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Multi-institutional Experience with Patient Image Access Through Electronic Health Record Patient Portals

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Abstract

The objective is to determine patients' utilization rate of radiology image viewing through an online patient portal and to understand its impact on radiologists. IRB approval was waived. In this two-part, multi-institutional study, patients' image viewing rate was retrospectively assessed, and radiologists were anonymously surveyed for the impact of patient imaging access on their workflow. Patient access to web-based image viewing via electronic patient portals was enabled at 3 institutions (all had open radiology reports) within the past 5 years. The number of exams viewed online was compared against the total number of viewable imaging studies. An anonymized survey was distributed to radiologists at the 3 institutions, and responses were collected over 2 months. Patients viewed 14.2% of available exams – monthly open rate varied from 7.3 to 41.0%. A total of 254 radiologists responded to the survey (response rate 32.8%); 204 were aware that patients could view images. The majority (155/204; 76.0%) felt no impact on their role as radiologists; 11.8% felt negative and 9.3% positive. The majority (63.8%) were never approached by patients. Of the 86 who were contacted, 46.5% were contacted once or twice, 46.5% 3–4 times a year, and 4.7% 3–4 times a month. Free text comments included support for healthcare transparency (71), concern for patient confusion and anxiety (45), and need for attention to radiology reports and image annotations (15). A small proportion of patients viewed their radiology images. Overall, patients' image viewing had minimal impact on radiologists. Radiologists were seldom contacted by patients. While many radiologists feel supportive, some are concerned about causing patient confusion and suggest minor workflow modifications.

Keywords Information technology · Image sharing · Patient image access · Radiology workflow · Healthcare transparency · Cures Act

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Introduction

Recent trends toward greater transparency in healthcare and increased participation by patients in their care accelerated when the 21st Century Cures Act was signed into law in December 2016 [1]. The Cures Act was designed to improve interoperability and exchange of electronic health information. Importantly for radiologists, it also includes provisions to eliminate information blocking. The information blocking provision mandates immediate access to clinical information including narrative imaging reports. While the ability to make the images available in portals may be less universal, the expectation is that immediate access to images is also included.

There are several benefits and little potential harm in sharing radiology imaging with patients. Several studies have shown that patients desire direct, immediate access to their imaging reports [2–4]. Up to 92.3% of patients

experience anxiety while waiting for imaging results [2]. Many prefer to have their results in a written, retrievable form, rather than a typical transient verbal encounter in person or via telephone. Similarly, patients also want access to their medical images. Two separate surveys showed that most patients want direct access to their medical images [2, 3]. In one survey, 81% reported that having access to imaging would help them feel more empowered and autonomous in their medical care [5]. Imaging access can also reduce unnecessary repeat scans [6]. Having online access through a familiar patient portal can potentially save costs, compared to the traditional methods of sharing images through a physical CD [7]. Potential harms of image access include patient confusion – from patients viewing their images without talking to their providers – that could lead to increased workload on the provider or radiologist [5].

Our study has two aims: 1) to determine patients' utilization rate of radiology image viewing through an online patient portal and 2) to understand its impact on radiologists' role in patient care.

Methods

Institutional Review Board approval was waived.

Implementation

At each of the 3 academic institutions, patient access to radiology image viewing was enabled through a secure electronic health record (EHR) patient portal for medical records (Epic MyChart, Epic Systems Corporation) [8]. Patients can access test results in the portal through a browser or by an EHR portal app downloaded to their mobile device. After a patient logs into the patient portal and views radiology exam results, a link to view the images via an encrypted URL is displayed (Fig. 1). Implementation dates, boundaries, and

