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3D interactive radiology reports: referring physicians' acceptance of artificial intelligence varies across practice settings

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ABSTRACT

Introduction: A 3D interactive report is a state-of-the-art artificial intelligence (AI) tool that integrates a patient's imaging history into an intuitive visualisation. Yet, despite the many potential benefits to patients, referring physicians, and the healthcare system, a substantial gap exists between such AI developments and their clinical implementation. The goal of this study was to evaluate physicians' attitudes towards AI and their readiness to implement new AI-technologies in different practice settings.

Materials and Methods: A 15-question cross-sectional online survey addressing AI in Radiology was distributed to physicians through professional networks and at a national neuroscience conference. Results were summarized using descriptive statistics, as appropriate for the type and distribution of the data. Group comparisons were made using Chi-square or Fisher's test, as appropriate.

Results: 75 physicians completed the survey between September-December 2025, 52 (69%) being hospital physicians and the rest private practitioners. Response rate was 17%. Hospital physicians were significantly more likely to implement a 3D interactive report in daily practice (Hospital: 82.4% vs. Private Practice: 36.8%; $p < 0.001$). Private practitioners more often believed that of AI-based radiology aids must be explicitly disclosed (82.6%), compared to hospital physicians (76.9%; $p = 0.007$).

Conclusion: Hospital physicians were more receptive for use of AI technologies in radiology compared to private practitioners. Practice patterns, economic factors, doctor-patient relationships, and frequency of interaction with the radiology department likely influence how AI use in radiology is perceived.

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Artificial intelligence; surveys and questionnaires; physician attitudes; technology acceptance; AI-assisted reporting

Introduction

Artificial intelligence (AI) encompasses a range of applications with the potential to transform healthcare by improving patient outcomes and reducing costs. AI in radiology can be broadly classified into three groups based on the primary beneficiary: patients, radiologists, and referring physicians. Patients benefit from reduced MRI scan times through deep-learning based acceleration, where undersampled data is filled in by AI algorithms for image completion [1]. The healthcare system may also benefit from this application, as the increased MRI throughput has the potential to reduce waiting times. Radiologists benefit from computer-aided lesion detection of pathologies such as metastases [2] and aneurysms [3]. Furthermore, they are provided quantitative decision support tools for longitudinal assessment of diseases such as brain tumors [4] and multiple sclerosis [5]. This additional information increases efficiency through reduced image interpretation times while increasing objectivity and consistency. Finally, referring physicians can benefit from natural language processing (NLP) algorithms and novel reporting technologies such as three-dimensional

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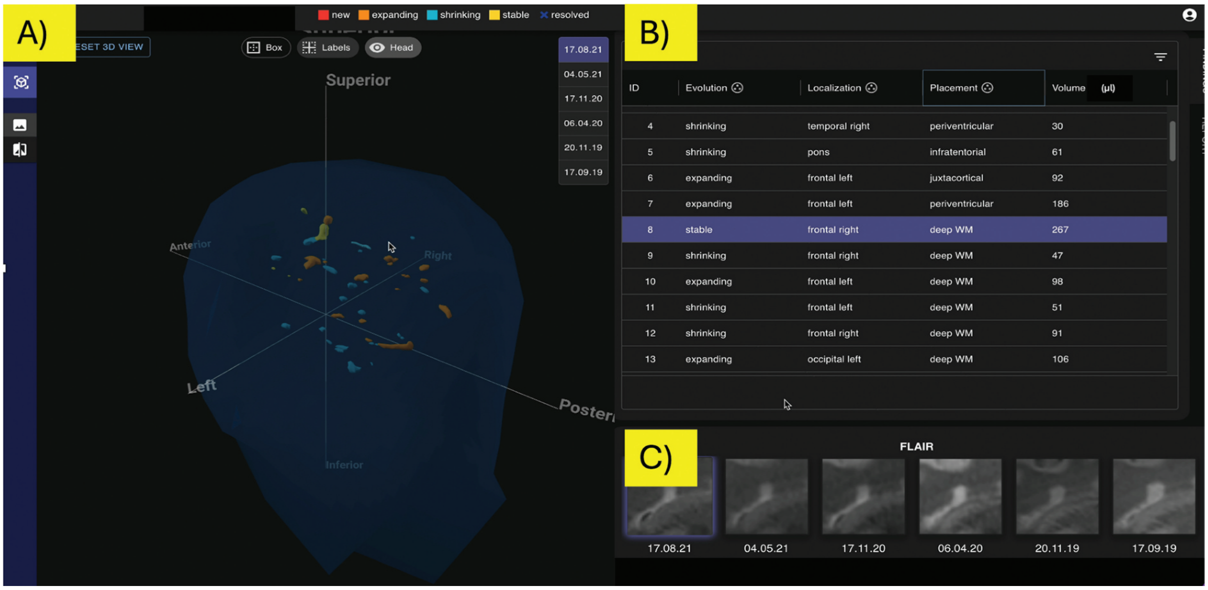

