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Capturing patient voices: A focus group-based study unveiling the potential of AI in medical diagnosis

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Abstract: *Purpose: This study examines patients' perspectives on the integration of artificial intelligence (AI) in radiology through focus groups, aiming to identify the main issues and areas for improvement. It is part of a larger research project that employs various methodologies to explore the views of both patients and radiologists regarding AI tools. Methods: We conducted two focus groups using a narrative story and vignettes: one with patients who self-assessed as AI experts and the other with non-AI experts. Results: The focus groups revealed diverse opinions on AI use in diagnostics, focusing on six main topics: acceptance, concerns, communication between radiologists and patients, explainability of AI, medical records, and emotional aspects. Conclusions: The findings underscore the importance of developing patient-centric AI solutions to build trust in AI-assisted diagnostic tools, considering emotional and communicational aspects and addressing both physician and patient concerns to facilitate smoother integration of AI in radiology.*

Keywords: *Artificial Intelligence, medical diagnosis, patient perspective, focus group, User Experience, Interaction Design.*

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INTRODUCTION

The integration of artificial intelligence (AI) technologies in medical practice has the potential to revolutionize the healthcare sector. AI has the ability to analyze vast amounts and various forms of data, thereby supporting the needs of medicine in ways that were previously unimaginable (Davenport & Kalakota, 2019; Malik et al., 2019; Yu et al., 2018). With rapid advances in computer processing and the capabilities of artificial intelligence-based systems, there is potential for significant improvement in the accuracy and efficiency of diagnosis and treatment in various specialties (Kulkarni et al., 2020).

Among these, imaging is one of the specialties that would most benefit from the potential of AI thanks to the large amount of data available (Hosny et al., 2018). One of the reasons behind AI's growth in medical imaging is the need for better effectiveness and efficiency in patient care. The amount of imaging data is growing much faster than the number of trained professionals to read it. As a result, radiologists are dealing with huge workloads which can lead to mistakes (Fitzgerald, 2001). AI can assist radiologists by, for example, providing pre-reconstructed images (Zhu et al., 2018) highlighting important features (D'Amico et al., 2018; Secchi et al., 2022), and prioritizing the most urgent examinations (Topff et al., 2023), thus facilitating workflow (European Society of Radiology, 2019). In this way, integrating AI into imaging allows processes to become more efficient, reduce errors (Hosny et al., 2018), and save time that can be used to improve doctor-patient interactions and facilitate a more patient-centric approach (Gampala et al., 2020; Topol et al., 2019).

Despite this, the integration of AI into healthcare systems has not been without controversy and research has raised concerns over legal lacunae, ethical issues, privacy, and accountability questions (Lekadir et al., 2022). These factors may contribute to undermining people's confidence in these technologies and consequently restrain their implementation in daily clinical practice. The large-scale deployment of AI will inevitably affect the physician-patient relationship in ways that are not easy to predict (Greco et al., 2022; Sauerbrei et al., 2023). The interaction between physicians and patients, characterized by empathy and compassion, is considered fundamental for patient engagement. This trust-based relationship has the potential to enhance patient satisfaction and adherence to prescribed treatments. In this context, the use of AI could introduce communication barriers and diminish human social interaction, thereby undermining the empathetic aspect of AI (Esmaeilzadeh et al., 2021).

In order to ensure the successful integration and adoption of AI technologies in healthcare, it is crucial to consider the perspectives and opinions of all stakeholders: physicians and patients first and foremost (Li et al., 2022; Mousa et al., 2023; Vo et al., 2023; Kang et al., 2023). In particular, patients play a central role in the healthcare system and their views and trust are vital in shaping the future of medical practice. Other studies have explored patients' opinions on the adoption of specific AI tools in medical practices (Ho et al., 2023; Hummel et al., 2024; Schaarup, et al., 2023), ranging from specific geographical areas (i.e., Central Denmark, Japan) to specific sectors of healthcare (i.e., people living with diabetes, emotional AI technologies). In general, in the above mentioned studies, positive attitudes were observed toward the use of AI in the medical field, recognizing its benefits for improving patient care, research, and education, highlighting that AI could potentially be used to create social value in medicine, provided it doesn't replace emotional and empathetic interactions. In the context of a specific mapping of the Italian territory and in the field of

diagnostics and imaging, we decided to employ various methodologies to question the stakeholders involved. This work is part of a research project that aims to explore the opinions and potential concerns of patients and physicians regarding the integration of AI technology in the diagnostic field. The goal is to understand how the use of AI is perceived and, if the current perception is not positive or can be improved, to derive design directions to enhance this sensitive interaction. This includes understanding how to increase trust in these tools to foster their adoption. To achieve this purpose, we conducted quantitative (large-scale questionnaires) and qualitative analyses (focus group) with the aim of mapping the perceptions of radiologists and patients regarding the use of AI in diagnostic settings, some of them already published (Ibba et al., 2023; Cè et al., 2024).