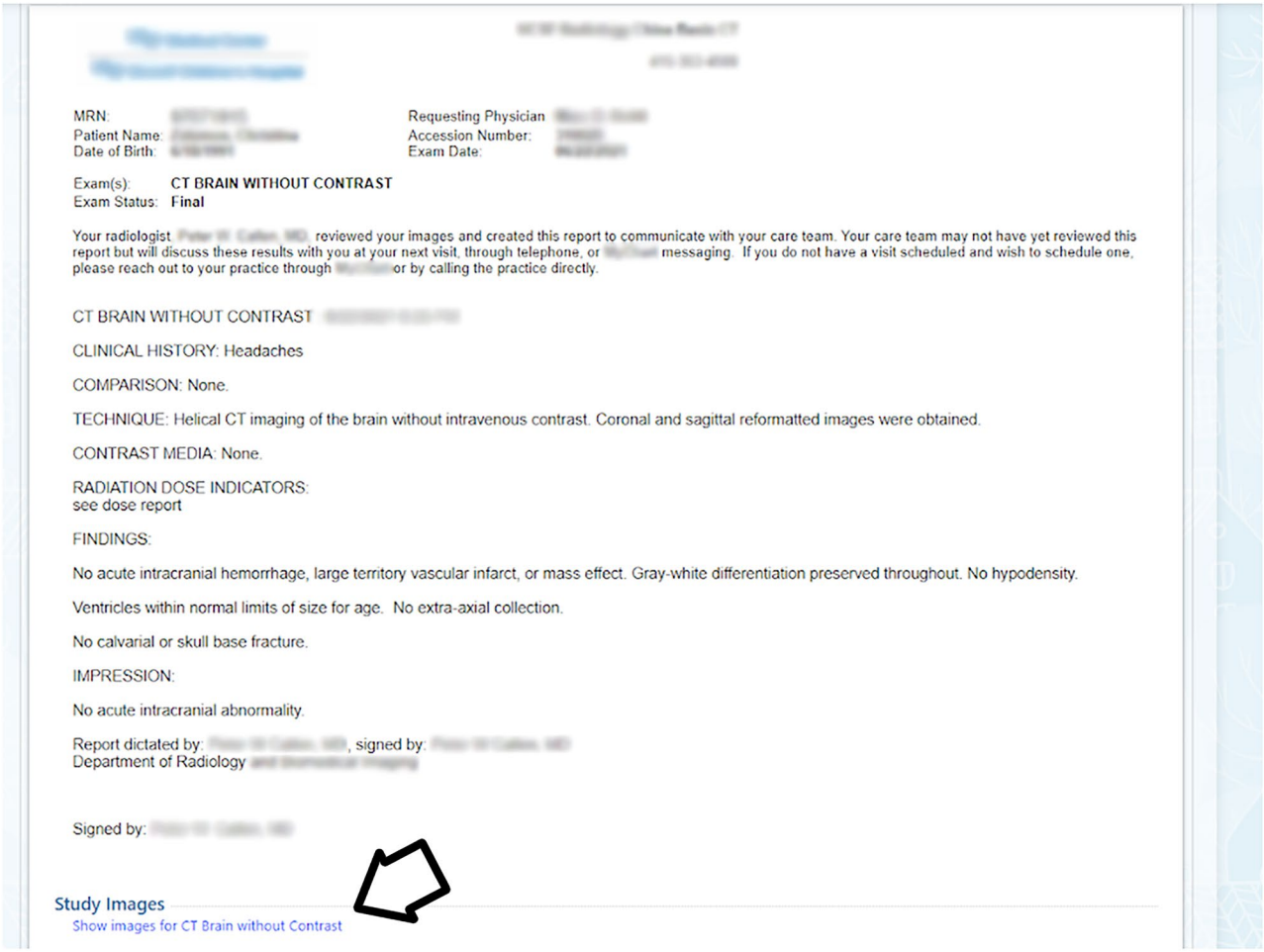

Fig. 1 Example screenshot of test result viewing page in the patient portal report viewer environment, where the link to view radiology images is displayed (arrow)

restrictions to image sharing differed slightly between institutions (Table 1). At institution 1, patient image access was implemented in November 2019; at institution 2, February 2016; at institution 3, August 2019. At all 3 institutions, radiology report sharing preceded image sharing. At institutions 1 and 3, all radiology and point-of-care imaging were made available. At institution 2, all radiology images were available to patients. At institution 1, access to radiology reports and images was linked, made available for patient viewing at the same time; during the study period, radiology results were either manually released by the ordering provider within the first 5 days following final radiologist signature or auto-released at 5 days. At institution 2, there was a 36-h time delay between completion of the study and patient access to images and reports. At institution 3, radiology images were immediately available, and radiology reports were available at the time of final signature.

Usage Data

Usage data were retrospectively collected to determine patients' utilization rate of viewing their images. Over a 6-month interval (September 2020 through February 2021), the first time an imaging exam was accessed by the patient was recorded and tallied on a per-month basis. To normalize this number against the background imaging procedure volume, the total number of viewable exams per month for the same period was also collected.

