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ORIGINAL RESEARCH

Radiologic Technology Students' Perceptions on Adoption of Artificial Intelligence Technology in Radiology

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Study Purpose: This study aims to analyze radiologic technology student's perceptions of artificial intelligence (AI) and its applications in radiology.

Methods: A quantitative cross-sectional survey was conducted. A pre-validated survey questionnaire with 17 items related to students perceptions of AI and its applications was used. The sample included radiologic technology students from three universities in Saudi Arabia. The survey was conducted online for several weeks, resulting in a sample of 280 radiologic technology students.

Results: Of the participants, 63.9% were aware of AI and its applications. T-tests revealed a statistically significant difference ($p = 0.0471$) between genders with male participants reflecting slightly higher AI awareness than female participants. Regarding the choice of radiology as specialization, 35% of the participants stated that they would not choose radiology, whereas 65% preferred it. Approximately 56% of the participants expressed concerns about the potential replacement of radiology technologists with AI, and 62.1% strongly agreed on the necessity of incorporating known ethical principles into AI.

Conclusion: The findings reflect a positive evaluation of the applications of this technology, which is attributed to its essential support role. However, tailored education and training programs are necessary to prepare future healthcare professionals for the increasing role of AI in medical sciences.

Keywords: radiologic technology students, radiology technologist, artificial intelligence, AI, perceptions, training, knowledge, awareness, radiology

Introduction

Artificial intelligence (AI) can evaluate massive amounts of medical data quickly and reliably. It can diagnose ailments using picture recognition and customize treatment programs based on a patient's genetics and medical history. AI-driven systems anticipate outcomes, uncover patient data patterns, and optimize healthcare operations. AI improves diagnostic accuracy and treatment efficiency revolutionize healthcare by improving patient outcomes and minimizing medical errors.[1–5]

AI aids analyzing radiographs, MRIs scans, and CT scans in medical imaging. AI algorithms can quickly and correctly detect irregularities, helping diagnose cancers, fractures, and other disorders. These algorithms excel in pattern recognition by identifying tiny features that humans miss. AI's capacity to process and compare massive medical imaging databases improves diagnostic accuracy, interpretation speed, and treatment recommendations. Medical imaging technology enhances diagnostics and can change patient treatment and outcomes.[6–8] These activities form the majority of radiological technologists, who can demonstrate data interpretation and describe the protocol and procedures of different radiological examinations, perform different positioning techniques, and manipulate and operate medical imaging systems. Although the roles of these technologists differ across countries, they mainly focus on the management and interpretation of imaging systems. In addition, their primary use, these systems can be used to schedule patient appointments, determine radiation doses, and perform image processing tasks, such as reconstruction, quality enhancement, lesion identification, measurements, organ segmentation, and documentation.[9,10] AI techniques improve image processing speed and accuracy and detect diseases early and more

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accurately.[11] AI-powered solutions automate common tasks, lower the workload and tiredness of radiology technologists, and help triage and prioritize cases.[12,13] Hybrid networks that combine lesion characteristics with clinical and laboratory data have been studied to predict disease survival and severity.[14,15] Owing to their simplicity, non-invasiveness, and potential use in prostate cancer detection and therapy, radiomic models using powerful machine learning methods and imaging features like MRI are gaining popularity.[16] Other models estimate prognosis and treatment response using CT and PET.[17] These advances have improved radiological diagnostic efficiency, reduced human error, and improved patient outcomes.

However, the adoption of AI in radiology has several ethical, medico-legal, and psychological considerations.[18,19] Ethical concerns revolve around patient privacy, potential biases in AI algorithms, accountability for errors, and ensuring informed consent. Medico-legal, issues arise regarding the liability of AI-generated diagnoses and adherence to regulatory frameworks. Psychologically, healthcare professionals and patients may experience challenges in trusting and understanding AI-assisted diagnoses, highlighting the importance of transparency and education in the integration of AI technology into radiology practices.

