

Acceptance of artificial intelligence (AI) and machine learning (ML) among radiologists in Saudi Arabia



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ABSTRACT

Artificial intelligence (AI) and machine learning (ML), in the new age of technological progress, provide huge benefits to every area of employment, ranging from IT to health care. To assess the knowledge of, attitude towards, and in-practice use of artificial intelligence and machine learning among radiology residents and faculty radiologists. A web-based questionnaire was distributed via Google Drive to 55 radiologists in the central region of the Kingdom of Saudi Arabia. The questionnaire comprised two sections: three questions regarding demographics and three questions regarding the knowledge, attitudes, and practices (KAP) of AI and ML in radiology. A total of 55 respondents (100%) completed the survey. The majority of respondents claimed familiarity with AI and ML (61.8%). Most radiologists (54.5%) expressed mixed feelings regarding the benefits of AI and ML applications in radiology. Regarding usability, a mixed response was received: 49.1% supported its usability and 45.5% were uncertain of the usability of AI and ML in radiology. Several studies have been conducted which have suggested the usability of AI and ML and their incorporation into the radiology department. The majority of radiologists in Saudi Arabia support the use of AI and ML. Further investigation into the usability of these tools is needed.

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1. Introduction

In the current era of technological advancement, artificial intelligence (AI) and machine learning (ML) offer immense benefits to every field of work, from IT to healthcare (Pesapane et al., 2018). Consequently, there has been rapid progress in research into AI, ML, and related advanced technologies, enabled by advancements in computing infrastructure and deep learning techniques (Hosny et al., 2018). AI algorithms, especially deep learning, have contributed to major progress in image recognition. ML has garnered significant interest for its potential impacts in the field of radiology, mainly due to its success in international image classification competitions. Computed tomography and magnetic resonance imaging are the most commonly used imaging

techniques in radiology (Kahn, 2017). Recent studies have shown that methods such as convolutional neural networks and variational autoencoders have great potential to advance the field of medical image analysis field in the near future.

ML is expected to affect radiology outside of image interpretation long before a fully functional "machine radiologist" is implemented in practice. Recently, rising optimism about radiology's potential to undergo a hi-tech transformation has led to a steady demand for AI and ML implementation in healthcare practice (Tang et al., 2018). Historically, AI tools excel at automatically recognizing multifaceted patterns in imaging while offering quantitative and real-time data analysis; conventional methods, on the other hand, offer qualitative data upon assessment of a sample's radiographic traits. Research has shown that methods utilizing ML and AI can have significant positive impacts on several facets of radiology, particularly in oncology, and has also demonstrated ways in which these methods may be further advanced and applied in the field (Paul et al., 2018).

Studies have also highlighted key challenges regarding the clinical implementation of ML and AI in the field of radiology and in modern healthcare

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more generally. The acceptance of new technology by practitioners is a key concern in every field, as they often require efficient training, knowledge, and high-tech equipment to continuously monitor and maintain their functions (Wong et al., 2019). In this case, however, the benefits outweigh the risks. Researchers have claimed that AI is not a threat to radiology; rather, it offers immense opportunities for improvement in diagnostic capabilities and other healthcare applications related to radiology. It is, however, crucial for radiologists and other clinicians to have specific, in-depth knowledge and expertise in AI and ML tools so that they can ensure the effective clinical application of these technologies (Yasaka and Abe, 2018). In this study, we aimed to evaluate the knowledge of, attitude towards, and in-practice use of AI and ML among radiology residents and faculty radiologists (Thrall et al., 2018).

The objectives of this research are as follows:

1. Identify knowledge gaps and behavioral patterns that indicate needs regarding, problems with, and barriers to planning and implementing AI and ML
2. Help set program priorities and make program decisions
3. Measure acceptance of and willingness to use AI and ML in radiology settings

2. Methods

We have used primarily quantitative methods to meet the research objectives. We conducted a web-based survey, designed using Google Drive, to assess residents' and faculty radiologists' knowledge, attitudes, and practices (KAP) of AI and ML throughout the central region of the Kingdom of Saudi Arabia. The survey was composed of two sections and also evaluated respondents' current age, gender, and experience in radiology. We developed the survey after reviewing the literature on AI and ML implementation in radiology and noting the reactions of key people, including clinicians, radiologists, surgeons, and others. Multiple rounds of internal validation and feedback were undertaken by the project members and sponsors to ensure the ethical validity of the survey and research methods. Further, the research methods underwent review by the review board of the lead author. The questionnaire was developed to include six questions to acquire the primary data required to perform the research. Among these six questions, three were demographic questions,

regarding the participants' age, gender, and years of experience as a radiologist (Basias and Pollalis, 2018). The remaining three questions covered the KAP elements. The response options for the survey questions were developed according to each question's specifications; no Likert scales were used in the survey.

All the radiologists within the Kingdom of Saudi Arabia who had the required expertise and experience in the field of radiology were invited to complete the survey. The group selected for the quantitative KAP survey included 55 respondents in total. We attempted to include radiologists with a standard period of experience. We aimed to understand the thoughts, attitudes, and practices of radiologists regarding the acceptance of advanced technology like artificial intelligence and machine learning in the radiology and imaging field. The survey was open from November 2nd, 2020 to November 16th, 2020.