Figure 1. 3D interactive report web interface. A) 3D rotatable visualization of lesions. B) list of individual lesions including automatically generated anatomical location and volumetric measurements. C) Longitudinal follow-up of individual lesions over time.

(3D) interactive reports, which facilitate communication of radiological findings. NLPs improve the clarity and structure of written reports, while 3D interactive reports provide a more intuitive visualization of disease evolution. These applications reduce misinterpretation and support more accurate clinical decision making.

A 3D interactive report integrates a patient's imaging history into an intuitive visualisation which is accessible through a link to a web interface (Figure 1). The 3D report leverages multiple AI technologies including automated lesion segmentation and volumetric analysis, generating an interactive, rotatable 3D visualization of disease burden. Furthermore, the evolution of disease can be visualized over time and correlated to treatment timepoints, enabling direct correlation to treatment response. Both referring physicians and patients may benefit from 3D interactive reports, as the real-world 3D visualisation is more intuitive than standard 2D radiological imaging. In turn, this could improve patient engagement through e-health, promote self-management, reduce the length and frequency of doctor's visits, and alleviate pressure on healthcare resources [6].

Despite the potential benefits of a 3D interactive report and other advancements in AI, a substantial gap exists between state-of-the-art AI developments found in research settings and their clinical implementation. This gap appears to be multifactorial and is influenced by physician experiences, resources, and attitudes [7]. AI-based statistical models helping to guide management can be perceived as helpful by some clinicians, but others may interpret the use of AI as a sign of lacking expertise [8]. Mistrust in the form of unpredictable performance, limited 'black-box' transparency, and concerns regarding accountability further hamper widespread AI acceptance [9,10]. On a managerial level, decisions are largely influenced by economic measures such as cost savings and workflow efficiency [11]. Consequently, even the most advanced AI algorithms are unlikely to be implemented if they do not provide measurable, short-term economic benefits. Thus, the goal of this study was to assess clinicians in different practice settings and evaluate their attitudes toward different forms of AI, including their readiness to implement new technologies in clinical practice.

Materials and methods

The requirement for ethical approval was waived prior to commencement of the survey. All procedures were conducted in accordance with local data protection guidelines and good clinical practice principles.

Survey design

A cross-sectional online survey was developed and distributed via LimeSurvey (LimeSurvey GmbH, Hamburg, Germany) [12], provided by the University of Zurich, Switzerland. LimeSurvey was selected because of its robust data-privacy features and support for local hosting. Throughout the study, the platform and all survey data remained under the exclusive administrative control of the University. The survey questions, response options, and responses can be seen in Table 1. The survey was available in both English and German and took approximately 8 to 10 minutes to complete. Data collection started in September 2025 and concluded at the end of December 2025.

General practitioners in Zurich, Switzerland were contacted systematically by email. Email addresses were collected from publicly available online physician databases [13,14]. Only physicians with an institutional email address and a practice location in Zurich were contacted this way. Hospital physicians and neurologists were additionally recruited through professional networks, a national neuroscience conference and the survey link was informally shared among colleagues. A sample 3D interactive report was available upon request (Jazz by AI Medical, Zollikon, Switzerland). Jazz is an FDA-cleared and CE-marked medical device neuroradiology AI software specialized in the follow-up assessment of multiple sclerosis MRI.