Survey

An anonymized survey was distributed to all trainee and faculty radiologists at the 3 institutions. The survey addressed how patients' imaging access affected their workflow and whether the radiologists were directly contacted by patients for imaging-related concerns. Radiology residents and fellows were included, as they typically handle the majority of phone calls throughout the day. Method of patient contact included email, phone, and in-person visits. Survey questions are available in Supplementary Information. Survey responses were collected over 2 months (January 2021–March 2021). Free text survey responses were categorized into common threads.

Results

Usage Data

A total of 1,657,992 radiology exams had images available for patient viewing at the 3 institutions over the 6-month interval from September 2020 to February 2021. Of these, 234,973 exam viewing links were opened through the patient portal, for an open rate of 14.2%. On average, there were 24,739 (range 23,590–26,090) available exams each month at institution 1, 164,193 (156,113–176,863) at institution 2, and 87,400 (83,647–93,977) at institution 3. The monthly exam open rates were 34.7% (range 27.4–41.0%) at institution 1, 7.9% (7.3–8.4%) at institution 2, and 20.1% (19.4–21.1%) at institution 3. The monthly trends are shown in Fig. 2.

Survey Results

The survey link was sent to 775 faculty and trainee radiologists: 233 at institution 1, 377 at institution 2, and 165 at

Table 1 Implementation dates, exam details, and restrictions for image sharing with patients that are specific to each institution

	Institution 1	Institution 2	Institution 3
Implementation date	November 2019	February 2016	August 2019
Which imaging exams are shared?	All radiology exams, point-of-care imaging	All radiology exams	All radiology exams, point-of-care ultrasound, endoscopic images
Which imaging exams are excluded from sharing?	Imaging exams for teens (ages 12–18) that could be used to indicate pregnancy (US abdomen/pelvis, abdominal radiograph, abdominal MRI)	Non-radiology imaging	None Studies performed before go-live are not available for viewing
Are image annotations shared?	Yes	No	No
Is there a time delay before images are shared?	No	Yes. (36-h time delay during the study period, will be immediate release going forward)	No
Are reports shared? (Is there a time delay before reports are shared?)	Yes (reports are shared at the time of final signature)	Yes. (36-h time delay during the study period, will be immediate release going forward)	Yes (reports are shared at the time of final signature)

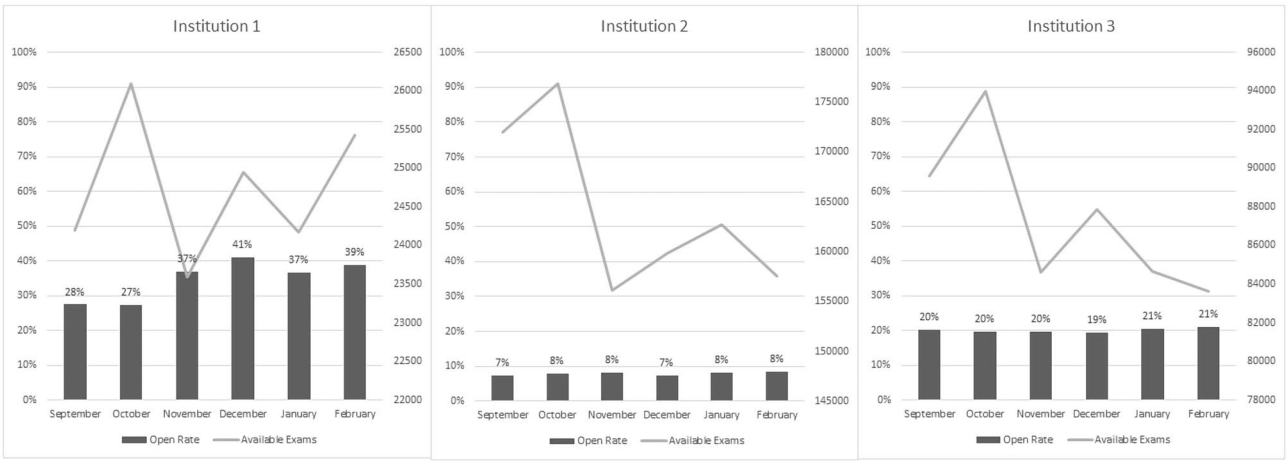

Fig. 2 Patient open rates for radiology exam viewing at each institution. Monthly aggregates are shown. The bars represent the proportion (%; scale on left) of available imaging exams that were viewed by the patients. The lines represent the total number of radiology exams with viewable images (scale on right)

institution 3. There was a total of 254 survey respondents (79, 101, and 74, at institutions 1, 2, and 3, respectively), for a response rate of 32.8%. There was a wide variety of subspecialty-trained faculty or fellow radiologists (Fig. 3). A total of 24.8% were in residency or fellowship training, 11.8% were within the first 5 years of practice, 26.8% were