Although AI has shown promise in some areas, radiology technologists are not at risk of global replacement.[20] This technology is expected to become the norm.[21,22] Effective communication and coordination between engineers and computer scientists is essential.[23] Therefore, appropriate training is crucial. Radiology will benefit from AI technology. Radiology technicians are image interpreters, algorithm validators, and clinical experts who can improve patient care. This will elevate radiology technologies in medicine. Recent studies have investigated the need to educate students, residents, and medical specialists in AI. There seems to be a growing consensus to continue training radiologists to adapt to new technologies. This training works best when started in university, reinforced in residency, and maintained through professional growth.[24,25] Many institutions provide radiology training programs; nonetheless, they are often brief, erratic, and non-integrated. Although AI training has emerged recently, its offerings do not match the learning needs.[26,27] To build trust in doctors who use AI, comprehensive training on its use, benefits, drawbacks, and concerns is essential.[28] Students must actively participate in AI-based practical tasks. Thus, people can learn to use AI critically and effectively in academic and professional work. Younger radiology technologists should be supported in strategic career planning and development considering AI.[26]

Studying radiologic technology student's perceptions of AI in radiology is vital for optimizing their education and readiness in the evolving medical field. This allows institutions to adapt curricula to address concerns, ensuring that future healthcare professionals are adequately prepared to collaborate with AI systems, ultimately enhancing patient care and diagnostic accuracy. Therefore, this study aims to analyze radiologic technology student's perceptions of AI and its application in radiology, based on which the following objectives were formulated:

1. Assess the level of student's broad understanding pertaining to AI.
2. Evaluate the significance of student's educational training in the field of AI.
3. Assess the impact of AI on human decision-making and capabilities and evaluate the necessity of including known ethical principles in its implementation.
4. Examine the assigned function of AI in the field of radiology and its potential impact on the performance of radiology professionals.

Methods

A cross-sectional quantitative survey design was adopted to achieve specified aims and objectives.

Study Settings and Participants

Participants were radiological technology students from three public universities in Saudi Arabia. As the study focused specifically on medical sciences students, researchers had to use an easily accessible sample. Therefore, purposive and convenience sampling techniques[29] were adopted in this study. Participation was voluntary, and participants were asked to partake in the survey through university portals and online student communities. The survey was online for four weeks.

Questionnaire Design

The survey comprised 17 items (Supplementary file 1), with several question formats such as multiple choice, true/false, and 5-point Likert scale items. The questionnaire is pre-validated and adopted from,[28] which attempted to address the

following primary aspects: (1) demographic information, including gender, age, current academic program, and institution of the participants; (2) evaluation of the ranking of radiology as a specialty with and without the incorporation of AI; (3) assessment of participant's level of confidence in and comprehension of AI; (4) identification of the sources from which participants obtain information about AI; (5) examination of the ethical considerations associated with AI implementation; (6) evaluation of participant's opinions regarding the inclusion of AI fundamentals in university curricula; (7) perception of the potential impact of AI on the field of radiology.

Data Collection

All participants were fully informed about the study through an information sheet attached to an online survey. Informed consent was obtained from all participants using a check button, before starting the survey. At the end of the study, 280 completed responses were received and used in the data analysis.

Data Analysis

The researcher utilized the statistical package for the Social Sciences (SPSS, IBM Version 24) to analyze the data. Descriptive statistics were used to characterize the participant's demographic data. Furthermore, a two-sample *t*-test with unequal variances and ANOVA were used to compare differences between the participant groups.

Ethics

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. The protocol was reviewed and approved by the Permanent Committee for Scientific Research Ethics at King Saud University, ensuring adherence to ethical guidelines for research involving human subjects. Informed consent was obtained from all participants prior to their inclusion in the study.

Results

Table 1 presents the participants demographic characteristics of the participants. As shown in from Table 1, participants were appropriately distributed across both genders with 53.2% males and 46.8% females. The mean age of participants

Table 1 Participants' Demographics

Variables		N	Relative Frequency
Gender	Male	149	53.2%
	Female	131	46.8%
Age (in Years)	<= 20	128	45.7%
	21–22	104	37.1%
	> 22	48	17.1%
Level	Level 1	40	14.3%
	Level 2	41	14.6%
	Level 3	33	11.8%
	Level 4	41	14.6%
	Level 5	30	10.7%
	Level 6	31	11.1%
	Level 7	29	10.4%
	Level 8	35	12.5%

was 20.73 years. For data analysis, the participants were divided into three age groups: less than or equal to 20 years (N=128), 21–22 years (N=104), and more than 22 years (N=48). The participants were distributed according to their level of study, where levels 1, 2, and 4 (14.3%, 14.6%, 14.6%, respectively) reflected higher participation, and levels 5 and 7 reflected lower participation (10.7% and 10.4% respectively).

