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Exploring Radiographers' Readiness for Artificial Intelligence in Kuwait: Insights and Applications

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ABSTRACT

Introduction: There is a growing adoption of artificial intelligence (AI) in the field of medical imaging. AI can potentially enhance patient care, improve workflow, and analyze patient's medical data. This study aimed to explore radiographers' knowledge, perceptions, and expectations toward integrating AI into medical imaging and to highlight one of the available applications of AI by evaluating an AI-based software that generates chest reports.

Methods: A cross-sectional survey was distributed to radiographers ($n = 50$) requesting information regarding demographics and knowledge of AI. In the retrospective part, chest radiographs were collected ($n = 40$), and an AI report was generated using Siemens AI software. A Likert scale was used by a radiologist to rate the report's accuracy. Ethical approval was obtained. Data are presented as mean ± SD.

Results: The survey results showed that most participants agreed that radiographers must adapt the AI technology, and they showed interest in taking courses about AI within radiography (98%, 92%, $n = 50$). Participants' opinions on AI correlated with their perceptions of AI education ($p < 0.05$, $r = 0.307$). The findings from the retrospective study showed that the radiologist agreed with 53% of the AI-generated chest reports.

Conclusion: The study findings identified a need for AI education and training for radiographers to increase their knowledge and improve their ability to use AI. Additionally, the study demonstrated that AI-powered tools are showing great promise in the field of medical imaging.

1 | Introduction

The field of medical imaging has been transformed by the development of magnetic resonance imaging (MRI), computed tomography scans, and other imaging modalities. Artificial intelligence (AI) has the potential to bring another major change in the field of radiology [1–3]. Recently, there has been a growing interest in the use of AI in medical imaging. With the help of deep learning algorithms, medical imaging technologies can provide more accurate and efficient healthcare services. For example, MRI is a powerful medical technology, however, scans can last up to 40–60 min and can be overwhelming for patients [4]. Therefore, it is always desirable to reduce the scan time. AI can overcome this by speeding up the scans using AI mathematical methods and consequently, patients can undergo much faster imaging procedures [4]. This will speed up MRI scans and reduce patient waiting times. Additionally, this will reduce the pressure on the departments [4]. Moreover, recent studies

showed that AI-reconstructed scans improved the overall image quality [4, 5] and offered more accurate diagnosis, especially in follow-up patients by providing excellent intrapatient reproducibility [4, 6]. Additionally, AI can generate computer-aided radiology reports which can assist radiologists in decreasing their workload, thus supporting the high volume of cases without fatigue [7]. This tool is useful, especially in emergency departments where timely interpretation of diagnostic imaging is critical and immediate intervention is required [8]. One of the advantages of this tool is the informative detailed output reports [7, 8]. However, the final evaluation by a radiologist is required for a complete qualitative and quantitative report.

In Kuwait, the healthcare system faces persistent challenges, including long wait times, patient overload, the lack of medical data sharing between hospitals, and an increasing burden of chronic diseases such as diabetes, obesity, and cardiovascular conditions, all while striving to meet the growing demands of an expanding population. Additionally, shortages of skilled healthcare personnel in Kuwait can significantly impact the quality of patient care. In such circumstances, AI emerges as a valuable support tool, transforming healthcare by enhancing efficiency, improving diagnostic accuracy, and reducing hospital wait times. However, there is a noticeable lack of studies in the field.

This study aimed to assess radiographers' knowledge, perceptions, and expectations toward integrating AI into medical imaging, and to highlight one of the available applications of AI in medical imaging. This has been investigated by evaluating an AI-based software available to generate instant radiographic chest reports.

2 | Methodology

2.1 | Study Type

A mixed methods approach, combining a questionnaire-based survey, and a retrospective analysis was conducted.

2.2 | Ethical Approval

Ethical approval was obtained from the Ethics Committee for Research of Health Sciences Centre (FAHS/19).