In particular, in this study, we present two focus group sessions with patients, engaging in detailed discussions on various aspects of AI implementation in diagnostic settings. Topics include the relationship between patients and AI diagnostic tools, the role radiologists play for patients when adopting AI instruments, and more. Our aim was to corroborate the results obtained from a previous questionnaire administered to 2119 patients, which showed a positive view of the potential benefits AI can bring to medical practice, especially in radiology. Patients appreciate the use of AI for more accurate diagnoses but emphasize the importance of the radiologist's supervision. The role of the radiologist remains pivotal and becomes even more important in the interpretation and communication of AI outcomes (Ibba et al., 2023). The innovative focus group methodology aimed to use narrative techniques to empathize with patients in situations where AI diagnostic instruments were present. The scenarios presented to the users were developed by reflecting on current and future use contexts to evaluate the impact of a progressive shift away from medical intermediation and the introduction of a direct relationship between AI and the patient. This approach sought to capture emotional and contextual nuances that might have been missed with the large-scale questionnaire.

The rest of the article is structured as follows. The next section presents the materials and methods used in conducting the two focus groups, gathering patients' opinions and feedback, and highlighting how the data were analyzed. The results of the two focus groups are illustrated in Section "Results" and discussed in Section "Discussion". Finally, final observations and directions for future work are identified in Section "Conclusions and Future Work".

MATERIALS AND METHODS

We conducted two online focus groups with 15 patients in the field of radiology to understand their perception of the use of AI in diagnostic medicine. We chose to use focus groups as the next step after a preliminary quantitative investigation (Ibba et al., 2023) because they allow researchers to uncover unexpected issues that cannot be identified through structured surveys. Despite the limited number of participants, typically ranging from 6 to 8, which may limit the generalization of the research, focus groups are particularly suitable for collecting qualitative data from users (Wilkinson, 1998). The approach is based on open-ended questions to explore users' attitudes, feelings, and beliefs, but also includes a series of designed questions to explore new feedback and generate new ideas (Mazza & Berre, 2007; Rabiee, 2004).

The participants were recruited from patients who voluntarily subscribed to the newsletter of CDI Centro Diagnostico Italiano, requesting voluntary interest in participating in an online focus group on AI in medicine. Interested participants responded to the email (128 responses), and a short questionnaire was sent to them to profile them based on age, gender, education level, and self-assessment of AI knowledge. They were also asked to propose two dates to join the focus groups.

The selected participants were divided into two focus groups: one group consisted of participants with a medium-high level of AI knowledge, while keeping the other three variables equally distributed, and another group consisted of patients with a self-assessed medium-low level of AI knowledge.

The choice to keep the two groups separated based on self-assessed AI knowledge level was made for two reasons: (i) to avoid the potential situation where individuals with less expertise in the topic might feel inadequate and participate less actively in the focus group, and (ii) to compare the results of the two focus groups to assess any differences, using AI knowledge level as a variable.

Each participant read and signed the privacy information form to participate. Each focus group lasted approximately 2 hours on the Google Meet platform and was moderated by one of the authors, while another author took notes using the Miro tool, which was also used to design the different phases of the focus group. Additionally, video and audio recording were used to enable subsequent review and analysis of the discussion.

Focus Group Design

Both focus groups followed the same structure to address the following research questions: (i) What is the attitude of patients toward doctors using AI? (ii) How much do patients trust medical results derived from AI? (iii) How is the physician's role perceived in the communication between AI and patients? (iv) What do patients want to understand about the functioning of AI tools? (v) How can the results of AI-assisted analyses be communicated in the clearest possible way to patients?

To facilitate a discussion around these five research questions, we decided to develop a scenario divided into five steps of a single story, utilizing visual support of vignettes (Fig.1) to help participants better empathize with the proposed situations and provide responses that closely align with their own experiences. For each step, the moderator provided an introduction and invited each participant to respond individually using Google Forms within 5 minutes.

Subsequently, the moderator initiated a guided discussion between all participants.

This approach, which involved collecting individual responses first and then engaging in discussion, allowed us to (i) obtain input from all participants, as some may be less inclined to express themselves openly, and (ii) have pre-discussion opinions that could potentially change during the discussion.

