ORIGINAL ARTICLE | Future Diagnosis

Future of Diagnosis: Impact and Rise of Artificial Intelligence in Radiology

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ABSTRACT

Introduction and purpose: This study explores the impact, awareness, and prognosis of Artificial Intelligence (AI) within the domain of Radiology. With objectives focusing on assessing AI's advantages and disadvantages, understanding its awareness within the radiology department, and estimating its future prospects.

Methodology: This study targets a group of 50 individuals including students and faculties from GD Goenka University along with 25 staff members of the radiology department from five hospitals. Using both online and offline questionnaires, data is collected via Google Forms and printed copies of questionnaires. The questions focus on the impact of AI and awareness levels within the individuals relating to radiology background, AI's potential in diagnosis improvement, and its capability to replace radiological staff.

Results: Results indicate a significant belief in AI's impact on radiology from both the participants' groups, with the majority expressing disbelief regarding its potential to replace radiographers and radiologists. The research findings highlight a strong agreement on AI's transformative potential in radiology, with 80% of online and 78% of offline respondents acknowledging its considerable impact. Most of the radiology staff from the hospitals shared that they did not receive any information about the use of AI in radiology prior our interviews. 90% of them believed that AI can have good impact on radiological practices. However, disbelief remains regarding AI's ability to replace human professionals.

Conclusion: In conclusion, the study emphasize on the pivotal role of AI in the future of radiology, including its potential to enhance diagnostic accuracy, streamline work- flows, and improve patient care. As AI continues to integrate into radiological practice, it presents both opportunities and challenges, indicating a new era of informed and efficient diagnoses facilitated by machine learning algorithms and deep learning techniques.

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Introduction

The field of radiography has undergone transformations driven by technological advancements, transitioning from manual film processing to automatic processing and eventually adopting digital image processing. This evolution has revolutionized clinical radiography, particularly with the introduction of cross-sectional imaging modalities like CT and MRI. In the context of healthcare infrastructure inadequacies in low-resource settings, a crucial discussion about the future impact of these innovations on clinical radiography practice is warranted [2, 3, 6, 7].

AI, a powerful technology utilizing computer programs to analyze complex data, has proven to be promising in diagnostic imaging, demonstrating high accuracy in detecting small abnormalities in medical images [1, 5, 10]. However, concerns arise regarding the current focus of AI studies on lesion detection without considering the nature or aggressiveness of abnormalities, potentially leading to biased evaluations. Improvements are required by consistently using clinically meaningful endpoints, such as patient survival, symptoms, and the need for treatment, to provide a more comprehensive evaluation of AI's effectiveness in medical imaging [15].

While improved sensitivity is advantageous, it comes with the challenge of detecting subtle changes of indeterminate significance. For instance, in screening mammograms, artificial neural networks exhibit higher sensitivity for pathological findings, including subtle lesions, though not surpassing radiologists' overall accuracy [1, 5]. Incorporating outcome variables like new diagnoses of advanced disease, disease requiring treatment, or conditions likely to affect long-term survival in AI imaging studies to enhance relevance is important [15]. In recent years, the integration of AI technology into healthcare has sparked significant interest and debate among researchers, practitioners, and policymakers. This paper reviews the impact of artificial intelligence on the current healthcare scenario in radiology, highlighting key findings, trends, and future research areas [10, 11, 12].

While AI demonstrates effectiveness in specific tasks, the global replacement of radiology staff is far from possible. AI can be utilized as a supportive tool, emphasizing the importance of communication and collaboration with professionals like engineers and computer scientists [18]. Despite the growing need for AI education for students, residents, and medical specialists, only a limited number of studies have addressed this need in recent years. The consensus advocates for continuous training, starting from the university phase, consolidating during residency or training, and persisting throughout one's professional career [14, 16].

While numerous training programs are available, they often lack integration into the overall learning path. The emerging nature of AI training creates a significant gap between program offerings and the actual needs of radiology staff. It is evident that comprehensive training encompassing the use, benefits, challenges, and implementation issues of AI in clinical departments is essential. This ensures increased confidence among clinicians interested in incorporating AI into their careers. Practical exercises with real AI applications should engage students, teaching them effective and critical usage [4, 8, 9, 13].