2.3 | Data Collection

A validated questionnaire-based survey was distributed to radiographers. The permission to use the questionnaire was granted and obtained directly from the author [9]. The survey was developed based on previous studies of perception and knowledge [9]. The inclusion criteria were male or female adults' radiographers above 18 years old working in the radiology department in Kuwait's hospitals and the sample size was $n = 50$. The survey consisted of six sections. The first section collected demographic information, including gender, age, and work experience. The second section included a single question to establish a baseline understanding of participants' knowledge about AI applications. The remaining four sections comprised 4-point Likert scale items (*strongly disagree*, *disagree*, *agree*, and *strongly agree*) and contained 5–7 questions each. These sections focused on participants' familiarity with AI, their opinions on AI, the integration of AI education within the radiography field, and the anticipated effects of AI on future roles. A printable version of the survey was distributed to the participants to be filled out by hand and returned.

In the retrospective part of this study, 40 randomly selected chest radiographs (both normal and abnormal) in anterior–posterior or posterior–anterior views were collected from the picture archiving and communication system from three different hospitals in Kuwait. The sample included male or female patients above 18 years. An AI interpretation report was generated using Siemens AI-Rad companion software. The AI-Rad companion chest X-ray is a diagnostic aid that uses an AI algorithm to automatically highlight and identify radiographic findings in the lungs and pleurae. The software detects the presence of five prespecified findings in chest X-ray images which represent the common findings in radiological routine: pneumothorax, pulmonary lesions, atelectasis, consolidation, and pleural effusion. The model takes the radiograph images as input and generates radiology reports as output. A Likert scale was used by one radiologist to rate the report's quality and clinical accuracy with responses ranging from agree to disagree.

Data collection was between February 2024 and May 2024. Participation in the study was voluntary. All the participants provided informed consent for participation in the study.

2.4 | Statistical Analysis

All statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS Inc., IBM, New York, USA version 29). Descriptive statistics was used to summarize participants' demographics. Spearman rank correlation was used to explore the strength and direction of an association between variables. Data are presented as mean $\pm$ SD values.

3 | Results

3.1 | Demographics

A total of 50 radiographers participated in the study, 54% were females and 46% were males. Figure 1 demonstrates the percentage distribution of participants by demographic characteristics and work experience.

3.2 | Baseline Understanding of the Application of AI

A baseline understanding of the application of AI has been established with one question “How much knowledge do you consider that you have about the application of AI in medical imaging?”. Almost half of the participants (52%) reported having a moderate understanding of the application of AI in medical imaging and 32% reported having little knowledge (Figure 2).

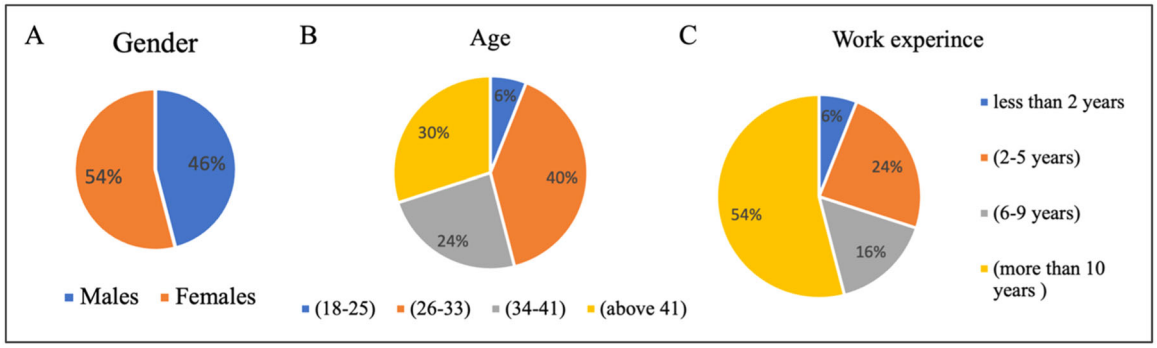

FIGURE 1 | Percentage distribution of participants by demographic characteristics and work experience. (A) Percentage distribution of participants by gender; (B) percentage distribution by age; and (C) percentage distribution of participants by work experiences.