The survey was kept concise to maximize completion rates. Structure was designed to address all aspects of practical AI use in radiology while introducing a novel, unseen form of AI, namely 3D interactive reports. First, respondents' prior experience with AI and their attitude towards it was gauged (questions 1–3). This was followed by the introduction of the novel technology, 3D interactive reports (question 4). Next, questions 5–7 introduced existing AI applications in radiology for which the respondents might previously have been unaware. For example, question 5 highlights the use of AI to reduce MRI acquisition times. Finally, questions 8–15 presented clinical scenarios in the context of these AI applications with corresponding acceptance rates.

Question formats

The survey included 15 questions. The first part collected demographic information, including age, gender, years of experience and primary work setting. The second part assessed physicians' awareness, attitudes and use of AI in clinical practice, with a focus on AI-supported radiology tools. Selected questions were preceded by a brief teaching point to ensure a shared understanding of the topic. The following question formats were used:

Single-answer and multiple-choice questions

These questions gathered demographic data, including years of experience as a licensed physician and primary work environment (private practice vs. hospital). In the AI section, these questions assessed AI use in daily practice, acceptance of AI results compared to reading performed by a senior radiologist, lesion detection preferences (fully automated vs. semi-automated with radiologist correction) and the capacity to integrate 3D interactive reports into clinical consultations.

A five-point Likert scale assessed agreement with two statements concerning AI transparency and standardised radiology reports (1 = strongly disagree, 5 = strongly agree).

Matrix questions

These questions were created using a three-point scale (Always/Sometimes/Never) and involved the following topics: how frequently physicians wished to be informed about AI use in specific steps of radiological workflow, including MRI scan time reduction, lesion detection support and report generation. In a binary response format (Yes/No), physicians indicated whether patients should benefit from AI in terms of shorter scan times, image interpretation and simplified report generation. Furthermore, physicians were asked whether their acceptance of AI would increase knowing that AI is already being used to accelerate MRI scan times.

Table 1. Survey questions and answers stratified according to practice setting, either Hospital or private practice.

Survey question	Response option	Hospital, n	Hospital, %	Private, n	Private, %
		(n = 52)		(n = 23)	
(1) Do you use artificial intelligence (AI) in your practice?	Yes	35	67.3	13	56.5
	No	14	26.9	10	43.5
	Unsure / Don't know	3	5.8	0	0
(2) How well must AI perform to be accepted without a second review by a radiologist?	Better diagnostic performance/lower error rate than a highly experienced senior radiologist	27	51.9	16	69.6
	Same diagnostic performance and error rate as a highly experienced senior radiologist	23	44.2	5	21.7
	No response	2	3.8	2	8.7
(3) For lesion detection in radiology, I prefer that AI:	operates semi-automatically – allowing radiologists to correct AI findings before report generation	45	86.5	23	100
	operates fully automatically – without human correction, but with faster processing	6	11.5	0	0
	No response	1	1.9	0	0
(4) A 3D interactive radiology report is an AI-assisted report that allows online interaction. It can be used, for example, to track lesion development in 3D over time and to help explain the disease evolution to patients, e.g. correlated with treatment timepoints. In my daily practice:	I would interact with the 3D interactive report together with my patients	29	55.8	7	30.4
	I would have time to interact with an online report	13	25	0	0
	No time, screenshots in finalized report are enough	5	9.6	8	34.8
	I would have no time and could only read the finalized report (screenshots not needed)	4	7.7	4	17.4
	No response	1	1.9	4	17.4
(5) I would like to know whether AI was used for my patients in radiology for the following steps: [AI to speed up MRI (shorter scanner time)]	Always	34	65.4	15	65.2
	Sometimes	11	21.2	3	13
	Never	6	11.5	3	13
	No response	1	1.9	2	8.7
(6) I would like to know whether AI was used for my patients in radiology for the following steps: [Lesion detection / follow-up]	Always	43	82.7	17	73.9
	Sometimes	8	15.4	2	8.7
	Never	1	1.9	2	8.7
	No response	0	0	2	8.7
(7) I would like to know whether AI was used for my patients in radiology for the following steps: [Creation of the radiology report]	Always	40	76.9	19	82.6
	Sometimes	10	19.2	0	0
	Never	0	0	2	8.7
	No response	2	3.8	2	8.7
(8) Patients should benefit from AI in the following ways: [Shorter MRI scan times]	Yes	50	96.2	20	87
	No	1	1.9	1	4.3
	No response	1	1.9	2	8.7
(9) Patients should benefit from AI in the following ways: [Supporting the radiologist in image interpretation]	Yes	51	98.1	23	100
	No	1	1.9	0	0
	No response	0	0	0	0
(10) Patients should benefit from AI in the following ways: [Creation of an easily understandable radiology report]	Yes	45	86.5	19	82.6
	No	5	9.6	3	13
	No response	2	3.8	1	4.3
(11) All else being equal, I would prefer to send my patients to an institution that . . .	Uses semi-automated AI, where radiologists can correct AI findings	37	71.2	19	82.6
	Uses AI for as many steps as possible	10	19.2	0	0
	No preference – my priority is that patients are scanned as quickly as possible (short wait times)	4	7.7	3	13
	Uses little or no AI	1	1.9	0	0
	No response	0	0	1	4.3