Literature Review

S. No.	Title of study	Authors	Methodology	Conclusion
1	AI IN MACHINE LEARNING IN RADIOLOGY, CRITERIA FOR SUCCESS	Thrall, J. H, et al.(10)	Involves a comprehensive literature review approach. The authors likely conducted a systematic search of relevant databases and sources to identify pertinent literature on AI and ML in radiology. They then extracted key insights and synthesized findings from selected studies to explore opportunities, challenges, pitfalls, and success criteria in the field. The methodology likely entailed qualitative analysis techniques to identify common themes and patterns across the literature.	Worldwide interest in AI applications, including imaging, is high and growing rapidly. - The large amount of image and report data now in digital form ("big data") provides a substrate for development of AI Applications.

Literature Review				
S. No.	**Title of study**	**Authors**	**Methodology**	**Conclusion**
2	RESEARCH: ARTIFICIAL INTELLIGENCE IN MEDICAL IMAGING PRACTICE: LOOKING TO THE FUTURE	Lewis, K, et al.(11)	The commentary presents a comprehensive review of the current landscape of AI in medical imaging, drawing on existing research and industry developments. The authors analyze the potential applications of AI, including machine learning and natural language processing, in various aspects of medical imaging practice. Additionally, they discuss the implications of AI for healthcare professionals, emphasizing the need for education and training to adapt to this technological shift.	The commentary provides valuable insights into the transformative potential of AI in medical imaging practice. It underscores the need for healthcare professionals to embrace AI as a collaborative tool rather than a replacement for human expertise. The authors advocate for ongoing education and professional development to empower medical imaging practitioners to leverage AI effectively while upholding ethical standards and prioritizing patient care.
3	AI IN DIAGNOSTIC APPLICATIONS OF ARTIFICIAL RADIOLOGY: A TECHNOGRAPHY STUDY	Rezazade Mehrizi, et al.(12)	Review based	The article provides a comprehensive analysis of the current state of AI applications in diagnostic radiology and suggests possible ways to further develop them and integrate them into clinical practice.
4	THERAPY: INNOVATIONS, AI IN IMAGING AND ETHICS, AND IMPACT:REVIEW ARTICLE	Drabiak, et al.(13)	Review based	AI in healthcare has significant potential to improve patient care, clinical outcomes and medical research. However, legalities, ethics and regulations must be addressed. Interdisciplinary collaboration and further research are needed to ensure the long-term benefits of the technology.
5	IMPACT OF THE RISE OF ARTIFICIAL INTELLIGENCE IN RADIOLOGY: WHAT DO RADIOLOGISTS THINK?	Waymel, Q., et al.(14)	A general data protection regulation-compliant electronic survey was sent by e-mail to the 617 radiologists registered in the French departments of Nord and Pas De-Calais (93 radiology residents and 524 senior radiologists)	Most radiologists lack adequate prior knowledge about AI but express a willingness to participate in additional courses to enhance their understanding and technical expertise in the field. Despite limited information, the majority of radiologists are optimistic about the positive impact of AI on their future practice. Their primary expectations revolve around improved patient care quality and time efficiency in their interactions with patients.