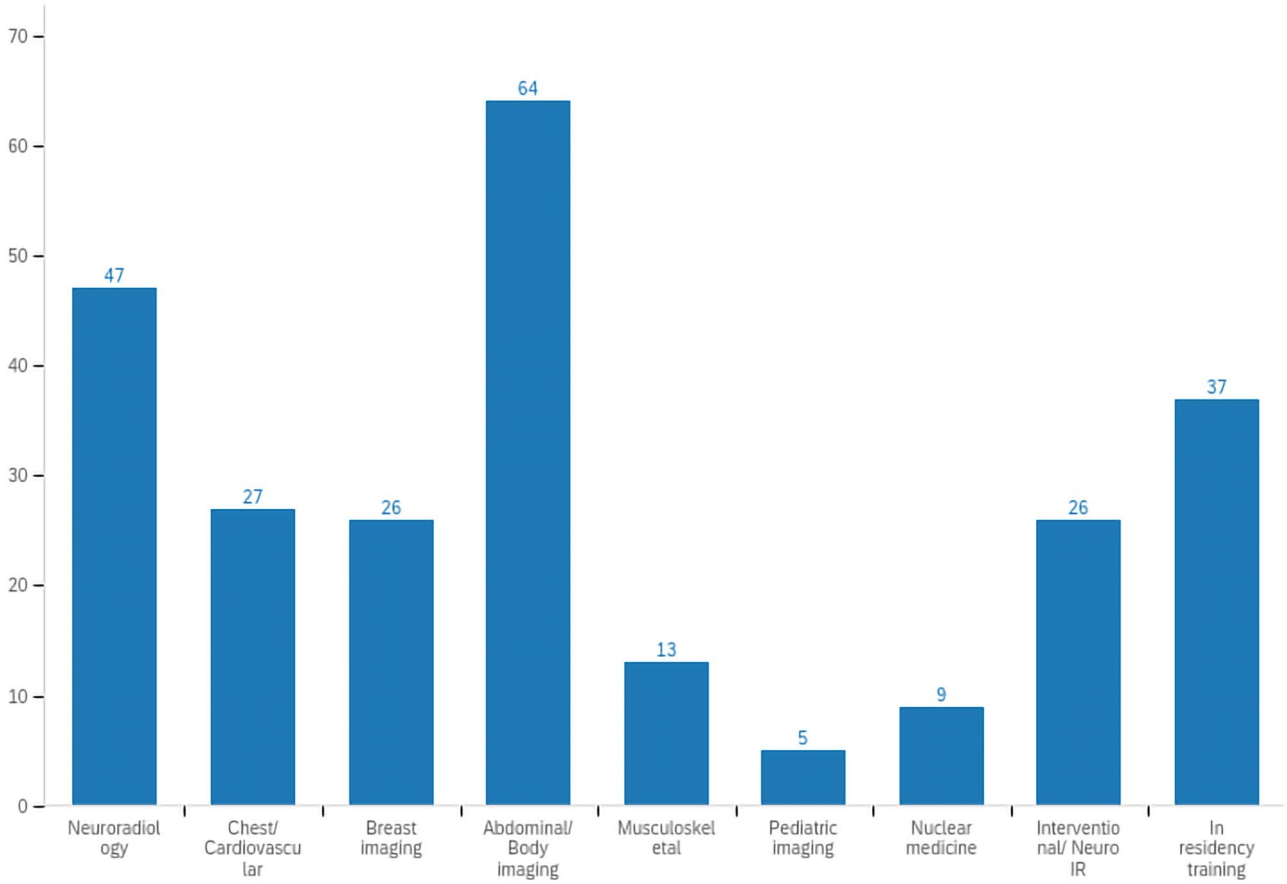

Fig. 3 Distribution of radiologists' areas of expertise or subspecialty

within 5–15 years of practice, and 36.6% had more than 15 years of practice.