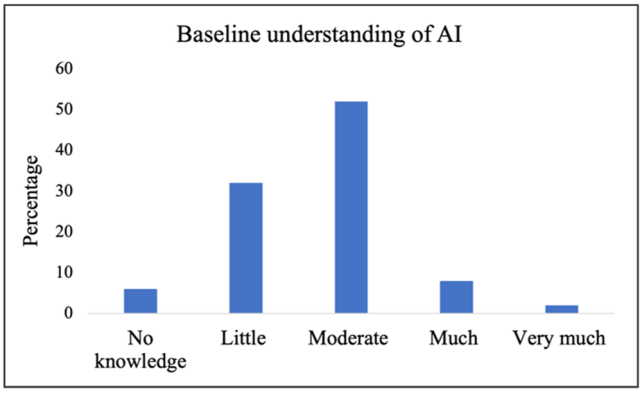

FIGURE 2 | Percentage distribution of baseline understanding of the application of AI in medical imaging.

3.2.1 | Survey Response Data

3.2.1.1 | Familiarity With AI. Most of the participants agreed that radiographers must adapt and embrace AI technology (98%, Figure 3). More than half of the participants knew that Automatic Exposure Control (AEC) and auto-positioning of the X-ray tube are types of AI (70%). Only 38% of the participants did not understand the difference between machine learning, deep learning, and AI.

3.2.1.2 | Opinions on AI. The results revealed that most participants agreed that AI would improve the radiographer's job (Figure 4). Moreover, 84% disagreed with the statement that AI will replace radiographers. More than half of the participants (54%) were not concerned about introducing AI; however, they were worried about the ethical issues surrounding its use.

3.2.1.3 | AI Education Within Radiography. Most of the participants (76%, Figure 5) have not received training/teaching on AI during their primary degree in radiography, and 72% of them did not receive training/teaching on AI at their workplace. The participants indicated that they noticed the recent increase in AI research within the radiography sector (84%). Interestingly, most of the participants (92%) showed an interest in taking courses about AI within radiography.

3.2.1.4 | Effects of AI on Future Roles. Most participants reported that AI would affect most aspects of the interpretation of images, radiographic quality assessment, selection of exposure factors and positioning, patient scheduling, communication, and patient care aspects (Figure 6).

3.2.1.5 | Inter-Thematic Correlation Analysis. The participants' opinions on AI correlated significantly with their perceptions of AI education ($p < 0.05$, $r = 0.307$).

3.2.1.6 | AI-Generated Chest Radiograph Reports. The radiologist agreed with more than half of the AI-generated chest reports (53%, Figure 7). Additionally, 20% of the reports were accepted with the request for minor changes. Figure 7 demonstrates that 15% of the reports were missing the clinical findings and a new report is required. Figure 8 demonstrates an example of an AI-generated chest X-ray report using Siemens AI-Rad companion software.

4 | Discussion

The interest in the applications of AI in medical imaging has increased due to the opportunities it presents to the field of radiology. This study aimed to explore the level of knowledge and expectations of radiographers toward AI in Kuwait's hospitals and to highlight one of the available applications of AI in medical imaging. The survey results indicated that most participants showed a positive attitude toward AI, indicating that most of the radiographers appreciate the value of AI. These results are in line with similar findings of a survey study with 1020 responses [10]. The results showed that 85% of the respondents revealed that AI technology would improve radiography practice [10]. In addition, our results showed that participants were excited about the AI's role in radiography. Furthermore, the results agreed with the literature concerning the role of AI in radiology, most of the participants believed that AI is playing an important role in medical imaging [4, 8]. The main concern of the participants was that of the ethical issues (72%), which was expected. As noted in the literature, one of the major concerns of the use of AI is data ownership and privacy [11, 12]. AI presents considerable ethical challenges, primarily due to its "black-box" nature, where the decision-making processes of AI models are often unclear and difficult for humans to interpret. This lack of transparency raises significant concerns, particularly in healthcare, where trust and accountability are crucial. Existing literature emphasizes the need for clear guidelines and ethical frameworks to address these concerns, ensuring that AI is integrated into clinical practice in a way that