(*Continued*)

Table 1. (Continued).

Survey question	Response option	Hospital, n	Hospital, %	Private, n	Private, %
(12) If you have reviewed an MRI in the last 6 months, it is very likely that some images were partially generated/ improved (de-noising) with AI. Knowing this, my acceptance of AI in radiology would be higher for: [Lesion detection]	Yes	33	63.5	17	73.9
	No	14	26.9	3	13
	No response	5	9.6	3	13
(13) If you have reviewed an MRI in the last 6 months, it is very likely that some images were partially generated/ improved (de-noising) with AI. Knowing this, my acceptance of AI in radiology would be higher for: [Report creation]	Yes	28	53.8	15	65.2
	No	19	36.5	5	21.7
	No response	5	9.6	3	13
(14) Please indicate how strongly you agree or disagree with the following statements: [AI contributions to reports should always be clearly stated.]	Strongly agree	35	67.3	15	65.2
	Agree	10	19.2	6	26.1
	Neutral	2	3.8	0	0
	Disagree	2	3.8	0	0
	Strongly disagree	3	5.8	1	4.3
	No response	0	0	1	4.3
(15) Please indicate how strongly you agree or disagree with the following statements: [Radiology reports should be consistently structured regardless of AI use.]	Strongly agree	30	57.7	12	52.2
	Agree	14	26.9	9	39.1
	Neutral	4	7.7	0	0
	Disagree	0	0	1	4.3
	Strongly disagree	4	7.7	0	0
	No response	0	0	1	4.3

Statistical analysis

Statistical analyses were performed using SPSS (IBM SPSS Statistics; IBM Corp., Armonk, NY, U.S.A., Version 31.0) and R (version 4.5.3, R Foundation for Statistical Computing, Vienna, Austria). Categorical variables are reported as absolute frequencies and percentages. Group comparisons between hospital physicians and private practitioners were performed using the Pearson Chi-Square test for multiple choice questions and Fisher's exact test for matrix questions. A two-sided p-value < 0.05 was considered statistically significant.

Results

Of the 104 referring physicians who began the survey, 24 respondents did not reach page 2 of the survey and were therefore excluded. Finally, five physicians answered 'both' for practice setting and were thus excluded. 75 physicians were included in the final analysis. 16 of the 75 physicians were part of the systematically sent emails (total 97 emails) resulting in a response rate of 17%.

The largest age group was 30–39 years (44%), followed by 40–49 years (20%), under 30 years (16%), and 50–59 years (16%). Only 4% of respondents were aged 60 or older. Most respondents were female (63%). Years of experience as a licensed physician varied across all career stages. The largest group had less than 5 years of experience (32%), followed by 11–20 years (26%), 5–10 years (25%) and more than 20 years (17%). Most physicians worked in a hospital setting (69%), with 31% working in a private practice. Respondents came from 11 different countries, with the majority based in Switzerland (71%), followed by Canada (4%), Germany, the United States and Italy (3% each). The represented specialities included mainly Neurology (52%), Internal Medicine (19%) and Neurosurgery (9%). Detailed demographic characteristics are presented in Table 2.

Table 2. Characteristics of survey responses included in the study.