Ranking Radiology

Regarding the inclination or selection of radiology as their area of expertise, 35% of the respondents expressed a disinclination toward choosing radiology, whereas 65% indicated a preference. No statistically significant differences were found in the choice of radiology based on gender ($p = 0.0624$) and level ($p = 0.0771$). Regarding age, a statistically significant disparity ($p < 0.0001$) was identified, indicating that older students had a greater inclination toward radiology than their younger counterparts. Of the total number of students who preferred radiology (N=182), 40.6% said that they would select radiology as their first choice, 25.3% stated that they would choose radiology as their second choice, and 34.1% expressed indifference towards their desire for choices. Upon completion of the questionnaire, participants were asked about their willingness to alter their selection based on the influence of AI. The findings revealed that 58 individuals (20.7%) expressed an unwavering commitment to their chosen specialty, irrespective of the potential ramifications of AI. Conversely, 177 respondents (63.2%) indicated their willingness to modify their preferences based on the impact of AI. The remaining 45 participants (16.1%) expressed some degree of uncertainty, suggesting a potential reconsideration of their initial choice.

Knowledge of AI

When asked if the participants knew about AI and its applications (subjective assessment), 179 (63.9%) stated that they knew, while 101 (36.1%) stated that they did not. T-tests revealed statistically significant differences ($p = 0.0471$, $p < 0.05$) among the gender-based groups, with male participants having slightly higher knowledge of AI and its applications than female participants. However, there was no significant difference ($p = 0.7107$) between the age groups. Moreover, regarding the awareness about the use of AI in daily lives, 149 (53.2%) stated that they were aware, and 149 (46.8%) stated that they were not. Regarding the source of information about AI, 79.4% stated it was through media such as the Internet and social media, followed by university teachers (53.2%), articles and journals (46.7%), radiologists (36.5%), and friends and family (21.9%). Table 2 provides the frequency of correct answers for the various statements related to AI and radiology.

Table 2 Objective Assessment of Radiologic Technology Students' AI Knowledge

Statement (Correct Answer)	N: correctly Answered	Relative Frequency
AI is advanced computer systems' ability to perform the same tasks as human beings (eg, reasoning, learning, creating, and planning). (TRUE)	179	63.9%
Machine learning (automatic learning) allows machines through algorithms and mathematical models to learn without being expressly programmed for it. (TRUE)	197	70.3%
Deep learning involves techniques based on artificial neural networks that process data and can automatically recognize patterns in biomedical images. (TRUE)	154	55%
The use of deep learning in radiology does not require large databases of medical images for good pattern recognition. (FALSE)	261	93.2%
CAD (computer aided diagnosis): These are computer- aided diagnosis tools developed to detect, segment, and classify lesions or complex patterns in radiological images. (TRUE)	255	91.1%
Radiomics involves: techniques that comprise obtaining quantifiable information from medical images such as MRI, CT, or PET. They are important in detecting, evaluating, and monitoring diseases. (TRUE)	243	86.7%
Radiomics emerged from radiology and oncology, and its application is exclusive to them. (FALSE)	190	67.8%

The findings from Table 2 reveal good levels of knowledge among the participants of AI techniques, such as deep learning, machine learning, and CAD, as well as knowledge of radiomics.

General Perceptions of AI

Regarding whether AI has improved human capabilities, 129 students (46.1%) stated that it has increased, while 151 students (53.9%) stated that it has not. Furthermore, regarding the question of whether AI can affect human autonomy by interfering with decision-making, 118 students (42.1%) agreed and 39 students (13.9%) strongly agreed.