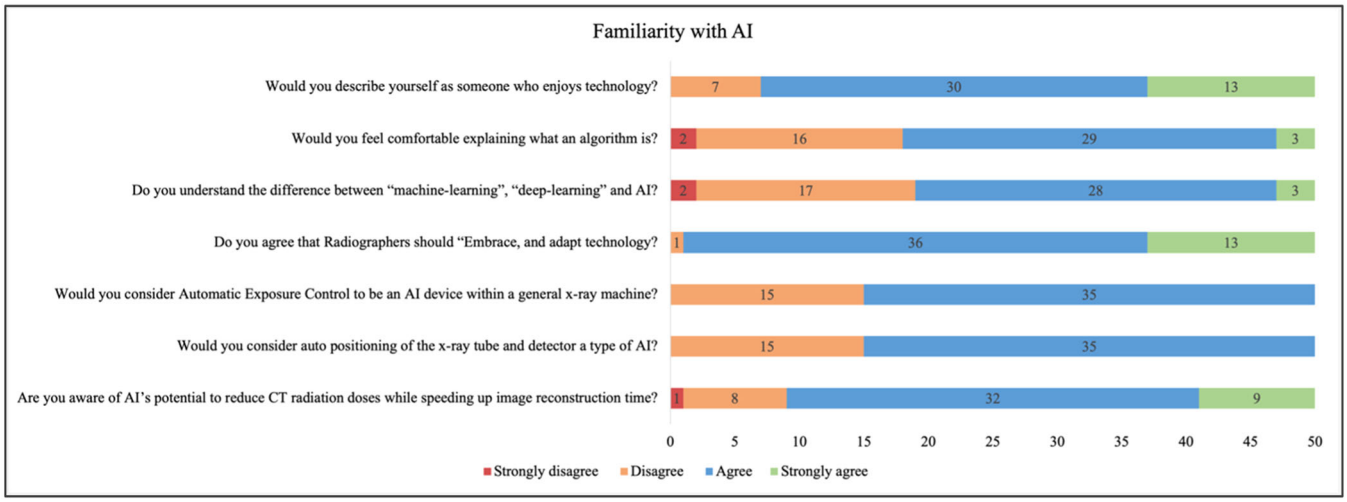

FIGURE 3 | Likert scale bar chart summary of the participants' familiarity with AI ($n = 50$).

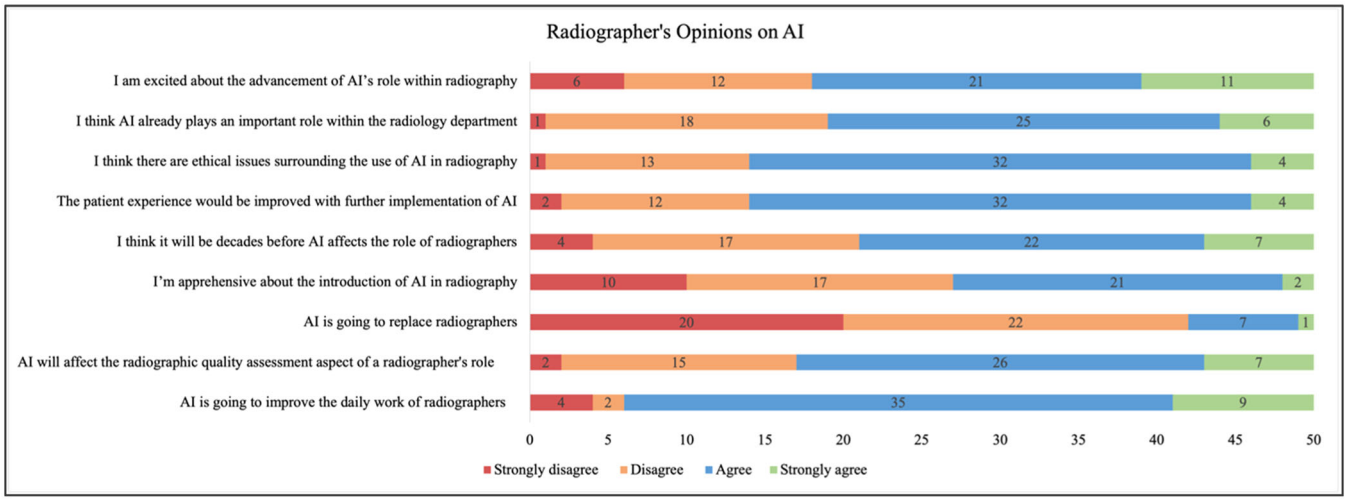

FIGURE 4 | Likert scale bar chart summary of the participants' opinions on AI ($n = 50$).