Literature Review				
S. No.	**Title of study**	**Authors**	**Methodology**	**Conclusion**
6	ARTIFICIAL INTELLIGENCE IN MEDICAL IMAGING: SWITCHING FROM RADIOGRAPHIC PATHOLOGICAL DATA TO CLINICALLY MEANINGFUL ENDPOINTS	Oren, O., et al.(15)	Review based	Unless AI algorithms are trained to distinguish between benign abnormalities and clinically meaningful lesions, better imaging sensitivity might come at the cost of increased false positives, as well as perplexing scenarios whereby AI findings are not associated with outcomes. To facilitate the study of AI in Medical image interpretation, it is paramount to assess the effects on clinically meaningful endpoints to improve applicability and allow effective deployment into clinical.
7	RESHAPING THE PRACTICE OF RADIOLOGICAL SCIENCES IN THE 21ST CENTURY	El Naqa, I., et al. (16)	Clearly define the objectives of the study, such as assessing the impact of AI on diagnostic accuracy, workflow efficiency, and patient outcomes in radiology practice.	The past few years have witnessed a tremendous rise in AI applications to a wide range of areas in radiological sciences (diagnostic and therapy) including automation of segmentation, improving image quality, and developing decision-support systems for personalization of detection and treatment.
8	IMPACT OF ARTIFICIAL INTELLIGENCE ON CLINICAL RADIOGRAPHY PRACTICE: FUTURISTIC PROSPECTS IN A LOW RESOURCE SETTING	Wuni, A. R., et al.(17)	Researchers can systematically investigate the impact of AI on clinical radiography practice in low-resource settings, providing valuable insights for healthcare professionals, policymakers, and technology developers.	Artificial intelligence has come to stay, radiographers equipped with clinical, analytical and research skills should be harnessed to ensure the safe and ethical use of AI. As professionals we must accept AI, embrace it, learn it and own it.
9	IMPACT OF ARTIFICIAL INTELLIGENCE ON RADIOLOGY AUTHOR; EUROPEAN SOCIETY OF RADIOLOGY (ESR)	Becker Christoph D, et al.(18)	Review based	The integration of artificial intelligence into radiology has the potential to revolutionize diagnostic imaging practices, offering opportunities for increased efficiency, accuracy, and patient care. While challenges such as data privacy and algorithm transparency remain, collaboration between radiologists and AI developers can help overcome these hurdles and ensure the responsible and effective deployment of AI technologies in radiology departments worldwide.

Methodology

• *Target population:*

The intended group comprises a minimum of 50 individuals, encompassing students and faculty with expertise in radiology from GD Goenka University. The goal is to encompass four hospitals and gather data from various members of the radiological staff, such as radiologists, radiological residents, radiographers, and radiological nurses, across these healthcare institutions.

• *Method of data collection:*

We have opted for two data collection methods, utilizing both online and offline approaches. The online method involves a questionnaire distributed via Google Forms, incorporating questions derived from the existing survey for faculty and students at GD Goenka University. In contrast, the offline mode entails printed copies of the same questionnaire, to be completed by the radiological staff in various hospitals.

Results

OFFLINE DATA:

A survey was conducted among 5 hospitals in Gurgaon; Medanta, Artemis, Polaris, Park and Veriezon hospital and Gd goenka university sohna among radiology students from 6th semester.

25 questionnaires were distributed among the medical staff including Nurses, Technicians and Doctors across all 5 hospitals, 5 questionnaire was given to each hospital.

The following are responses received after distribution from respondents:

Medanta hospital, 4 out of 5 respondents heard about AI through workshop and 1 heard through social media 3 believes AI has a great impact in medical imaging modalities and 2 reverse the case, 2 respondents have 9 years of working experience and 3 have 5 years, 2 believes AI can replaced radiographers and 3 so not believe.

Artemis hospital, 3 heard about AI through workshop and 2 heard through professional conference, 2 believes AI have great impact in radiology and 3 3 respondents do not believed, 5 believes AI cannot replace radiographers,4 respondents have 8years and 1 has 4years of working experience.

Park hospital, 4 respondents heard about AI through social media and 1 heard through conference, 5 believed AI have a great impact in radiology, 5 believed AI cannot replace radiographers, 2 have 4years and 3 have 4 years of working experience.

Veriezon hospital,5 heard about AI through workshop,4 believed AI have great impact in radiology and 1 not, 3 respondents have 4 years working experience and 2 have 2 years' experience, 5 believed AI cannot replace radiographers.

Polaris hospital, 2 heard about AI through professional conference, and 1 through workshop and 3 through scientific journals, 5 believed AI have a great impact in radiology, 5 believed AI can replace radiographers, 3 have 3 years working experience 2 have 1 year experience.