After a brief introduction to contextualize the focus group and break the ice with the participants, they briefly introduced themselves to each other. The moderator then posed a series of questions to the attendees in order to engage them in a broad conversation and encourage them to start conversing with one another:

- What are your thoughts on Artificial Intelligence in general?

- What are the advantages and disadvantages of AI for you?
- In the medical and diagnostic field, have you ever interacted with AI?
- Have you ever read or looked through your medical records? What is their purpose?

Following this initial phase, the focus group proceeded with the five steps as follows, asking for their reactions if they were in the protagonist's shoes, Mr. Paolo Rossi:

1. Mr. Paolo Rossi, after experiencing a series of episodes of forgetting what he did, visits a doctor and undergoes four different examinations. After analyzing the results of these examinations, the doctor concludes that the likelihood of a neurodegenerative disease is low. However, there is a possibility of using AI for an additional opinion. What would you do if you were Paolo Rossi?
2. Paolo Rossi decided to use AI. The diagnosis formulated by AI is a "medium-high risk of developing a neurodegenerative disease", suggesting further investigations through a specific type of exam. However, the attending physician does not consider the AI diagnosis reliable and prescribes a different type of exam from the one proposed by AI. The doctor tells Paolo Rossi that, in their opinion, AI tools are not yet reliable given technological advancements. Paolo Rossi can choose to trust the doctor's words or present the AI diagnosis report to another specialist. What would you do if you were Paolo Rossi?
3. Paolo Rossi decides to consult another specialist. After thorough research, he approaches a doctor who extensively uses AI as a support and is considered an expert in the field. Dr. Bianchi reviews Mr. Rossi's medical records and believes that the investigation conducted by the first hospital using AI is not particularly reliable due to outdated data and analysis tools. Dr. Bianchi asks Mr. Rossi to undergo a new examination using a new technology based on different AI algorithms that Dr. Bianchi trusts. The result of the new examination is the same as the previous one. Would you prefer Dr. Bianchi to explain the details of AI, or is it sufficient for you to know that Dr. Bianchi trusts the result?
4. Mr. Rossi wants to better understand why Dr. Bianchi trusted AI while the first doctor did not. He asks Dr. Bianchi for explanations. What questions would you ask to better understand how AI functions?
5. In this phase, a hypothetical report (Fig.2), specifically adapted from those currently used by doctors, was shown to assess (i) what was clear and (ii) what was unclear to the patient, (iii) what they would prefer to read and how, and (iv) how they felt emotionally while reading such a report.

Data analysis

The audio recording of the focus group was transcribed for coding: three authors analyzed the transcripts, Google Forms responses and notes taken during the focus group. The transcripts and Google Forms were handled with Atlas.ti software (Version 23.2.0 (4305)), following the constant comparison analysis method. We chose to use this method in order to test the frequency and recurrence of the same themes in the two different focus groups (Onwuegbuzie et al, 2009). Two of the authors worked independently, using, during the first phase, the open coding technique to assign relative codes to each intervention. Then, during the second phase (axial coding), the authors grouped data into categories. Finally, in the final phase (selective

coding), the researchers developed more themes that expressed the content of each of the groups. At the end of each phase, the authors compared with each other, discussing and resolving disagreements. New codes that emerged during these phases were also discussed to determine whether they should be retained, merged or eliminated. The authors then arrived at 6 themes, which can also be traced back to the 5 phases of the focus group (the last two emerged in the last phase): (i) acceptance of AI in medicine, (ii) concerns, (iii) communication between patient, physician and AI, (iv) explainability of AI, (v) medical records and referrals, and (vi) emotional aspects. Each of these themes brings together various categories: for example, the theme of concerns includes "concern of the contrast between doctor's opinion and AI", "concerns about the doctor-patient trust relationship", "concerns about doctor's preparation about AI", "concerns related to privacy", "concerns related to informed consent" and "concerns related to AI regulation". This step was followed by identifying representative quotes to support the statements. We also decided to maintain a comparison between how the various issues were raised in the two different groups.