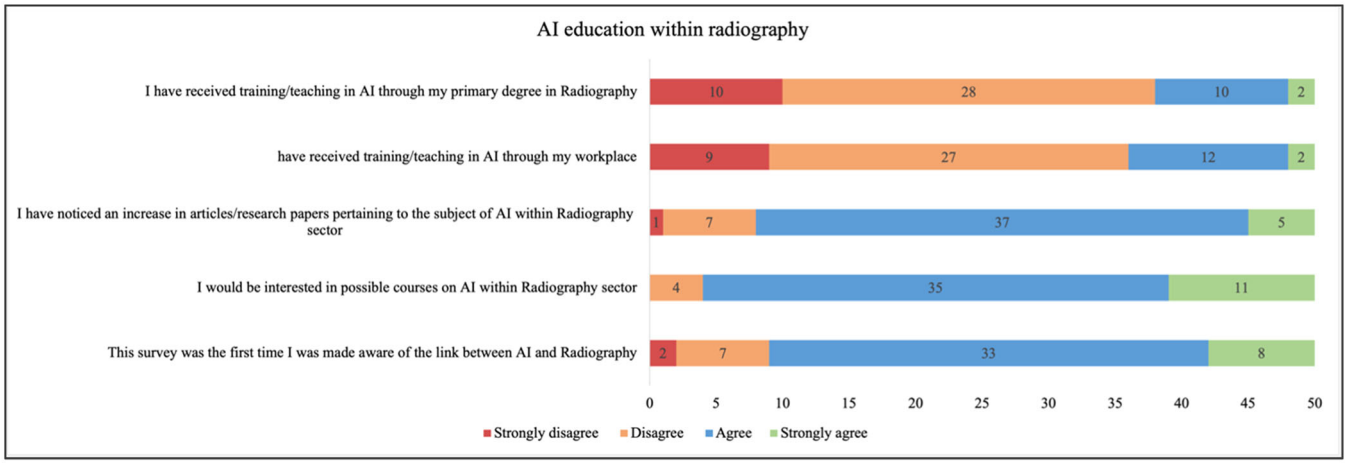

FIGURE 5 | Likert scale bar chart summary of the participants' perceptions of AI education within radiography ($n = 50$).

enhances the role of radiographers while safeguarding both patient care and professional integrity [11, 12]. The results also reported that AI is going to improve the daily work of the radiographers. This can be explained by reducing patient waiting time and appointment lists [4]. On the other hand, most of the participants (84%) disagreed with the statement that AI will replace radiographers. This is primarily because AI cannot replace essential aspects of patient care and communication,

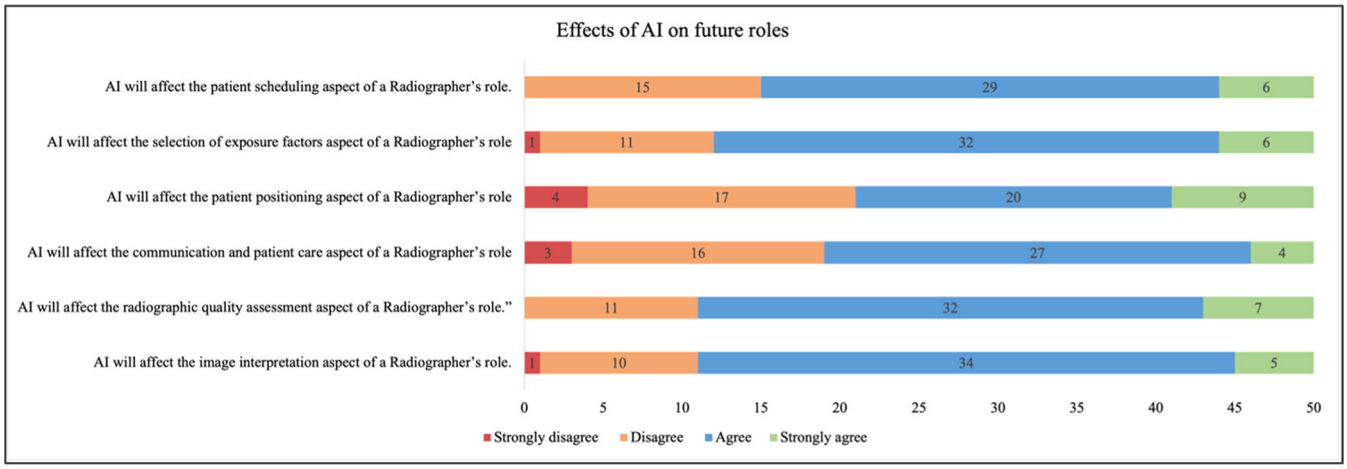

FIGURE 6 | Likert scale bar chart summary of the participants' perceptions of the effects of AI on future roles ($n = 50$).