Table 1: Tally responses received from all the 5 hospitals after distribution of questionnaire from respondents

Age			
Under 18	18-29	30 and above	
0	20	5	
Have you receive any information about artificial intelligence in radiology prior to this study?			
Yes	No	Unsure	
25	0	0	
Please, specify how you became perceive of Artificial intelligence?			
professional conference	Scientific journal	workshop/seminars	Online resources
6	2	17	0

Table 1: Tally responses received from all the 5 hospitals after distribution of questionnaire from respondents			
Do you believe that artificial intelligence will have a positive impact in future of radiology?			
Yes	No	Unsure	
22	4	0	
Can Artificial intelligence replace radiological staff or healthcare professionals?			
Yes	No	Unsure	
7	19	0	
How do think training and education in radiology should adapt to incorporate AI technology			
Formal training programs on AI integration	Continuous professional development on AI Application	Revision to radiology curriculum	Others
2	8	2	14

DATA PRESENTATION

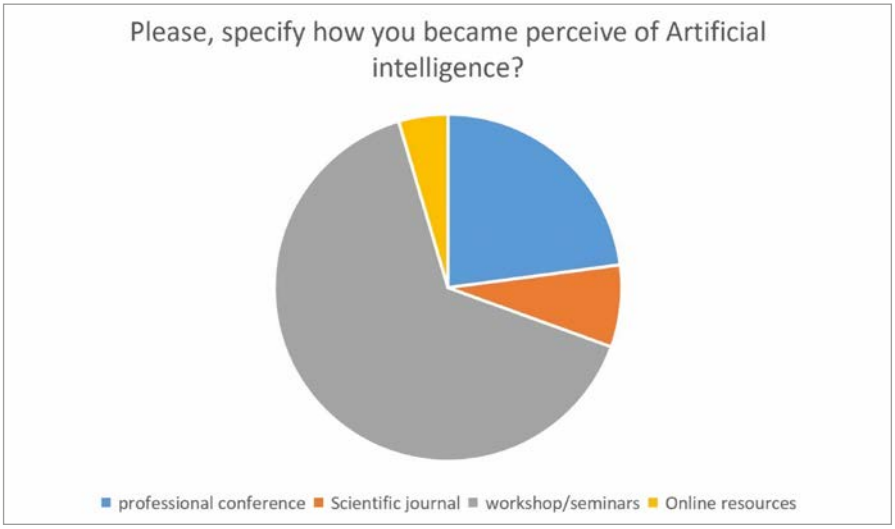

Fig 1: *Sources of prior information of AI*

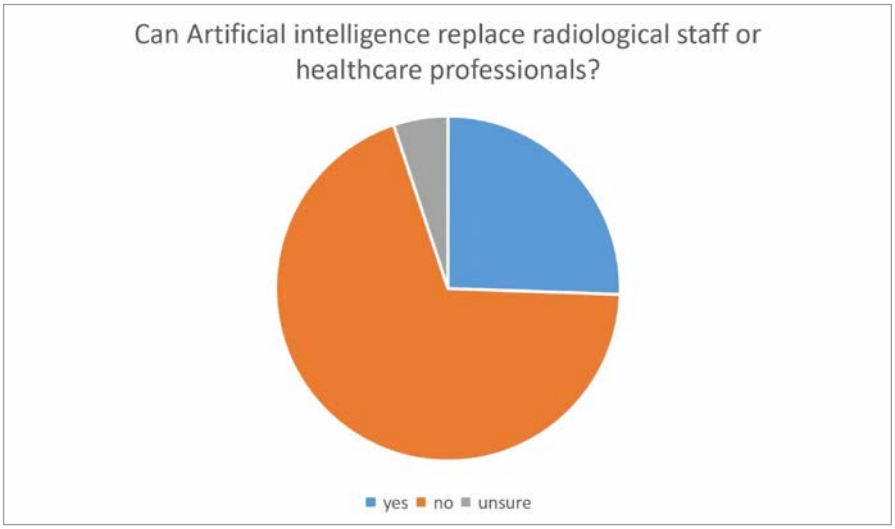

Fig 2: *Views on replacement of healthcare professionals by AI*

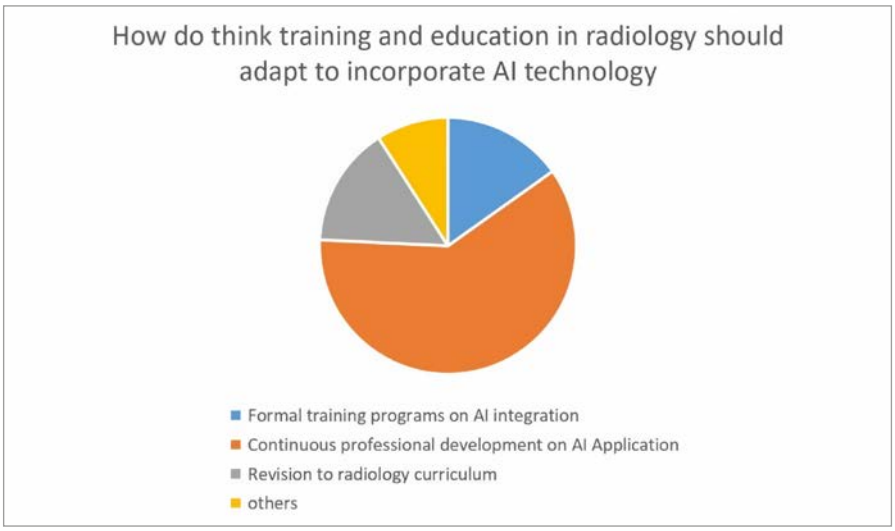

Fig 3: *Methods to adapt to AI technology*

ONLINE DATA

A survey from online survey was conducted and all the 35 responses are all from 18-29 age and for their gender categories, 20(57.1%) responses are male while 15(42.9%) are female. From the survey, 24(70.6%) have not been exposed from to AI while 10(29.4%) have been exposed to AI in hospital. 29(82.9%) responses feel that AI will have an impact in patient care while 6(17.2%) responses did not feel AI will have impact in patient care.

The responses were asked whether they receive any information about AI in radiology prior to these studies and 19(54.3%) responses are aware, 10(28.6%) are not aware and 6(17.1%) responses are unsure. 20(57.1%) responses became perceive of AI in online resources while 6(17.1%) through workshop/seminar, also 3(8.6%) perceive through scientific journal and 5(14.3%) have become perceive of AI in radiology through professional conference. 28(80%) of the responses believe that AI will have a positive impact in the future of radiology, 6(17.1%) responses are unsure and 1(2.9%) responses says no at all.

