AI tools with clinical needs. Best practices for AI integration include ensuring technical support and regular updates to facilitate smooth implementation.

INTRODUCTION

The introduction of Artificial Intelligence in the field of medical imaging can bring diagnostic accuracy to a new dimension, with streamlined workflows and thus better patient outcomes in Radiology. Among the numerous concerns stood knowledge gaps, uncertainty about the validation of AI software, and ethical considerations. This discussion was conducted through reviews of knowledge, attitude, and practice regarding AI among radiologists. The importance of transparency in AI algorithms along with complete validation using diverse datasets to aid in regulatory approvals that drive trust in AI. Finally, this article looked at some of the ethical considerations surrounding AI, such as bias and patient privacy, before describing best practices for selecting AI software, including making sure there is technical support and regular updates to ensure a smooth integration. The involvement of radiologists in the development of AI is also emphasized. Collaboration between AI developers and medical professionals is considered crucial to promoting AI tools in clinical needs.

MATERIALS AND METHODS

An online questionnaire was designed by using google forms online program [Table 1]. The study was conducted in medical colleges & hospitals located in different regions in India. A total of 74 participants completed the questionnaire, of which 34 were Post graduate students in radiology, 30 were senior residents and fellows, and 10 were consultants.

Table 1: Online questionnaire presented to radiology residents & consultants

Questions			
Name			
Phone & Email			
How old are you?			
Gender?			
Current Position?			
Working place?	University/Teaching hospital, Hospital, Private practice, Private research centre, Private company, Other		
Do you have a brief idea about Artificial Intelligence?	Yes	No	Somewhat

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Do you feel like you understand the basic concepts of Deep learning, machine learning, AI & convolutional neural networks etc.?	Yes, I have	I have a vague sense what they mean	I have heard them, but don't really understand them
Do you know what big data and graphic processing data (GPU) is?	Yes	No	Yes, and trained
Do you think AI requires us to acquire a new skill set completely out of our area of expertise?	Yes	No	
Would you be willing to learn these new skills regarding artificial intelligence if it is made easy	Yes	No	Depends
As a radiologist, do you use Artificial Intelligence software on daily basis?	Yes	No	
Do you think artificial intelligence will change the practice of radiology 10 to 20 years in the future	No / to minimum effect	The job will be changed dramatically	The job will be obsolete
In which radiological subspecialties do you see AI having the biggest impact?	◯ Breast imaging	◯ Cardiovascular imaging	
	◯ Emergency imaging	◯ GIT & Abdomen imaging	
	◯ Head & Neck imaging	◯ Interventional procedures	
	Musculoskeletal imaging	◯ Oncology Imaging	
Do you think AI is a threat to new age Radiologists?	Yes	No	
Will your current knowledge about AI change your decision to continue your career as radiologist?	Yes	No	
Do you think AI will influence decision making in interventional radiological procedures?	Yes	No	
Do you think the introduction of AI will increase doctor patient interaction/ role of patient care in radiology?	More impersonal;	More interactive;	Unchanged
Do you think artificial intelligence has a role in other specialities also?	Yes	No	

RESULTS

Based on the survey, majority of our respondents were between 25 to 47 years old, with a mix of male and female radiologists. The respondents work in various setups including hospitals (20%), universities (55%), and private practices (25%), holding roles from junior residents to consultants. Almost Most respondents (80%) have a basic or vague understanding of AI. A few respondents (5%) are unaware of AI's applications. 80 % of them believe that AI in radiology is necessary and should form part of a radiologist's knowledge base. [Figure 1]