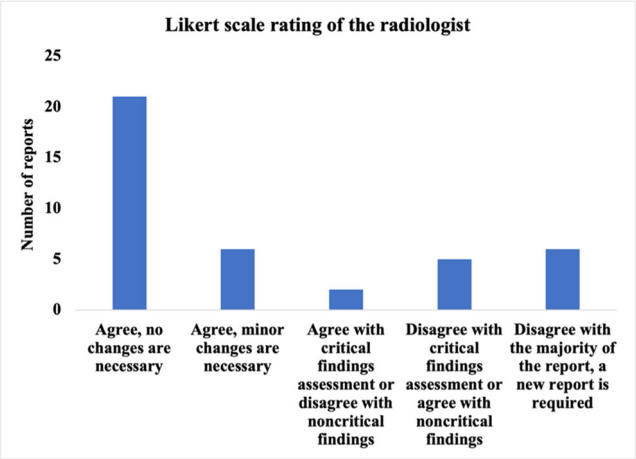

FIGURE 7 | The Likert scale rating summary for the radiologist ranging from agree to disagree ($n = 40$).

such as gathering patient histories and providing instructions. The human touch remains indispensable in these areas. Additionally, the relationship between the radiographers and the radiologists cannot be replaced by AI. This is mainly needed when further examinations and additional imaging projections are required and final approval of clinical reports by radiologists is required.

Although most of the participants (76%) did not receive training on AI during their primary degree in radiography and at their workplace, they expressed an interest in taking courses about AI within radiography. These findings suggest a potential gap between the current educational offerings and the interests of radiology professionals. There seems to be a demand for AI education within the field, despite the lack of prior training, which are in line with previous findings in the region [13–16]. Therefore, there should be more educational opportunities of AI for radiographers to increase their knowledge, keep up with the latest advancements in the field, and improve their ability to use AI tools to provide a better patient care [17, 18]. Moreover, the findings suggested that most participants anticipate significant impacts of AI on various aspects of radiographers' jobs. Particularly, there is a widespread belief that AI can influence tasks like interpreting images, assessing radiographic quality, selecting exposure factors, positioning patients, and even aspects of patient care [19].

In the second part of this study, a chest radiograph interpretation by an AI model was used to evaluate chest radiographs. The results showed that the AI model successfully detected and reported most of the cases and the critical findings. These results are in line with a retrospective study of 500 chest radiographs [8]. Researchers indicated that the AI model produced reports of similar clinical accuracy and textual quality to radiologist reports [8]. These AI reports are generated within seconds thus this will be beneficial for critical findings and life-threatening pathology. Moreover, this will improve the clinical workflow mainly in the emergency department and for the daily employment requests.

The survey results clearly indicate that radiographers in Kuwait are embracing AI as a valuable tool to enhance their work in medical imaging. As highlighted in the study, the availability of these AI tools demonstrates significant potential in advancing the field of medical imaging. Radiographers recognize the promise of AI in improving diagnostic accuracy, reducing their workload, and ultimately enhancing patient care. This growing acceptance and integration of AI within medical imaging workflows underscores its transformative role in modern healthcare practices. As AI becomes increasingly integrated into medical imaging, there is a critical need to revise educational curricula to incorporate training on AI technologies, ethical considerations, and their practical applications. Currently, we are utilizing virtual reality software in the education of our undergraduate students and have conducted research in this area, which is set to be published soon. Additionally, policy changes that offer clear guidelines on the use of AI in clinical practice will be essential for helping radiographers address challenges while ensuring the responsible use of AI to enhance diagnostic accuracy and improve patient outcomes.