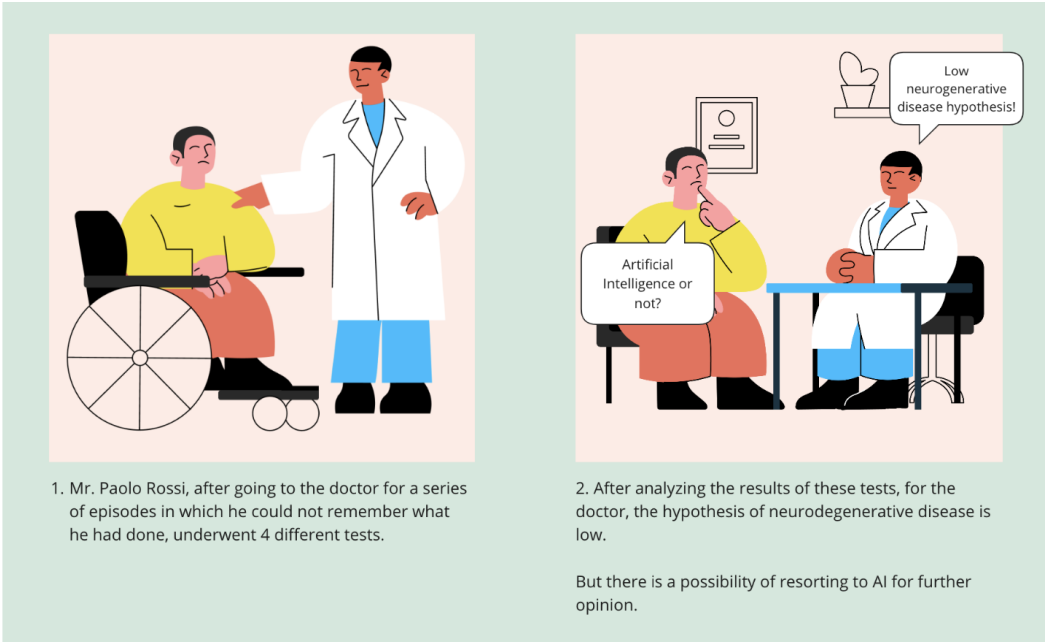

Figure 1. Example of a graphical scenario presented to the patients: this particular panel illustrates the first step of the story.

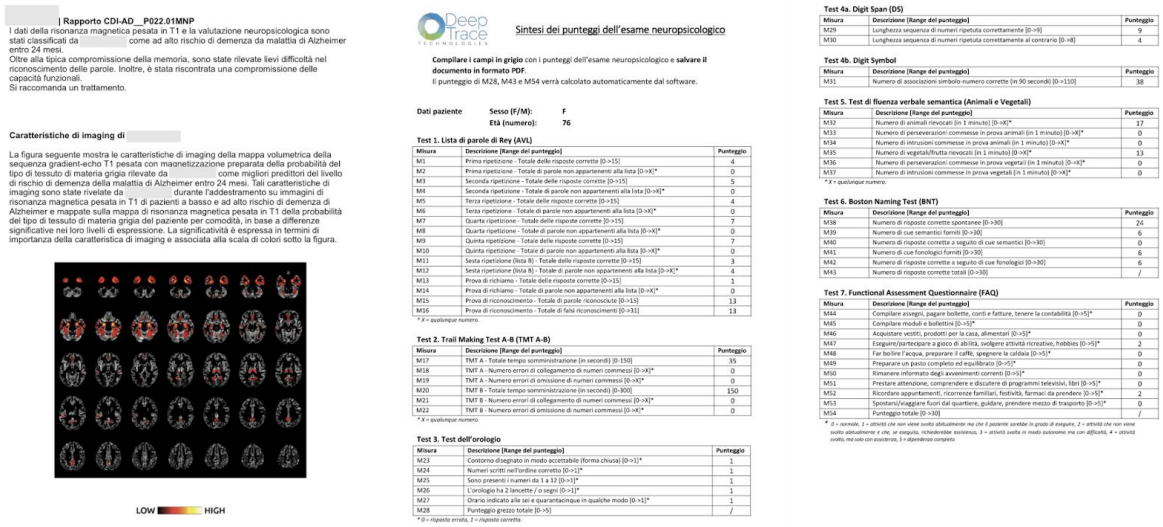

Figure 2. Report presented to the patients.

RESULTS

The two focus groups were conducted in December 2022 and April 2023. The 15 participants selected were then divided into two groups: experts and non-experts. The first focus group was conducted with 8 patients who self-rated themselves as medium-experts (A). The second one, on the other hand, was conducted with 7 patients who rated themselves as having little or no expertise in AI (B). The 15 selected participants are distributed as in Tables 1 and 2.

Although the two focus groups involved people with different knowledge of AI, themes emerged in both groups, even if with slightly different frequencies. Below, we will go on to analyze the discourses that emerged for each theme.

Table 1. Group A participants, also referred to as 'experts" (self-reported a medium to high level of AI knowledge).