Also, 15(42.9%) of the responses did not believe AI can replace radiological staff in healthcare system, 12(34.3) responses have believe AI can replace radiological staff while 8(22.9%) are unsure of the idea of replacement. Also 21(60%) responses think training and education in radiology of AI can be adapt through formal training programs of AI integration while 10(28.6%) responses believe through continuous professional development on AI Application and 3(8.6%) says through revision to radiology curriculum and 1(2.9%) is unspecified.

Table 2: Tally responses received from Radiology students

Age			
Under 18	18-29	30 and above	
0	35	0	
Gender			
Male	female		
20	15		
Have you ever been exposed to AI in hospitals?			
Yes	No	Unsure	
24	10	0	

Table 2: Tally responses received from Radiology students			
Do you feel AI in radiology will impact patient care?			
Yes	No	Unsure	
29	6	0	
Have you receive any information about artificial intelligence in radiology prior to this study?			
Yes	No	Unsure	
19	10	6	
Please, specify how you became perceive of Artificial intelligence?			
professional conference	Scientific journal	workshop/seminars	Online resources/ network
5	3	6	20
Do you believe that artificial intelligence will have a positive impact in future of radiology?			
Yes	No	Unsure	
28	1	6	
What did you perceive as the potential benefit of artificial intelligence in radiology?			
Lowering of imaging-related medical errors	Lowering the interpretation time of examination	Increase in the time spent with patients	Others
18	12	4	1
Can Artificial intelligence replace radiological staff or healthcare professionals?			
Yes	No	Unsure	
12	15	8	
How do think training and education in radiology should adapt to incorporate AI technology			
formal training programs on AI integration	continuous professional development on AI Application	revision to radiology curriculum	Others
21(60%)	10(28.6%)	3(8.6%)	1(2.9%)