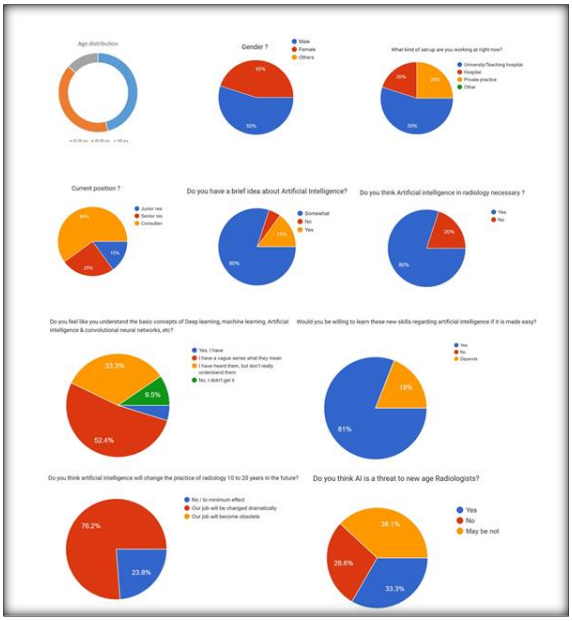

Figure 2: Response from radiologists

A significant number (95%) feel AI requires them to acquire new skills, but they are willing to learn if it is made accessible. A common sentiment is the understanding of basic AI concepts like deep learning and machine learning is vague for many (50%). Several respondents (60%) indicated that they are not currently using AI-based applications in clinical practice; although they acknowledge that it may become a key part of future workflows. 75% of them believe AI will change the landscape of radiology in the next 10 to 20 years, especially in subspecialties like breast imaging, emergency imaging, oncology, and interventional procedures. However, there is a split opinion on whether AI will influence decision-making in interventional radiology. Interestingly There is a divided view on how AI will affect patient interactions. Some of us believe (35%) it will make radiology more interactive, while others think it might reduce (30%) the personal element of patient care.

Respondents' willingness to embrace AI and the acknowledgment that AI may reduce or enhance patient interaction points to a broad recognition of AI's potential. The perception that AI is not a threat to new-age radiologists suggests optimism about AI being an adjunct rather than a common perception of replacement for human expertise.

DISCUSSION

The integration of AI in medical imaging has been expected to be a radical change in the horizon of radiology with all possible prospects of being more accurate in diagnostics, efficient in delivery, and possibly less workload. However, these promises notwithstanding, adopting AI leaves the community of radiologists with so many unknowns. Radiologists, particularly those less familiar with

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AI, often express concerns related to software validation, the ethical implications of AI, and the practicalities of selecting and purchasing AI software. This discussion explores these challenges while also addressing the factors radiologists should consider when integrating AI into their practice.

Knowledge and Attitudes toward AI in Medical Imaging:

Potential of AI in medical imaging lies in its ability to analyse huge amounts of imaging data for patterns that might elude human observation. Significant value has been demonstrated in AI applications, including breast cancer screening, thoracic imaging, and oncology, significantly assisting identification of more difficult-to-spot anomalies such as tumours or lesions. Despite this promise, knowledge gaps remain a critical challenge for the adoption of AI by radiologists. There is evidence that many radiologists are positive about AI-the capability of AI in minimizing diagnostic errors and the simplification of routine image interpretation. However, there is a related drawback, including job insecurity and a lack of thorough training in the use of AI.

A Chinese survey of radiologists has shown that only a few respondents have received special training on AI, though many are studying and conducting research on AI, and limited knowledge of its technical aspects prevented it from being widely applied.[1]

Radiologists who have had exposure to AI through professional networks and conferences tend to have more confidence in the technology, particularly when comparing AI to older tools like Computer-Aided Detection (CAD). However, radiologists in less connected environments or those lacking access to AI education often express scepticism. The Royal College of Radiologists,[2] the British Institute of Radiology and various societies have made efforts to promote AI, but this information does not always reach professionals at all levels.