ID	Age	Gender	Level of education	AI experience (self judgment 1-5)
A1	50-59	Male	University or similar	4
A2	40-49	Male	High school diploma	4
A3	40-49	Male	University or similar	4
A4	> 60	Male	Post-graduate specialization	5
A5	50-59	Female	High school diploma	3
A6	30-39	Female	University or similar	4
A7	> 60	Female	High school diploma	3
A8	> 60	Male	Post-graduate specialization	4

Table 2. Group B participants, also referred to as 'non-experts" (self-reported having little to no knowledge of AI).

ID	Age	Gender	Level of education	AI experience (self judgment 1-5)
B1	> 60	Male	High school diploma	2
B2	> 60	Male	High school diploma	3
B3	50-59	Female	University or similar	3
B4	50-59	Female	High school diploma	1
B5	50-59	Female	University or similar	1
B6	> 60	Female	University or similar	2
B7	> 60	Male	High school diploma	3

Acceptance of AI in medicine

In general, all participants were in favor of the use of AI tools in the medical field (the code "favorable" emerged 15 times) or at least its use was viewed in a "positive" way (5 times), as it was acknowledged that it "supports the work of the doctor" (6 times), especially "in the diagnostic field" (2 times) and "facilitates and speeds up data analysis" (2 times): "*I would like my doctor to be supported in something that humans have a hard time doing, which is to see a lot of data. The problem with humans is that they see everything through their experience, which, however great, is limited*" (A2). Both groups showed the same distribution, despite different levels of AI knowledge (A = 7 times, B = 8 times).

Concerns

Especially during the second step, but also at other times during the focus group, several concerns related to the use of AI in the medical field emerged. The first concern raised, which also emerged due to the structuring of the step itself, is precisely about the possible "clash between the doctor's opinion and AI" (10 times), most prevalent in the non-expert group (A = 3 times, B = 7 times), which causes "distrust in the doctor due to the inconsistency" of wanting to use AI but then deviating (2 times) and triggers the fear that the use of AI could "create distrust in the doctor" (1 time). The concern that adversarial situations might arise is based on the more specific fear of "the physician's inexperience with AI" (4 times), a concern that opens up comments that it is often the patients themselves who "inquire about the physician's CV" (2 times), about the type of technologies - more or less advanced - that are used by the center in which the physician operates (3 times). A3 states: "*I am afraid of scenarios where AI and doctor's views are conflicting if the doctor does not have full knowledge and awareness of what AI is and how it works, because humans do not like to be contradicted. The problem arises when physicians and AI disagree*".

Other concerns raised included those pertaining to "privacy" (3 times) and "informed consent to the use of AI tools" (4 times): these codes were noted only in the A focus group. Regarding informed consent, A6 claimed that they were not interested in whether the doctor used AI, while the other three claimed that it was as important to them as knowing the use of their data, coded as "privacy".

One theme that emerged, however, only in the B group was "concerns related to AI regulation" (5 times). Various codes, which emerged during the beginning of the discussion related to the third step and, in particular, to the consideration that there are more or less up-to-date AI tools, came under this category. One participant (B4) was surprised at the information that AI does not mean a single entity, while three others said that their choice of which center to go to depends on the technological advancement of the tools used in each field: *"When I have to do some exams I also decide which center to go to depending on the tools I know they use: more than the doctor, for exams that have become routine I have the centers I trust, whose technological updates I follow. For example, for a CT scan I go to X, but for mammography I go to Y"*. From these considerations, the importance of having a single regulation for AI tools was raised (4 times), imagining that there should be minimum requirements on the update and performance of AI tools used in medicine. The democratization of the dissemination and quality of AI tools in the medical field has also been associated with an economic problem of patients (1 time), as not everyone can afford to go to private and centers of excellence in the field of AI tools, but also territorial (2 times), referring to the disparity in public health.

Communication between patient, physician and AI

During the second and third steps of Paolo Rossi's story, participants focused on communication between patient, physician and AI, dwelling on the role of the physician in this three-way relationship. As already shown in the "concerns" theme, the physician's role is not secondary. The mediation of the physician was considered crucial (21 times), mainly among experts (A = 12 times, B = 9 times), not only in assessing the reliability of AI results (7 times), which is considered indispensable in making diagnoses (4 times), but also in reassuring and conveying confidence to the patient (5 times) in communicating the results: *"In my opinion, the AI must be available to the physician before making his diagnosis, because for the patient to learn about the AI outcome in contexts of major diseases could be a boomerang: unfortunately, we patients lack medical knowledge and need confidence in dealing with diseases. And it is the doctor who needs to convey this confidence, and not AI, which should instead be a tool for the doctor to strengthen his knowledge and diagnosis in order to propose the most appropriate treatment"* (A7).