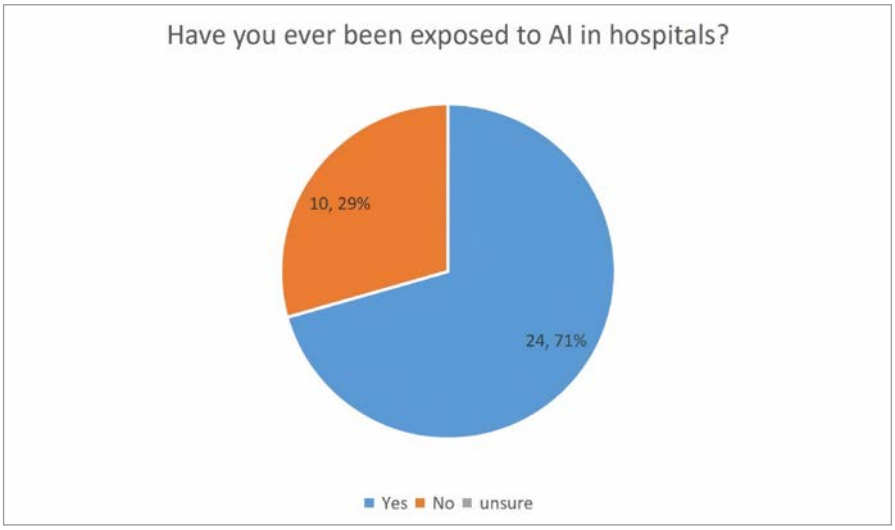

Fig 4: *Exposure to AI in hospitals*

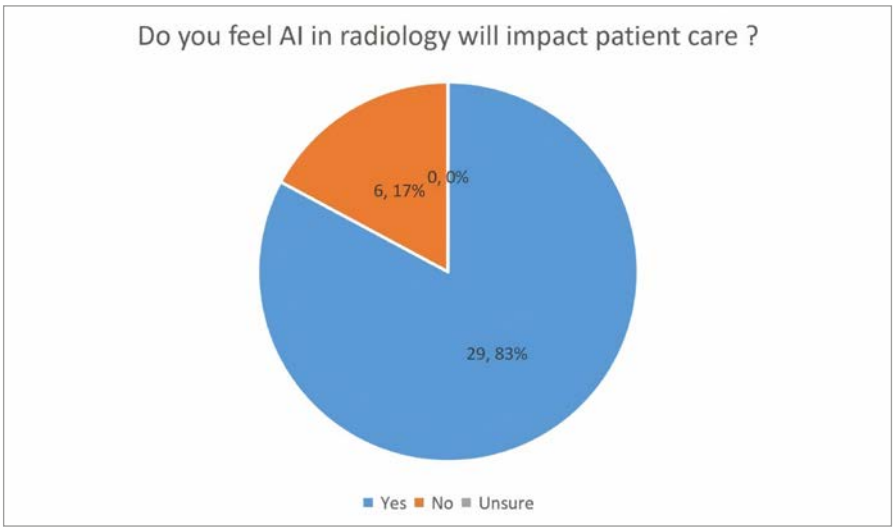

Fig 5:
Views on imapct of AI on patient care

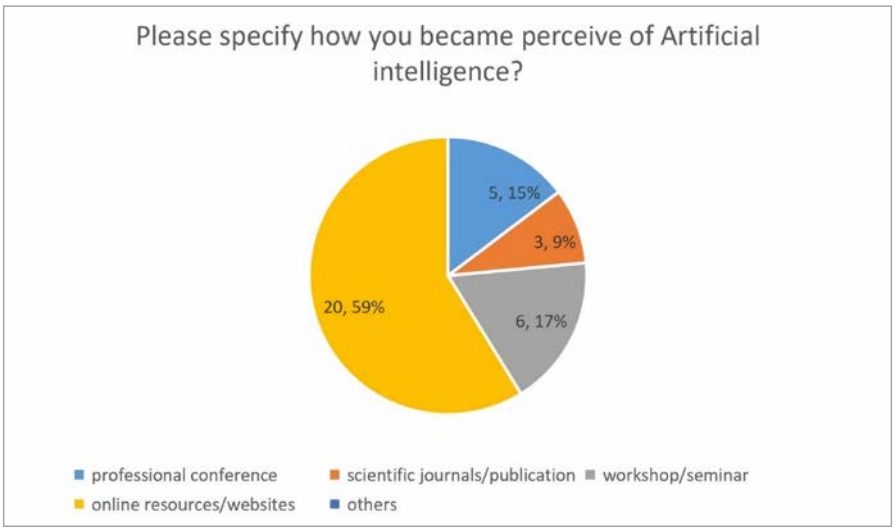

Fig 6:
Sources of prior information of AI

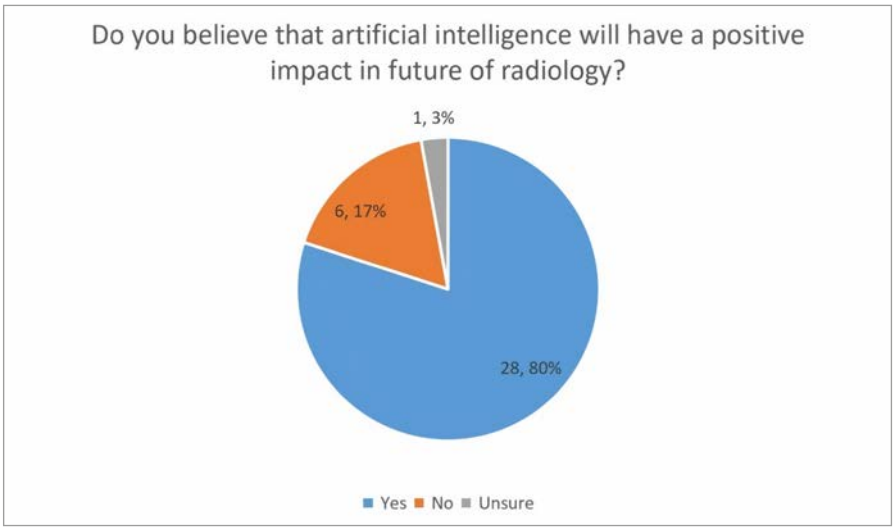

Fig 7:
Views on impact of AI in future of Radiology

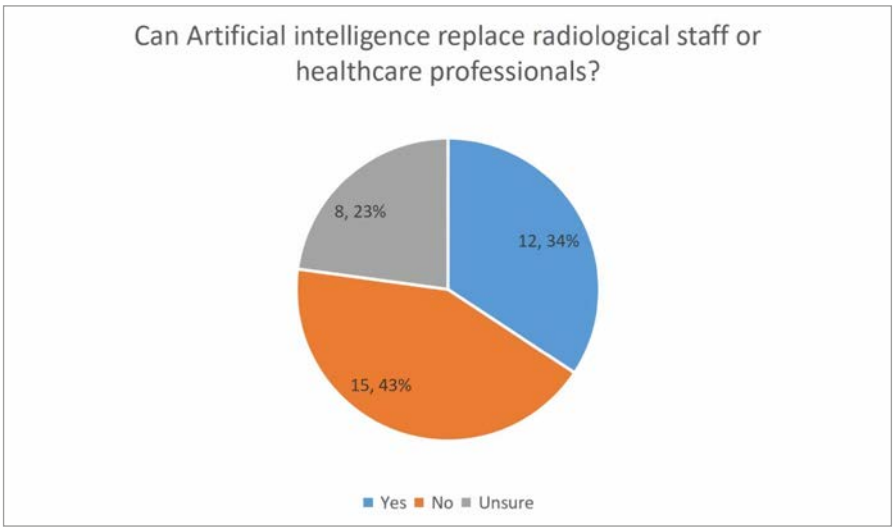

Fig 8: *Views on replacement of healthcare professionals by AI*

Conclusion

From the study conducted both offline (using survey questionnaire) and Online (using Google forms), 80% from online respondents and 78% from offline respondents believed that AI have a great impact in radiology, 42% online respondents and 93% offline respondents do not believe AI can replace radiographers, 57% received AI through online source from online survey and 87% through workshop from offline survey. The future of diagnosis in radiology is undeniably intertwined with the rapid rise of artificial intelligence (AI). AI technologies have already begun to revolutionize the field, offering unprecedented opportunities to enhance diagnostic accuracy, streamline workflows, and improve patient outcomes.

The integration of machine learning algorithms and deep learning techniques into radiological practice has led to significant advancements in image interpretation, enabling radiologists and radiographers to make more informed and efficient diagnoses. **R**

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KEY WORDS

Radiology, Artificial Intelligence, Impact, Rise

READY - MADE CITATION

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