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A Qualitative Study to Understand Patient Perspective on the Use of Artificial Intelligence in Radiology

Marieke Haan, PhD, Yfke P. Ongena, PhD, Saar Hommes, MA, Thomas C. Kwee, MD, PhD, Derya Yakar, MD, PhD

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DESCRIPTION OF THE PROBLEM: NEGLECT OF PATIENT’S PERSPECTIVE ON ARTIFICIAL INTELLIGENCE USE IN RADIOLOGY

Artificial intelligence (AI) refers to the development of computer algorithms to accomplish tasks traditionally associated with human intelligence, such as the ability to learn and solve problems [1]. Currently, several narrow task-specific AI applications have been shown to match and occasionally surpass human intelligence [2]. However, it is expected that general AI will surpass human performance in specific applications in the coming years [2].

In radiology, AI can provide detailed quantifications of tissues on imaging examinations, which can be used for diagnostic, prognostic, and treatment-planning purposes [3]. Potential benefits of AI in medical imaging may be increased diagnostic certainty, faster turnaround, and better quality of work life for radiologists [4]. Although the role of

AI in radiology is anticipated to increase in the near future, this technology should also be embraced by patients, who are important but still neglected stakeholders.

At present, it is still unknown how patients view the developments of AI in radiology in terms of awareness of this topic, uncertainties, and expectations. This knowledge is crucial to define preconditions for the development of AI systems for different clinical purposes and how they should be used in routine radiology practice. It may also provide insight into whether there is a need for patient education on this topic.

WHAT WAS DONE: SETTING UP A QUALITATIVE STUDY TO UNDERSTAND THE PATIENT’S VIEW ON THE USE OF AI IN RADIOLOGY

Before developing and implementing an AI system for a particular radiological task, it would be very useful to understand how patients view the use

of AI in radiology. The goal of this qualitative study is to develop an understanding of the patient’s level of knowledge of AI and to explore the meanings patients ascribe to key topics, such as radiology and AI. Finally, we aim to identify domains related to patients’ perspective on the use of AI in radiology. This prospective study was approved by the local institutional review board (number: 201800329) and all patients provided verbal informed consent.

We used purposeful sampling to select a sample according to the study’s goals, which is a common sampling method for qualitative research [5]. Participants (ie, patients) were recruited at the Department of Radiology of the University Medical Center Groningen, which is a tertiary care academic institution in the Netherlands. Patients were approached on 10 random days from July to August 2018. Variance in age, gender, education, and whether or not they had previous scans was maximized while selecting patients.

The selection process was not based on clinical indication or medical history of the participants.

The participants were 11 men and 9 women with a mean age of 63.8 years (range: 39-79 years; SD: 12.1 years). All patients were scheduled for a CT scan of the chest and abdomen on an outpatient basis.

With each of the 20 participants, a semistructured face-to-face interview was conducted by a single interviewer with a mean interview duration of 9.30 min (range: 4.48-19.53 min). Half of the participants were more comfortable participating in the interview in the presence of a relative or partner, who occasionally also participated in the conversations. All interviews were conducted directly after the CT scan of the chest and abdomen was performed. Afterward, the participants received a 5-euro voucher.

Because of the lack of specific literature on patients' view on AI in radiology, topics for the interview were first selected based on radiologists' view on implementing AI in practice. Subsequently, an interview topic list with dilemmas was defined and refined by a team of social science research methodologists with more than 10 years of experience in developing surveys. The dilemmas were used as an elicitation method to engage participants [6,7] and were related to the need of involving a radiologist when a computer would be able to autonomously evaluate a scan. Patients were asked about their views on (1) the radiology department in general, (2) AI in general, (3) the combination of AI and radiology, (4) the evaluation of scans by a radiologist versus a computer, (5) receiving results from a medical doctor versus a computer, and (6) the focus of the

scan (ie, whether the computer should only answer the questions of the referring physician or also search for incidental findings).

All interviews were transcribed verbatim shortly after the interview. Confidentiality and anonymity were always ensured by using functional codes when personal information was mentioned. Our data analysis is based on a grounded theory approach [8]. Coding was done by three researchers to maximize researcher triangulation. A range of "grounded" insights was generated in this way [8].

OUTCOME: SIX KEY DOMAINS RELATED TO AI USE IN RADIOLOGY

A prominent result from the interviews is that patients' views on radiology are diverse and sometimes incorrect. For instance, to patients it is not clear what the differences are in roles and responsibilities of different staff members (radiologist, radiologic technician, nurse, or doctor's assistant) at the radiology department. With respect to AI in general, patients noted either no particular associations or mentioned factors like "loss of jobs," "making life easier," or "what need do we have for that?" Patient education may be necessary to increase patients' acceptance of and input on how to best use AI systems in radiology.