This study has some limitations, one of these limitations was the small sample size. A future study is suggested with a larger sample size. Furthermore, a comparison between the two

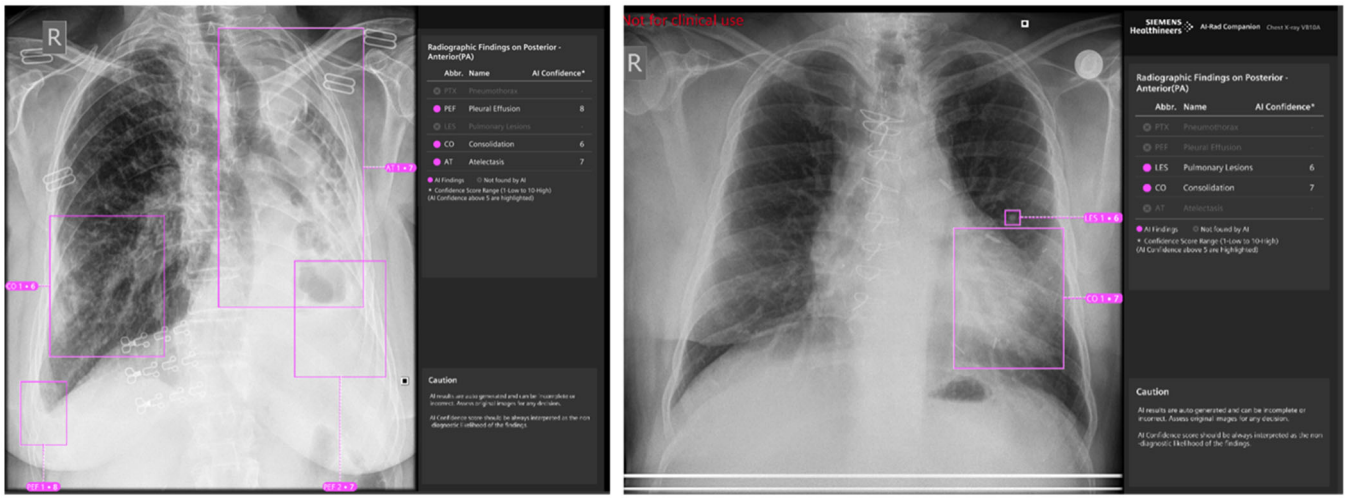

FIGURE 8 | Example of an AI-generated chest X-ray report with markings indicating the pathological findings with the AI confidence scores.

divisions of the radiology department: Diagnostic Radiography and Nuclear Medicine is suggested. Additionally, another limitation of this study is the manual distribution of the questionnaire which may have contributed to the small sample size. Furthermore, in the retrospective study, the radiologist rating was evaluated using a single rater. A future study is recommended with more than one rater to investigate interrater reliability, with a comparison between written, AI, and radiologist reports. Another valuable recommendation is to compare the results of radiologist reports with AI-generated reports, and reports produced by other AI language models, such as ChatGPT.

5 | Conclusion

In conclusion, this study explored the level of knowledge and expectations of radiographers toward AI in Kuwait's hospitals and highlighted one of the available applications of AI in medical imaging. This study revealed that radiographers in Kuwait are embracing AI as a valuable tool to enhance their work in medical imaging. Moreover, the findings identified the need for AI education and training for radiographers to bridge the gap, increase their knowledge, keep up with the latest advancements in the field, and improve their ability to use AI tools to provide better patient care. Additionally, the study demonstrated that AI-powered tools are indicating great promise in the field of medical imaging in enhancing diagnostic accuracy, reducing workload, and improving patient care. However, while AI excels at many tasks, it will not replace radiographers and radiologists but will assist in improving the healthcare system.

Author Contributions

Asseel Khalaf: conceptualization, validation, writing – review and editing, project administration, methodology, supervision, formal analysis, software, writing – original draft, resources, data curation, visualization. **Manar Alshammari:** writing – original draft, investigation, methodology, writing – review and editing, formal analysis, data curation, software, resources, visualization. **Hawraa Zayed:** writing – original draft, investigation, methodology, writing – review and editing, formal analysis, data curation, resources, software, visualization. **Maryam Emnawer:** writing – review and editing, methodology, writing – original draft, investigation, formal analysis, data curation, resources, software, visualization. **Abdulmohsen Esfahani:** investigation, writing – original draft, writing – review and editing, methodology, formal analysis, data curation, resources, software, visualization.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Transparency Statement

The lead author Asseel Khalaf affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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