Perception of the Impact of AI in Radiology

When the participants were asked if AI could change the way radiology technologists worked, 98 students (35%) agreed, and 63 students (22.5%) strongly agreed. Further, 166 students (59.3%) assigned a support role for AI, followed by 16 (5.7%) assigning a preponderant role and 98 (35%) being against its use. Nearly half of the respondents (96 [34.3%] agreed, and 61 [21.8%] strongly agreed), expressed that AI could replace radiographers. Additionally, concerning the areas that could be improved in radiology with the help of AI, early diagnosis and treatment (84.3%) were the most expressed factors followed by improvement in the management and quality of radiology services (72.1%).

Ethics, Teaching, and Drawbacks of Using AI in Medicine

A total of 86 students (30.7%) agreed and 88 (31.4%) strongly agreed that there was a need to adopt ethical principles in using AI in radiology services. In terms of teaching, 82 students (29.3%) agreed and 88 (27.8%) strongly agreed that there was a need to train medical sciences students to use AI in radiology services. The drawbacks of using AI in medicine, as shown in Figure 1, include privacy and security concerns (92.7%) and high implementation costs (89.4%), which were identified as the major barriers.

Discussion

This study aims to analyze radiologic technology student's perceptions of AI and its applications in radiology. While AI could have immense potential in radiology, its implications are being researched, and medical sciences students may be influenced by the idea of selecting radiology as their career option. Supporting the implications of AI in radiology, approximately 65% of the radiologic technology students preferred selecting radiology as the option, which is considerably higher compared to similar studies,[30] in which only 24.9% of radiologic technology students preferred radiology as an option. Compared to,[30] the radiologic technology students reflected good knowledge and awareness of

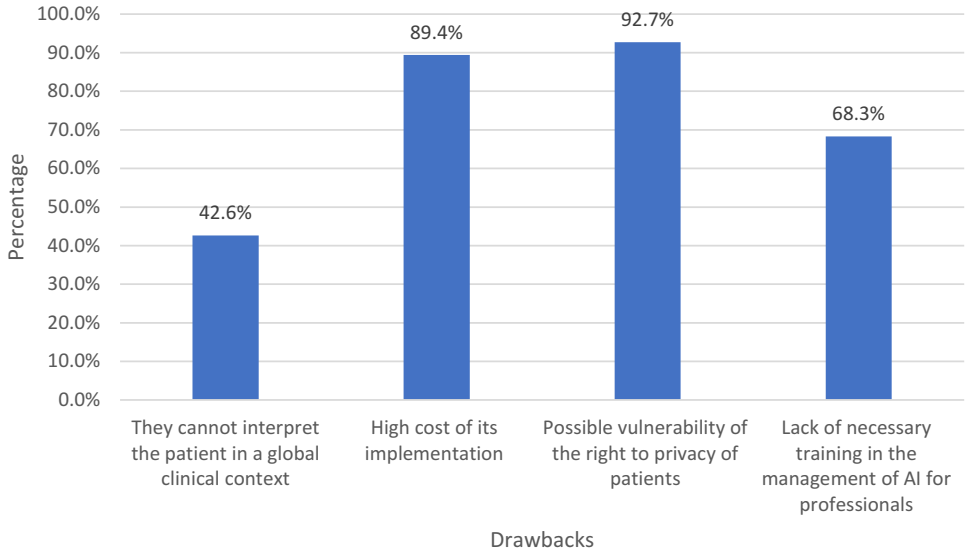

Figure 1 Participants agreement on drawbacks of AI in medicine.

AI and its application in daily life. Similar results were observed in a study conducted in 2021,[31] where 93% of Spanish medical students reported knowing the applications of AI in daily life and 70.7% answered correctly regarding the basic knowledge of AI. Nevertheless, in a similar study in Canada,[32] several participants exhibited a considerable degree of confidence in their comprehension of AI. Conversely, 50% of them accurately responded to a minimum of three of the five questions administered to assess their knowledge level objectively. In another study conducted in Germany, approximately 63.1% of the surveyed individuals identified themselves as technologically proficient, whereas only one-third reported a fundamental understanding of AI (30.8%).[33] The findings of this study reflect good knowledge and awareness levels among medical sciences students in Saudi Arabia, similar to studies in other regions[30–33] but contrasting with the findings in the Kingdom.[30,34] These discrepancies may be attributed to the growing awareness of AI technologies and their use in daily life, as well as the differences in knowledge and awareness across regions.