Characteristics	n	%
Total participants	75	
Age group		
under 30	12	16
30–39	33	44
40–49	15	20
50–59	12	16
60 or older	3	4
Gender		
Female	47	63
Male	28	37
Years working as a licensed physician		
less than 5 years	23	32
5–10 years	18	25
11–20 years	19	26
more than 20 years	12	17
Primary practice setting		
Hospital	52	69
Private practice	23	31
Country of practice		
Switzerland	53	71
Canada	3	4
Germany	2	3
United States	2	3
Italy	2	3
France, Japan, India, Spain, Turkey, Czech Republic	1 each	1
Not specified	7	10
Specialty		
Neurology	39	52
Internal Medicine	14	19
Neurosurgery	7	9
Cardiology	1	1
General surgery	1	1
Not specified	13	18

Survey results

Survey responses by practice setting are presented together with the survey questions and response options in Table 1. AI use in daily practice was reported by most physicians, with hospital physicians (67.3%) using AI more often than those in private practice (56.5%). When asked which performance level AI would need to reach to be accepted without a second review by a radiologist, most indicated that AI would need to outperform a highly experienced senior radiologist. This applied to both hospital physicians (51.9%) and private practitioners (69.6%). For lesion detection, a semi-automated approach was favoured by both groups, allowing radiologists to review and correct AI findings before report generation. This was the case for hospital physicians (86.5%) and all private practitioners (100%).

When asked about AI disclosure, respondents indicated in which specific scenarios they would want to know whether AI was used in the radiology workflow of their patients (Figure 2). 'Always' was most frequently selected for lesion detection and follow-up (Hospital: 82.7%; Private Practice: 73.9%), followed by report creation (Hospital: 76.9%; Private Practice: 82.6%) and reduction of MRI scan times (Hospital: 65.4%; Private Practice: 65.2%). Regarding patient benefit, physicians in both groups agreed that patients should benefit from shorter MRI scan times (Hospital: 96.2%; Private Practice: 87%), AI-assisted image interpretation (Hospital: 98.1%; Private Practice: 100%) and the creation of an easily understandable radiology report (Hospital: 86.5%; Private Practice: 82.6%). When asked about referral preferences among otherwise equal institutions, most physicians indicated a preference for those using semi-automated AI with radiologist oversight (Hospital: 71.2%; Private Practice: 82.6%).

Physicians were informed that MRI images reviewed in the last six months had likely been partially processed using AI- based de-noising. Knowing this, most indicated that their acceptance of AI would increase for lesion detection (Hospital: 63.5%; Private Practice: 73.9%) and report creation (Hospital: 53.8%; Private Practice: 65.2%). Regarding transparency, most physicians agreed or strongly agreed that AI contributions to reports should always be clearly stated (Hospital: 86.5%; Private Practice:

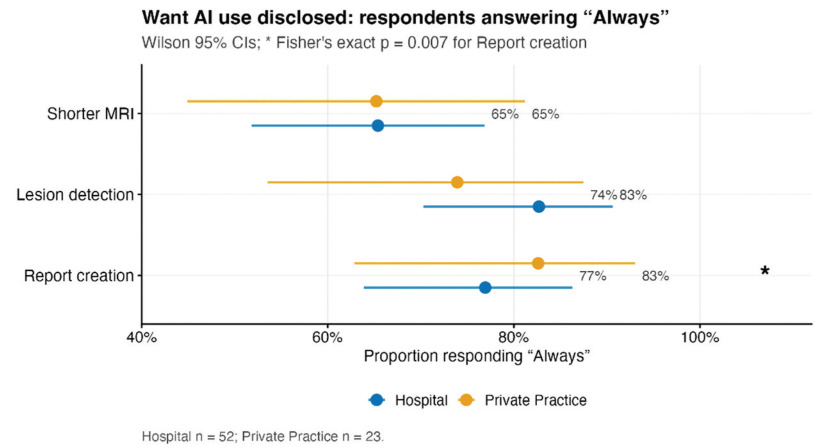

Figure 2. Proportion of 'always' responses regarding the disclosure of artificial intelligence usage for various radiology workflow steps between.