Uncertainty Surrounding AI Validation and Legal Responsibility:

One of the critical concerns in integrating AI into radiology is the validation of AI models. AI systems, especially those using deep learning algorithms, require extensive and diverse datasets to ensure their reliability across different patient demographics. Radiologists are often unsure whether the AI models they are using have been adequately validated for the populations they serve, which introduces significant hesitation.[3]

The question of legal responsibility further complicates AI adoption. In cases where AI misdiagnoses or fails to identify critical findings, it remains unclear who bears the legal burden—radiologists or the software developers. This ambiguity has left radiologists wary of fully trusting AI in clinical practice without human oversight. Regulatory bodies, such as the FDA and the European Medicines Agency (EMA), play crucial roles in validating AI for clinical use, but the lack of clear guidelines on accountability remains a stumbling block for wider adoption.[4]

Best Practices for Selecting and Implementing AI Software:

Given the complexities of AI in medical imaging, radiologists must adopt a systematic approach when selecting AI tools. Transparency and explainability is one of the most important factors, as radiologists need to understand how an AI algorithm arrives at its conclusions.[5] Trust in AI systems grows when radiologists can verify how the system processed the data to generate its output. Therefore, when evaluating AI tools, it is essential to inquire about the datasets used for training and whether these datasets are representative of the radiologists' patient population.

Another critical consideration is the validation process.[3] Before deploying AI tools in clinical practice, radiologists should inquire about how the software has been validated and tested. Specifically, they should ensure that the AI has been trained on diverse datasets that reflect the patient population they serve. An AI model trained on a limited or biased dataset may produce inaccurate results when applied to a broader, more diverse group of patients.

Furthermore, regulatory approval is an essential factor. AI systems that have received approval from regulatory bodies such as the FDA or the European Medicines Agency or Indian standard (Central Drugs Standard Control Organisation - CDSCO) have undergone rigorous testing to ensure their safety and efficacy. Radiologists should prioritize purchasing software that has met these regulatory standards, as it provides additional assurance of the software's reliability.[6]

When selecting AI software, it is also vital to consider the level of technical support provided by the vendor. Comprehensive training, ongoing support, and regular software updates are necessary to ensure that AI tools are effectively integrated into clinical workflows and adapted to evolving medical practices. Radiologists should seek vendors that offer extensive user support and are responsive to feedback from clinicians.[4]

Finally, the ethical implications of using AI in medical imaging should not be overlooked.[7] AI algorithms, if trained on biased datasets, can perpetuate healthcare disparities by producing skewed results for certain patient populations. Radiologists must ensure that the AI systems they adopt are designed to minimize bias and promote equitable care across all demographic groups. This can be achieved by collaborating closely with AI developers and advocating for ethical practices in AI development.

The Role of Radiologists in AI Development and Implementation:

Radiologists are not just passive end users of AI tools but should be actively involved in shaping their development and implementation. Their clinical expertise is invaluable in defining the tasks AI systems should address and in labelling medical

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images for algorithm training. By participating in these processes, radiologists can help ensure that AI tools meet the practical needs of clinical practice and produce results that align with real-world diagnostic requirements.[8,9]

Collaboration between radiologists and AI developers is crucial for the successful integration of AI in medical imaging. Radiologists provide essential feedback that can help developers refine AI algorithms, making them more accurate and reliable. Moreover, radiologists who are directly involved in AI projects are better positioned to guide the development of tools that fit seamlessly into clinical workflows.

In addition to their role in AI development, radiologists must continuously update their skills to keep pace with technological advancements. As AI continues to evolve, radiologists will need to learn how to interpret AI-generated results,[10] identify potential errors, and understand the limitations of the AI tools they use. Ongoing education and training in AI will be essential for radiologists to fully harness the potential of these technologies and integrate them into their daily practice.

Future Directions and Challenges: While AI holds immense promise for the future of medical imaging, several challenges must be addressed to ensure its successful integration. One of the most pressing issues is the need for standardization across AI systems. Currently, different AI tools may produce varying results depending on the algorithms used and the datasets they were trained on. Standardized protocols for AI development, validation, and implementation are needed to ensure consistency and comparability across different systems.[11,12]

Another challenge is the need for long-term research into the effects of AI on the radiology profession. While initial studies suggest that AI can reduce diagnostic errors and improve efficiency, the long-term impact of AI on radiologists' roles remains unclear. Will AI reduce the demand for radiologists, or will it create new opportunities for radiologists to expand their roles within healthcare? Addressing these questions through continued research will be crucial for shaping the future of radiology in the AI era.