With respect to AI in radiology, we identified six key domains that will be outlined next.

1. *Proof of technology* is related to the belief of patients that they can trust the efficacy and reliability of AI throughout the entire process of scan evaluation. Patients report that scientific evidence is required to

validate the use of AI systems in radiology before they can be used in practice. Furthermore, patients acknowledge that humans also have flaws and may therefore not always perform optimally when doing their job. Patients also mention they prefer humans when research shows that humans and computers are equally skilled in performing their job. However, when scientific research shows that computers are indeed superior to humans, most patients indicate that they would rather let the computer do the work than the radiologist. Most patients think that using AI in radiology is a development that will happen, but not in the near future. All in all, proof of technology refers to the need of patients for high-quality studies that prove the value and reproducibility of AI systems, which is the responsibility of the scientific community.

2. *Procedural knowledge* is related to the importance of understanding how AI will be implemented in the current radiological practice. To form opinions on the use of AI in radiology, participants noted that it would be important to understand how AI would be used precisely. Patients express uncertainties about who is involved in the procedure at what stage when implementing AI. To them, the roles of the radiologist, the radiology technicians operating the scan equipment, and the referring physician in relationship to the use of AI are not completely clear. Patients also say that it is unclear to them how AI would affect the procedure of scanning and receiving results. Patients seem to prefer an "all-inclusive" use of AI when evaluating scans. They report that they

would like to receive results not only of findings based on the questions of the referring physician (ie, the primary aims of the scans) but also of incidental or unrequested findings that can be extracted from the scan. Overall, procedural knowledge will require clear communication between the patient, the referring physician, and the radiologist on how to actually implement diagnostically validated AI systems in radiology, from scan acquisition to scan evaluation and sharing scan results with patients.

3. *Competence* is related to the capability of AI to produce reliable results. Patients report that they are unsure about the skills of a computer. They value the experience of the radiologist. They indicate that AI in radiology is a nice instrument to double-check the conclusions of the radiologist, but only using AI could result in restricted views with wrong diagnoses. To sum up, patients were rather skeptical about the skills of AI systems (and regarded a second reading by a radiologist as useful).
4. *Efficiency* is related to the duration of the scanning process. Patients expect that AI will allow more scans to be analyzed in a shorter amount of time. They report that this can have consequences for being assisted sooner and that this will reduce costs. In conclusion, the evaluation speed of AI systems was considered an advantage that may decrease waiting times. Current lack of patients' experience with clinically validated AI systems may perhaps explain their different

views on the domains of competence and efficiency.

5. *Personal interaction* refers to the direct communication between patient and doctor. Patients report that personal interaction when receiving information about the results of a scan is important to them; this human contact allows them to safely ask questions and to gain mutual understanding of the impact of results and reliability of findings. Patients express their concerns about depersonalized procedures in which patients become numbers. Also, to discuss the results of a scan in a sensitive manner, human dialogue is important. To sum up, the domain of personal interaction mainly refers to the redundancy or need for human interaction when receiving scan results in the era of AI systems. The need for human interaction was unambiguously indicated.
6. *Accountability* is related to the responsibility of humans when computers make mistakes. Patients note that radiologists can be held accountable for their mistakes, and they wonder who can be held responsible for errors made by computers. Some patients report that a computer is just a "giant calculator" or a "dead thing" and that humans will always be responsible. Finally, given the anticipated widespread use of AI in radiology in the near future [2], this domain underlines the need to speed up the discussion of associated ethical issues and the development of legal AI regulations.

The results of this exploratory study suggest that patients' level of knowledge of AI and radiology may be rather limited, although further research is

warranted. The six relevant domains that were identified could be considered as a base framework to expand upon and to use for future studies.

This study had some limitations. First, the results of this study are based on data of patients scheduled for a CT scan of the chest and abdomen on an outpatient basis and thus not representative for the whole population of patients. On the other hand, we were able to maximize variance in age, gender, and educational background. Second, the sample size of this study was limited to 20 patients, which was sufficient for a qualitative analysis but not for drawing definitive conclusions on patients' views and preferences in various clinical scenarios with different AI systems. For future research, the results of this qualitative study should be tested in a quantitative approach with a larger sample size.

CONCLUSIONS

The six identified domains of patients' perspective on the use of AI in radiology could provide a framework for patient education and for future quantitative research to investigate and match patients' expectations with the development and implementation of AI systems in radiology practice.

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The authors state that they have no conflict of interest related to the material discussed in this article.

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