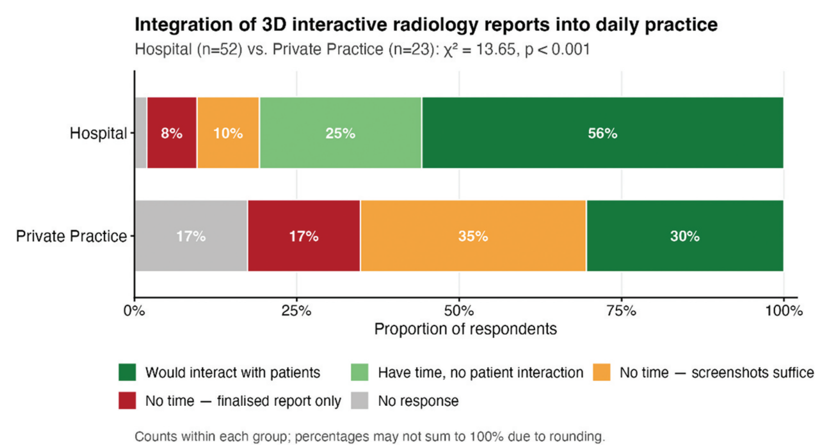

Figure 3. Comparison of responses on the capacity to use/integrate 3D interactive radiology reports in patient consultations.

91.3%) and that radiology reports should be consistently structured regardless of AI use (Hospital: 84.6%; Private Practice: 91.3%). 'Strongly agree' was the most frequently selected response in both cases.

Two survey questions showed statistically significant differences between the two practice settings. The first concerned the 3D interactive radiology report, where the capacity to use/integrate the dynamic report into clinical routine was assessed. Hospital physicians were significantly more likely to interact with this type of report in their daily practice (Hospital: 82.4% vs. Private Practice: 36.8%; $p < 0.001$, Cramér's V = 0.43) (Figure 3). Private practitioners more often reported not having sufficient time to interact with this report format (63.2%) compared to hospital physicians (17.6%). The second significant difference concerned disclosure of AI involvement in report creation. Private practitioners more consistently indicated they would always want this disclosed (82.6%), compared to hospital physicians (76.9%; $p = 0.007$, $n = 71$). No statistically significant differences were observed across the survey responses based on age or sex.

Discussion

To our knowledge, this is the first survey assessing the perceived potential impact and acceptance of a novel AI-enabled technology in neuroradiology, namely 3D-interactive reports. 3D interactive reports allow for an intuitive visualization of a patients' MRI imaging history through an interactive, rotatable 3D visualization of disease burden. Furthermore, the assessment of disease evolution and correlation to treatment timepoints is facilitated, thereby supporting patient empowerment and ultimately helping alleviate pressure on healthcare resources.

Our survey of 75 physicians from 11 countries revealed that the practice setting of referring physicians possibly played a role in how AI technologies were accepted in radiology. Both hospital physicians and private practitioners supported the use of AI-based MRI acceleration to shorten scan times and the use of AI-based lesion detection to support radiological interpretation. Furthermore, both groups agreed that AI technology had to perform above the level of a staff radiologist to be accepted, and that the final responsibility should remain with a human radiologist. In contrast, a significant difference emerged ($p < 0.001$) regarding the adoption of 3D interactive reports, where hospital physicians seemed to demonstrate a higher readiness to integrate these reports into patient consultations.

A physician's practice environment appears to shape the decision-making process on multiple levels [15]. Private practice can be associated with a high financial risk including startup costs and a higher responsibility in terms of management and building patient volume [16]. Moreover, physicians in private practice report having shorter consult times per patient compared to those in hospital outpatient clinics [17]. Patients opting to go to private practice report valuing the quality of the physician-patient relationship and the interpersonal continuity and trust [18]. On the other hand, some patients prefer the hospital outpatient setting for the constant rotation of doctors [18]. The team-based structure of hospital departments facilitates division of tasks and may allow individual team members more time to adapt to new AI tools and innovations. Thus, not only the practice setting but also the reciprocal influence and interaction with patients appears to shape preferences from a physician's point of view.