Trust in AI is often linked to the trust patients have in their physicians, which was mentioned 8 times during our interviews. Additionally, trust in AI is influenced by factors such as the physician's age and their familiarity with technology (3 times). Furthermore, the physician's own trust in AI (5 times), plays a significant role. Some patients even probed the physician's stance on AI with preliminary questions (mentioned 3 times) to gauge their comfort with this technology. In cases where they found a misalignment, 2 patients mentioned considering switching to a more AI-oriented physician. Direct communication between AI and patient is thus decisively rejected (19 times), with more conviction in the A group (A = 14 times, B = 5 times). The reasons are various: they need to be reassured in the case of serious illness (7 times), communication in everyday life with generic AI tools is considered already complex and frustrating, so they fear even more such a complex field as medicine (4 times). They feel the need for subjectivity and personalization during the dialogue with the doctor (3 times), as well as being aware that they need someone to guide

them in understanding the results, since the medical field is not easily interpreted (3 times). A6 says: *"The results given by AI tools should be accessible only to the physician, as not only do we need a figure to contextualize them, but also to avoid creating confusion for the patient who is already in a moment of high pressure, crisis, and anxiety...when it comes to important diseases there is a need to trust the physician and for him to reassure us"*.

Explainability of AI

The explainability of AI was one of the themes deliberately introduced through Step 4, but during the B focus group emerged spontaneously already during Step 2, anticipating the flow. Thus, it seems important for patients to understand how AI tools work at the time the physician introduces them since this is the only way they can trust (17 times), although others (3 participants) prefer to have information about the diagnosis and treatment more than how it got there, and one A group participant fears that it would only confuse the patient. Most of the interventions in favor of understanding how AI tools work stick to low-tech explanations (14 times, of which B = 10 times): they want to know the reasons why the physician defines one AI as more reliable than another (4 times), whether it is related to the amount of data analyzed (3 times), the exclusion or inclusion of certain case histories similar to their own (2 times), how up-to-date it is (4 times), how reliable it is (1 time). In the A group, on the other hand, three participants would like precise and technical information about how the AI tools used work: they would like to see statistics (2 times), know the type of software (2 times), know how it was tested (1 time), know the depth of scan (1 time), be informed about neural networks (1 time) and the level of database sharing (1 time).

Medical records and referrals

The last step of Paolo Rossi's story required participants to analyze a medical record and generate questions about it, with a focus also on the emotional aspect (the results of which we will present later). Preliminary questions about the medical record carried out during ice-breaking, revealed that it is not used much by patients (10 times), as it is considered unclear (3 times), inconsistent, as each physician enters documents that have different appearance and terminology (3 times). The report shown to patients was found to be not so different from those they are used to seeing in their own medical records (4 participants) and clear for only 3 of them (A = 2 participants, B = 1 participant), though not in its entirety (2 participants). In 9 (A = 4 participants, B = 5 participants) proposed methods to improve communication, especially if the recipient is the patient, which puzzled 1 participant, as they do not believe the patient is the right interlocutor. Proposals for improving report communication were: providing information with less technical and clearer language (6 times), creating different standard templates, so as to improve communication with the patient (3 times), but also between doctor and doctor (2 times), showing only the necessary information in reports that have patients as interlocutors, explaining it as best as possible and reassuring the patient (3 times), focusing mainly on treatment (1 time).

Emotional aspect

The last step confirmed the misgivings about the direct communication of AI instruments with the patient because it was felt even more necessary to have the human figure acting as a mediator, a theme already analyzed in Subsection "Communication between patient, physician and AI". Ten participants, in fact, in front of the report said they felt anxiety (9 times), confusion (4 times), and worry (2 times). Also touching on the theme of the previous section, A3 says: *"I felt anxiety, in the sense that in 24 months it says elevated Alzheimer's: that's the only thing I understand. In my opinion, it is right that there is this information only for the doctor's use; then I would like instead a separate report that contains information that can help me (patient) understand better and not scare me".*

The emotional theme emerged especially in the B group, where all participants expressed themselves in emotionally negative terms, emphasizing the coldness of communication (5 times) and lack of empathy (4 times). In particular, 2 participants raised the issue related to medical ethics and transparency, arguing that the practice of wanting to inform the patient of everything may lead them to surrender to the disease, as the psychological aspect is important, especially in severe stages. In light of these considerations, they all agreed (7 participants) that direct AI communication with the patient can only take place in non-serious cases, such as routine tests.