204/254 (80.3%) were aware that patients had access to radiology images. Of these, 155/204 (76.0%) felt that patient access to imaging had no impact on their role as radiologists. 24/204 (11.8%) reported a negative impact, and 19/204 (9.3%) a positive impact. Descriptions of positive impact included: direct communication with patients, patient-directed timely follow-up of findings, improved patient understanding and discussion for interventional procedures, and initiative to make reports and annotations clearer. Negative impact comments included: too many phone calls or emails from patients – particularly about non-relevant findings that do not pertain to symptoms, increased calls/emails from providers, patient confusion and stress – particularly for small errors in reports. In total, there were 83 free-text responses to describe how patient image access has affected the radiologists, which are summarized in Table 2. Of these free-text responses, 28 (33.7%) indicated little or no impact. The next common responses were that patient image access results in workflow adjustment (17), it causes patient confusion and anxiety (16), patients will contact the radiologists more often (14), it will result in positive patient interactions and improve transparency in healthcare (14). Workflow adjustments mentioned included using clearer language and deciding whether to report benign incidental findings (or stating "of no clinical significance" in accompanying reports).

Overall, most radiologists 162/254 (63.8%) were never contacted by a patient about radiology images. Of the 86 (33.9%) who were approached by patients, 40 (46.5%) were contacted once or twice thus far, 40 (46.5%) reported several [3, 4] times a year, 4 (4.7%) several times a month, and only one respondent was contacted several times a week; one respondent did not specify frequency.

There were 147 free-text comments on the topic of patients' access to radiology imaging (Table 3). Seventy-one (48.3%) reacted favorably, stating that patients should have the right to healthcare transparency. Comments included:

Table 2 Categorized free-text responses to "How does patient image access affect your role as a radiologist?"

How does patient image access affect your role as a radiologist?	
Little to no impact	28
Requires workflow adjustment	17
Increases patient confusion/anxiety	16
Patients will contact radiologists more	14
Led to positive patient contact experience; it is a positive move towards healthcare transparency	14
Other	4
Medicolegal concern	1

Table 3 Categorized free-text responses to "Please share your thoughts and experiences about patients having access to their imaging studies"

Please share your thoughts and experiences about patients having access to their imaging studies	
In support of patients' rights to healthcare transparency	71
Worried about increasing patient confusion/anxiety	45
No opinion or neutral	23
Will need more attention to report and/or image annotations	15
Other	9
Want time delay before images are available	9
Worried about increased radiologist workload	7
Worried about increased provider workload	5
Medicolegal concern	2
Patient privacy concern	2

positive step toward patient empowerment, patients have the right to view their own bodies, and greater transparency for doctor-patient relationship. Forty-five (30.6%) expressed concern for patient confusion, misunderstanding, and anxiety (as patients will be viewing images without the tools or resources to understand them), and 23 felt neutral. For example, several respondents commented that the patients may misinterpret the images on their own and cause more stress than a theoretical benefit. Fifteen responses indicated that radiologists should pay more attention to reports and annotations. Nine wanted a short time delay before releasing images to the patients. Other concerns included increased radiologist workload (7), increased provider workload (5), patient privacy issues (2), and medicolegal concerns (2).

Discussion

Our multi-institutional experience shows that a small proportion (14.2%) of imaging procedures was viewed by patients online. Most radiologists (78.3%) felt neutral about online patient access to imaging. Only a minority of radiologists (34.7%) were approached by patients about radiology imaging, typically a few times a year. While many radiologists feel that sharing radiology images with patients is a step toward transparent, patient-directed care, they are also worried that it could confuse and alarm patients.

Within this environment of increasing healthcare transparency and patient autonomy, there is an expectation that patients should have access to their imaging studies. Waiting for the results of imaging studies can be stressful and frustrating for patients; patients desire more detailed, documented results rather than a typical verbal report [4]. Having access to the accompanying images may help patients better understand their disease processes and allow them to partake as informed participants in shared decision-making

[3, 5]. As our patient population becomes more tech-savvy and better-informed consumers of health, there will be an increased demand for sharing medical imaging data. Radiologists are at the forefront of this initiative, and our patient care roles may shift slightly in this changing environment.

Our experience also highlights several workflow modifications for sharing images with patients. The paperwork and annotations burned-in image data being captured in the radiology study, such as a prenatal ultrasound image showing gender textual annotations being available to patients who did not want to know, had to be considered in our workflow. Another important area for workflow consideration is with image annotations (i.e. measurements, arrows, region-of-interests), artificial intelligence result images, and scanned diagrams/documents that may potentially alarm patients or be unrelated or incongruent with the accompanying report.