Ethical issues in the application of AI in medicine have been highlighted in several studies,[35–37] reflecting the implications of using machines in decision-making, which can significantly affect patient's privacy, autonomy, and healthcare decision-making. Accordingly, most participants suggested the need for ethical principles in using AI in radiology. Accordingly, students highlighted privacy issues and high implementation costs as major barriers to use of AI in medicine. Although there are benefits to AI, its application in medicine requires huge investments, especially in technology and relevant resources which may incur high costs.[38] Furthermore, any potential bias in the treatment and diagnosis healthcare services due to its application can result in severe legal and financial consequences.[39,40] Given the novel nature of AI and its associated risks, there is a need to fully understand the potential implications of using AI in medicine and the need for training healthcare professionals in using AI.[41–43] Accordingly, most students identified the need for training in AI technologies for use in radiology. Nonetheless, almost 56% of the participants opined that AI could replace their jobs, which contradicts a previous study[44] in which 89% of the participants were not afraid of losing their jobs. This discrepancy suggests a shift in attitudes toward AI within the field of radiology, possibly influenced by evolving technology, changing job market dynamics, or differing levels of awareness of AI capabilities. Addressing these concerns and providing education on the complementary role of AI in radiology may be crucial for mitigating fears and fostering acceptance of AI technology among radiological professionals.

The impact of these AI related issues and their implications may be observed in the perceptions of medical sciences students, as most participants expressed the need to improve AI in diagnosis and treatment, assigned a supportive role to AI rather than a preponderant role, and hesitated to use AI in the future. This study has practical and theoretical implications. Understanding these perceptions is crucial for adapting medical education to the evolving healthcare landscape. This helps medical sciences institutions tailor their curricula to address student's concerns and knowledge gaps, ensuring that future healthcare professionals are well-prepared to collaborate effectively with AI systems in the clinical setting. Moreover, it can guide the development of comprehensive and sustained training programs that encompass the utilization, advantages, difficulties, and ethical concerns associated with AI in clinical departments, fostering trust and competence among future clinicians.

Theoretically, this research sheds light on the evolving roles of healthcare professionals and radiology technologists. This highlights the shift from traditional image interpretation to a more collaborative model, emphasizing the importance of healthcare professionals validating AI algorithms and using their clinical expertise to enhance patient care. By studying student's perceptions, we gained insights into the changing dynamics of the medical profession and the increasing significance of AI integration. This knowledge contributes to a broader understanding of the evolving role of radiology technologists within the medical community, recognizing their vital contributions to the age of AI.

A few limitations of this study should be considered when interpreting the results. First, the sample was limited to medical sciences students from specific universities in Saudi Arabia, which may not fully represent the global diversity in medical sciences education. Second, the study primarily relied on self-reported data, which can be subject to response bias and may not accurately reflect the participant's actual knowledge and perceptions. Third, the cross-sectional design provides a snapshot of radiologic technology student's perceptions at a specific point in time and does not capture potential changes in attitudes over time. Finally, this study focused on radiologic technology students, and the findings may not be generalizable to practicing healthcare professionals or radiology technologists. Further research with larger and more diverse samples is necessary to gain a comprehensive understanding of AI perceptions and education in the field of medicine.

Conclusion

This study provided valuable insights into radiologic technology student's perceptions of AI and its applications in radiology. These findings underscore the need for tailored education and training programs to prepare healthcare professionals for the increasing role of AI in medical practice. While several students expressed an awareness of AI, there remains room for improvement in their understanding of and confidence in AI technologies. Moreover, the ethical considerations and potential implications of AI, including privacy and decision-making, were recognized by the participants, highlighting the importance of incorporating ethical principles in AI implementation. These insights can inform the development of educational strategies and curricular enhancements to ensure that medical sciences students are well-equipped to harness AI's potential for improving patient care in radiology and broader healthcare fields. Further research, especially a longitudinal study is essential to explore these perceptions among a more diverse population of students and professionals and monitor the evolving landscape of AI in medicine.

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Disclosure

The author reports no conflict of interest in this work.

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