DISCUSSION

The results that emerged from conducting the two focus groups offer insight into the opinions and perspectives of both expert and non-expert patients on the use of AI in the medical setting. Most participants expressed a favorable attitude toward the use of AI in medical practice: the value of AI in supporting the work of physicians, particularly in the diagnostic setting, was recognized in both focus groups. AI is seen by patients involved in the focus groups as a means to tackle the challenge of analyzing large amounts of data, overcoming the limitations of the human experience-based approach. These results show that, regardless of participants' level of knowledge, there is a growing acceptance of technology as a complementary tool to traditional medical intervention.

These results are in line with a previous study conducted through semi-structured interviews with 13 participants to understand patients' perceptions and acceptance of using AI in radiology report interpretation (Zhang et al., 2021): the authors observed a generally positive attitude toward the use of AI for the interpretation of radiological reports and the identification of AI as a useful tool to help patients understand better their clinical situation and further steps in their disorders management (e.g., scheduling an urgent appointment with a clinician).

In parallel with the acceptance of AI tools in the medical field, various concerns from patients emerged during the focus groups. A major concern is the possible conflict between the opinions of physicians and those of AI in the formulation of diagnosis and treatment. This concern is more prominent in the B group, highlighting the crucial role the physician plays in establishing trust in patients. Interestingly, the two groups then dwelled on different spontaneous concerns: in the A group, the concern of data processing, privacy, and informed

consent emerged; while in the B group, the issue of AI regulation emerged, with the idea of establishing standards and requirements to ensure the quality and effectiveness of AI solutions used in medicine for all, regardless of income and territoriality. This corresponds to the results of the study by Zhang et al. (2021), with responders expressing concerns about the trustworthiness and cybersecurity, and the will to know information about the system reliability. This study showed that patients also valued knowing details about how the system functions and how its results are produced. This finding aligns with ongoing discussions about the ethical and legal implications of AI-based tools. Issues such as obtaining informed consent for data use, ensuring transparency, safety, addressing algorithmic biases, and safeguarding data privacy are crucial for maintaining patient safety, privacy, and trust, as highlighted in the study by Alì et al. (2024). Additionally, the study points out that different regions adopt various approaches to AI regulation, ranging from a policy of unrestricted innovation to a precautionary principle. These regulatory frameworks need to evolve quickly to keep up with the rapid advancements in AI and to ensure both safety and innovation in the healthcare sector (Alì et al., 2024).

During the focus groups, the importance of the physician as a mediator in the relationship between the patient, the radiologist, and AI emerged prominently. Participants believe that the physician plays a key role in interpreting and communicating AI results to patients. This results in a sense of safety and trust in medical communication, which AI alone cannot provide.

Direct communication between patients and AI has generally been rejected, as patients recognize the need for a human presence to provide personalized and reassuring explanations, especially as AI lacks the emotional support that may be provided during a face-to-face consultation with a qualified medical professional (Zhang et al., 2021). In a survey conducted in the U.S., the responders supported using AI to promote public health and medical professions, they are wary about trusting AI to make key personal health decisions (Beets et al., 2023). A Pew Research Center survey (N = 10.260) conducted in 2021 asked respondents how "excited or concerned" they would be "if artificial intelligence computer programs could diagnose medical problems" (Center, 2021). 40% of respondents were either "very" or "somewhat" excited, 24% were equally concerned and excited, and 35% were either "somewhat" or "very" concerned.

While the focus groups revealed that the role of the physician is seen as necessary, patients also expressed a strong desire to understand how the AI tools being used work. This demand for explanations is seen as imperative in order to trust the results given by AI. Most patients, mainly of the B group, would prefer generic, low-tech, understandable details, but some of them want more detailed information about how AI works. As highlighted by prior research, making system functionality understandable is advantageous as it increases the transparency of systems (Vorm, 2018).

The patients involved in our focus groups stated that the AI-generated reports do not appear very different from those in their medical records, but emphasized that they should be improved so that patients can understand them better. Participants suggest using less technical language and creating standard templates to make the reports clearer and more understandable- both for patients and physicians. Personalization and focusing on relevant information, such as the care to be followed, are seen as crucial. During the review of the reports, the emotional aspect was held in high regard, especially by the B group. Many

participants reported feelings of anxiety, confusion, and worry, emphasizing the importance of empathy and sensitivity when interacting with patients, especially when dealing with sensitive medical issues.

CONCLUSIONS AND FUTURE WORK

This study explored patients' perceptions of the use of artificial intelligence (AI) in medical and diagnostic contexts, employing an innovative focus group methodology that used a narrative story and vignettes. The participants were divided into two groups based on their level of familiarity with AI. The results revealed a generally positive attitude towards adopting AI as a support tool rather than a replacement for doctors. Participants acknowledged the potential of AI to enhance the analysis of clinical data, but also expressed significant concerns, such as the need to ensure data privacy and obtain informed consent. A central theme that emerged is the necessity for clear and accessible communication regarding AI-generated results. Patients want to understand how these tools work and prefer empathetic and reassuring mediation by doctors, especially when communicating complex or sensitive diagnoses. Additionally, there is a recognized need to standardize the language used in reports to make them comprehensible to patients, avoiding overly technical jargon.