There are several challenges in incorporating DICOM image-sharing technology into patient portals, especially in ensuring patient privacy and institutional data security. An organization must prevent any unauthorized access using encrypted URLs, perform robust patient authentication, and demonstrate the ability to audit accesses. Patents do not require and may be overwhelmed by the depth and breadth of image analysis features required by diagnostic imagers. Image pan, zoom, triangulate, reference lines, magnifying glass, window level, and window level presets are likely more valuable than image manipulation tools like invert brightness, linking, and annotation. In addition to removing low-value image manipulation tools, removing functionalities specific to physicians is prudent, including those for reading worklists. This may be accomplished by passing an access patient portal parameter – through the encrypted URL – that specifies the application features and functions to present to the user making the request. Institution 1, due to state teen privacy regulations, creates only study-level image links. This leverages existing result routing logic built into the patient portal. Creating a single patient-level view into the imaging history can create challenges, especially with patient proxy access (e.g., parent who accesses child's portal).

To our knowledge, there are only a few studies addressing patients' access to imaging studies through an online portal [5–7, 9]. A recent study from Italy described a similar implementation of web-based image viewing and reported that only 4.9% of exams were accessed [7]. Our multi-institutional experience shows a substantially higher rate of exam viewing by patients, 14.2% (the highest monthly open rate was 41.0% at institution 1), highlighting that our patients are actively involved in their care, curious to understand more about their health conditions. We did find differences in exam open rate between the 3 institutions – in particular, the open rate at institution 2 was notably lower than the other institutions. This may relate to the underlying study type, background rate of patient portal (MyChart) activation, and usability of the patient portal app. Institutions that have more functionality built into patient portals – such as online appointment scheduling, bill pay, direct messaging with treating physicians – likely have higher rates of patient engagement with the patient portal image viewer. Another potential reason could be that patient image access was implemented 3 years earlier at institution 2; the novelty factor could have worn off. Patient demographics, education level, and/or patients' comfort levels with computer- or app-based tools could also be other possible explanations. These factors were not evaluated in our study but would be topics for future research.

Several studies have explored patients' perspectives on having access to radiology images. Halaska et al. reported that 89.5% of patients wanted access to radiology images; a majority of patients felt that this would help them better understand medical conditions and feel more in control of their care [5]. Our study, however, is the first to document radiologists' perspectives in this changing atmosphere – our multi-institutional experience highlights how radiologists' roles and workflow could be adjusted in the open notes environment.

Our study had several limitations. Patient imaging access usage data was captured over the same 6-month interval, although the implementation dates differed between the institutions; therefore, we were not able to assess for any significant changes in utilization rates over time. As our objective was focused on the radiologists' perspective and role, we did not survey patients about viewing images through the patient portal. We did not assess for any potential effects in clinical outcomes or repeat or follow-up imaging utilization. Our survey relied on voluntary participation from the radiologists at the 3 institutions. While the survey questions encouraged radiologists to provide feedback based on their experience, some of the comments could have reflected the radiologist's perceptions or theoretical concerns, rather than true experience. As the survey only provides radiologists' stated preferences, a true objective evaluation of the impact on radiologists was not quantified.

Conclusion

In our experience, a small proportion of exams (14.2%) were viewed by patients, at a rate higher than previously reported [7]. Our experience highlights that many patients are actively involved in their medical care, utilizing access to their medical records with advancing information sharing technology. Patients' online access to viewing their own radiology exams had little to no impact on radiologists' day-to-day workflow. Radiologists are seldom contacted by patients about imaging studies. While many radiologists are supportive of patients

having access to their radiology images, some are worried that it would cause confusion and alarm for patients and suggest minor workflow modifications.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10278-021-00565-9.

Author Contribution HHC and MDK contributed to the study design, data collection, and analysis and writing parts of the manuscript. ALK and CJR contributed to the data collection and analysis and writing parts of the manuscript. JVC contributed to the data analysis and writing parts of the manuscript.

Data Availability De-identified data can be made available on request, subject to IRB data sharing approval.

Declarations

Ethics Approval and Consent to Participate IRB approval was waived. Consent to participate and consent for publication were waived.

Competing Interests The authors declare no competing interests.

Disclaimer The authors declare that they had full access to all of the data in this study and the authors take complete responsibility for the integrity of the data and the accuracy of the data analysis.

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