In addition, greater collaboration between radiologists, AI developers, regulatory bodies, and policymakers is needed to establish a framework for the safe and ethical use of AI in medical imaging. Clear guidelines for AI validation, legal responsibility, and ethical practices will help ensure that AI systems are used responsibly and to the benefit of all patients.

Finally, radiologists must advocate for the inclusion of AI training in medical education programs. As AI becomes increasingly prevalent in medical imaging, future radiologists will need to be equipped with the knowledge and skills to use AI tools effectively. By integrating AI education into medical school curricula and continuing education programs, the next generation of radiologists will be better prepared to navigate the AI-driven future of healthcare.

CONCLUSION

AI has the potential to revolutionize medical imaging by enhancing diagnostic accuracy, reducing workloads, and improving patient outcomes. However, radiologists face significant challenges in adopting AI, including knowledge gaps, concerns about validation, legal uncertainties, and ethical implications. To navigate these challenges, radiologists must engage in continuous learning, advocate for transparent AI systems, and collaborate with developers to create tools that meet clinical needs. As AI continues to evolve, radiologists will play a critical role in shaping its integration into healthcare, ensuring that AI tools are both reliable and ethical.

REFERENCES

1. Hwang EJ, Park JE, Song KD, Yang DH, Kim KW, Lee JG, et al. 2023 Survey on User Experience of Artificial Intelligence Software in Radiology by the Korean Society of Radiology. Korean J Radiol. 2024 Jul;25(7):613–22.
2. Artificial intelligence (AI) | The Royal College of Radiologists [Internet]. [cited 2024 Oct 3]. Available from: https://www.rcr.ac.uk/our-services/artificial-intelligence-ai/
3. Chi EA, Chi G, Tsui CT, Jiang Y, Jarr K, Kulkarni CV, et al. Development and Validation of an Artificial Intelligence System to Optimize Clinician Review of Patient Records. JAMA Netw Open. 2021 Jul 23;4(7):e2117391.
4. Gerke S, Minssen T, Cohen G. Ethical and legal challenges of artificial intelligence-driven healthcare. Artif Intell Healthc. 2020;295–336.
5. Amann J, Vetter D, Blomberg SN, Christensen HC, Coffee M, Gerke S, et al. To explain or not to explain?—Artificial intelligence explainability in clinical decision support systems. PLOS Digit Health. 2022 Feb 17;1(2):e0000016.
6. Massella M, Dri DA, Gramaglia D. Regulatory Considerations on the use of Machine Learning based tools in Clinical Trials. Health Technol. 2022;12(6):1085–96.
7. Savulescu J, Giubilini A, Vandersluis R, Mishra A. Ethics of artificial intelligence in medicine. Singapore Med J. 2024 Mar 26;65(3):150–8.
8. Scheek D, Rezazade Mehrizi MohammadH, Ranschaert E. Radiologists in the loop: the roles of radiologists in the development of AI applications. Eur Radiol. 2021;31(10):7960–8.
9. Cheng PM, Montagnon E, Yamashita R, Pan I, Cadrin-Chênevert A, Perdigón Romero F, et al. Deep Learning: An Update for Radiologists. RadioGraphics. 2021 Sep;41(5):1427–45.
10. On the Interpretability of Artificial Intelligence in Radiology: Challenges and Opportunities | Radiology: Artificial Intelligence [Internet]. [cited 2024 Oct 3]. Available from: https://pubs.rsna.org/doi/full/10.1148/ryai.2020190043
11. Wiggins WF, Magudia K, Schmidt TMS, O'Connor SD, Carr CD, Kohli MD, et al. Imaging AI in Practice: A Demonstration of Future Workflow Using Integration Standards. Radiol Artif Intell. 2021 Nov;3(6):e210152.
12. Integrating and Adopting AI in the Radiology Workflow: A Primer for Standards and Integrating the Healthcare Enterprise (IHE) Profiles | Radiology [Internet]. [cited 2024 Oct 3]. Available from: https://pubs.rsna.org/doi/abs/10.1148/radiol.232653.

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