Based on these needs identified during the focus groups, several design considerations can guide future research directions. Embracing co-design methodologies involving both physicians and patients could improve the design of AI tools, especially in terms of transparency in their operation. The end users could suggest how these tools could communicate more clearly to increase trust in the result generation process. Indeed, patients expressed the need for medical records and reports to be accessible not only to specialists but also to themselves, avoiding overly technical jargon. Thus, it would be beneficial for AI-generated reports to include explanations in less technical and more reassuring language directed at patients. Moreover, AI should be seen as a supportive tool rather than a replacement for radiologists, who act as intermediaries. It is essential that radiologists understand and trust the tools generating the results, as a lack of this trust could break the chain of communication. Therefore, these tools should be designed to clearly explain the result generation methodology to radiologists, helping them assess the reliability of the results. While the role of the radiologist is seen as irreplaceable, this does not mean that patients do not want to be informed about the technology being used. Providing clear and accessible information on how AI works and how results are produced is crucial to building patient trust. Explanations should range from general to technical, depending on the patient's knowledge level and interest in the subject. Developing explanatory tools that answer patient questions about the AI tools used in their exams could be a solution. These tools should also include information on how the AI handles sensitive data, ensuring patient data security. They could be integrated at the time of report delivery or utilized during waiting periods, such as in waiting rooms.

Lastly, it is necessary to work towards developing and implementing standards and regulations for using AI in medicine, ensuring that solutions are safe, effective, and accessible to all patients, regardless of their socioeconomic or geographical conditions. Physicians should receive adequate training on using AI tools and be involved in their

development to ensure they are well-integrated into clinical practice, irrespective of the type of diagnostic center. The legal framework for AI in healthcare continues to evolve, requiring continuous adaptation. The regulation of AI, exemplified by the ongoing work of the EU AI Act, is just the first step in establishing standard rules, highlighting the need to reshape how AI developers and healthcare professionals operate in this field. Given that this is a young and rapidly expanding field, it opens many avenues for research in regulatory and legal design.

The results of this study are consistent with the quantitative findings obtained from a survey of 2119 diagnostic patients from a diagnostic center in northern Italy (Ibba et al., 2023). Validating these results with a more heterogeneous and extensive sample would further strengthen the conclusions. This study has some limitations: the overall positive sentiment towards the use of AI tools may have been influenced by the voluntary participation in these focus groups, indicating an interest in the topic rather than complete rejection. Moreover, this study is still in an exploratory stage: it would be interesting to develop prototypes of specific AI tools aimed at addressing patients' needs for clear explanations and answers to medical questions, as well as their need for continuous support, including emotional aspects, leveraging co-design approaches that involve both patients and radiologists to unite the two different perspectives.

IMPLICATIONS FOR RESEARCH AND APPLICATION

Future research should consider co-design methodologies involving both physicians and patients to improve AI tools. This approach can enhance transparency and ensure the tools communicate effectively, building trust. Patients emphasized the need for accessible medical records and reports, suggesting AI-generated documents should use simpler, more reassuring language. AI should complement, not replace, radiologists, who are key intermediaries. It is crucial for radiologists to understand and trust the AI tools they use. Providing clear, accessible information about how AI works and generates results is vital for both patients and doctors. Prototyping specific AI tools to meet these needs, including emotional support, could improve patient care. Co-designing with both patients and radiologists will help align perspectives and refine the application of AI in healthcare.

DATA AVAILABILITY AND CONFLICTS OF INTERESTS

The data that support the findings of this study are available from University Suor Orsola Benincasa, but restrictions apply to the availability of these data, which were used under licence for the current study and so are not publicly available. The data are, however, available from the authors upon reasonable request and with the permission of University Suor Orsola Benincasa.

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors' Note

Chiara Tancredi managed the focus group methodology, moderation, data collection, and analysis of results. Arianna Fantesini supervised focus group methodology, moderation, and data collection. Roberta Presta contributed by handling the focus group methodology, introduction, and discussion of results. Laura Mancuso contributed by analysing the results of the focus group. Simona Ibba and Michaela Cellina contributed by working on the state of the art, introduction, and discussion of results. Marco Alì, Sergio Papa and Roberto Montanari discussed the research results within a general framework and were responsible for determining the scope of the study.

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