Differences in communication with radiology may further distinguish the two groups of physicians in terms of AI acceptance. Hospital physicians more frequently attend multidisciplinary radiology conferences and may be more familiar with evolving imaging techniques such as new pulse sequences or post-processing software. However, substantial heterogeneity exists within the hospital environment itself, limiting generalization to the practice setting alone. Orthopaedic surgeons less frequently communicate with the radiology department given their need to independently assess images for preoperative planning [19]. Surgeons in general prefer concise reports in a 'question and answer' style while general practitioners prefer free-text reporting for its flexibility and all-encompassing descriptive style [20]. Given these differences, it becomes clear that innovative AI technologies such as 3D interactive reports might have different acceptance rates among different groups of physicians. Implementing an innovation that shows potential benefits but does not directly speed up workflow or demonstrate a short-term economic benefit may not align with various practice settings. AI technologies promising to re-define disease, offer new perspectives, or promote patient empowerment may lead to long-term changes on a healthcare-system level and require co-ordinated system-level implementation; still, this begins with individual clinician acceptance.

Enhancing patient empowerment is an overlooked aspect of AI in radiology that could have a profound effect on the healthcare system as a whole [21. 3D] interactive reports, alongside chatbots, wearables, and mobile applications, are grouped under AI-driven digital health tools, allowing for patient self-monitoring and remote management [22]. AI-based language models are increasingly being developed to account for differences in medical knowledge between patients and physicians, further enhancing patient empowerment while increasing heterogeneity for improved AI performance [23]. With the plethora of health information available online, patients are more informed and proactive about their diseases than ever before [24–26]. Transforming 2D slice-based radiological images, which require years of training to read, into intuitive 3D images with simple longitudinal follow-up functionality promises to render the abstract nature of radiology more patient-friendly. This promotes proactive patient care and has the potential to improve outcomes [27–29].

Current research on AI algorithms is focussed on integrating multiple AI applications within a unified, multi-task framework. Combined with more powerful 3D convolutional neural networks, these applications can provide a more comprehensive assessment of anatomical structures but are associated with substantial computational demands and costs [30]. Cloud-based processing is frequently used to provide the necessary computing capacity but raises important concerns regarding data privacy and security. Several approaches have been proposed to address these challenges [31,32]. The demand for multi-task frameworks is high; such optimized networks have, for example, been applied to the automated recognition of narcotic and psychotropic medications in the hospital setting [33]. Similarly, 3D interactive reports integrate image pre-processing, lesion segmentation, visualization, and longitudinal comparison within a single application.

The sample 3D interactive report presented to survey respondents was intended for comprehension purposes only, and clinical experience with this technology remains limited. The diagnostic performance of such a tool depends on several factors, including the quality and consistency of the input imaging data, acquisition parameters, and the use of identical or different scanners across follow-up examinations. Differences in image acquisition and reconstruction may therefore influence lesion detection, segmentation accuracy, volumetric measurements, and longitudinal comparability. A key feature of the Jazz software is the possibility to manually correct automated results, thereby incorporating human oversight to ensure high accuracy output. However, this step often represents a bottleneck in model development and clinical implementation, and alternative strategies, such as text-image vocabulary-based supervised learning [34] or automated outlier detection [35] are being developed to accelerate this process.

Several limitations must be discussed. First, this study relied on self-reported data as opposed to data-driven facts from clinical routine. Most responses from within the country came from Zurich, reflecting our intention to evaluate our referring physicians. Supplementation of survey answers from conference promotion and peer-to-peer distribution increased heterogeneity. The response rate was low, which is a common limitation of survey-based studies. Furthermore, heterogeneous recruitment may have preferentially attracted respondents with an interest in AI, potentially biasing the results toward a more favourable perception of AI. The small cohort size precludes definitive conclusions on the subject and limits subgroup analysis; thus, the results should be interpreted as exploratory or hypothesis-generating. The demographic distribution is heavily skewed towards certain countries and referring physicians, thus limiting generalizability to other healthcare systems and cultural contexts. The number of survey questions was kept short with mainly multiple-choice answers to promote survey completion. Thus, only a limited number of AI implementations in radiology were discussed.

To conclude, our survey revealed that the practice setting of referring physicians potentially played a role in how AI technologies in radiology were accepted, whereby hospital physicians appeared more receptive for use of AI technologies in radiology compared to private practitioners. Differences in workflow, economic factors, doctor-patient relationships, and frequency of interaction with the radiology department are likely underlying reasons for this. Future research should investigate the clinical impact and acceptance of 3D interactive radiology reports among both physicians and patients.

Author contributions

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