We used an online platform for devising and distributing the survey and receiving feedback from the radiologists targeted in the study. The participants accessed the survey through their email (Wolf et al., 2016). A reminder email was sent to the participants three to four days after the survey opened and they were initially notified. At the end of the survey period, results were entered into an Excel file. These quantitative data from 45 respondents were then imported into SPSS Statistics. Frequency distributions, chi-square tests, and directional measures were performed to achieve the results. For the statistical analysis, the confidence level was 90% and a p-value <0.05 was considered significant (Kottler, 2020).

3. Results

A total of 55 complete responses to the survey were submitted via Google drive and email during the survey period after eliminating incomplete or invalid responses. In Tables 1–3, the response rates and responses to the demographic questions are shown. The overall response rate was high, including among core and non-core radiologists (n=45, 81%). All 55 responses to the survey were included in the statistical analyses. The findings showed that the majority of participants were male (n=47, 85.5%). More than half of the total respondents were 31–40 years old (n=32, 58.2%), while there was only one participant over 50 years old (1.8%). These differences were statistically significant.

Table 1: Radiology experience of participants

	Experience	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 years	23	41.8	41.8	41.8
	More than 5 years	32	58.2	58.2	100.0
	Total	55	100.0	100.0	

Table 2: Gender distribution of participants

	Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	47	85.5	85.5	85.5
	Female	8	14.5	14.5	100.0
	Total	55	100.0	100.0	

Table 3: Age distribution of participants

	Age	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20+	13	23.6	23.6	23.6
	30+	32	58.2	58.2	81.8
	40+	9	16.4	16.4	98.2
	50+	1	1.8	1.8	100.0
	Total	55	100.0	100.0	

Tables 4, 5, and 6 show the findings from the KAP survey elements. The majority of participants were familiar with AI- and ML-related tools and their use in the field of radiology (n=34, 61.8%); however, a sizable number (n=21, 38.2%) revealed that they were unfamiliar with these advanced technologies in the context of radiology (Table 4). This difference was statistically significant. In Table 5, respondents' feelings towards AI and ML applications in healthcare are displayed. The greatest number of participants expressed mixed feelings (n=30,

54.5%), followed by participants who felt AI and ML were exciting (n=18, 32.7%). The fewest number of people felt that AI and ML were concerning (n=7, 12.7%). Table 6 shows the mixed responses regarding the usability of the AI and ML tools in radiology: 49.1% of respondents (n=27) were aware of its usability, compared to only 5.5% (n=3) who replied in the negative; however, 45.5% of respondents (n=25) expressed uncertainty regarding usability. These results were statistically significant.

Table 4: Familiarity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	21	38.2	38.2	38.2
	Yes	34	61.8	61.8	100.0
	Total	55	100.0	100.0	

Table 5: Feeling

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mixed Feelings	30	54.5	54.5	54.5
	Exciting	18	32.7	32.7	87.3
	Concerning	7	12.7	12.7	100.0
	Total	55	100.0	100.0	

Table 6: Usability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	3	5.5	5.5	5.5
	Yes	27	49.1	49.1	54.5
	Maybe	25	45.5	45.5	100.0
	Total	55	100.0	100.0	

4. Discussion

There are several challenges to be faced in the clinical application of advanced technologies like AI and ML, chief among them resistance and poor acceptance by practitioners (Wang et al., 2017). Our study findings showed that radiologists practicing in the Kingdom of Saudi Arabia generally have a positive perspective regarding the adoption of AI and ML in radiology facilities. The study findings support existing evidence of the benefits and immense opportunities offered by the AI- and ML-related tools in the field of radiology, thereby increasing the credibility of the results (Codari et al., 2019). One of Ooi et al.'s (2019) research studies concluded that increasing confidence in technical processing and the introduction of AI/ML radiology has resulted in a clear need for an AI/ML residency curriculum. Our results were confirmed by the analysis when clinicians requested to undergo AI/ML instruction.

In the residency and radiology departments of hospitals in the Tajaldeem and Alghamdi (2020) research, there is a substantial lack of knowledge of AI. As indicated in our report, the rapid growth of AI and its use in diagnostic radiology means that

knowledge of its function in various diagnostic fields needs to be increased urgently.

In this field of research, studies that explore the perceptions of clinicians regarding AI and ML are rare. Therefore, our study's findings have significant implications for radiology research (Morozov et al., 2019). Additionally, the mixed response from radiologists regarding the usability of these advanced technologies indicates a key area for further research, namely, the primary factors hindering the usability of AI and ML in clinical radiology (Pakdemirli, 2019). One key limitation of our study is its small sample size, which has a risk of procedural bias.

In conclusion, our study supports the evolution of radiology practices to include advanced technologies like AI and ML. Clinicians' acceptance of this technological transformation is increasing. However, more research is needed to explore the usability and perceived applicability of AI and ML in order to improve clinicians' attitudes towards accepting these technologies.

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Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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