DESCRIPTION OF THE PROBLEM
As of 1996, HIPAA has granted patients access to all aspects of their medical record, including imaging studies [1]. Such access has been shown to improve many aspects of patient care [2]. Most patients utilize access to imaging reports when available, and the majority of patients prefer direct access to their imaging studies [3]. Determining how to best provide such access and meaningfully communicate complex medical information proves challenging.

Patients prefer online access to imaging studies over the use of compact discs (CDs), although CDs are still used exclusively by the vast majority of medical centers [4,5]. CDs and universal serial bus devices leave sensitive medical data at risk of being lost, stolen, damaged, or inaccessible on other systems [2,5]. As of 2018, only 4% of hospitals provided patients with access to their images via online imaging portals [5]. Such an electronic portal can potentially provide patients with secure, convenient, cost-saving access to their medical imaging studies and in turn foster related discussions with their providers [6].

WHAT WAS DONE
Since November 2013, our institution has offered a patient-facing imaging-viewing portal (MyVue, formerly Carestream Health in Rochester, New York; acquired by Philips Healthcare Information Solutions in Andover, Massachusetts), which provides patients online access to their medical imaging studies. Our radiology leadership requested integration between this imaging portal (MyVue) and our electronic health record (EHR) patient portal (MyChart, Epic Systems Corporation, Verona, Wisconsin) with the intention of facilitating patient access to images and interactive reports with fewer accounts and login steps. Technical development by the vendors and implementation by our site took approximately 3 years combined. With development completed, implementation at a similar institution should take months. Our institution did not incur additional vendor-related costs.

Our portal integration (MyChart–MyVue) was implemented for patients on September 10, 2019. In conjunction, our institution deactivated existing patient accounts in the imaging-viewing portal and notified account holders that going forward, access would only be available through the EHR patient portal. Notifications were sent to image portal account holders over email and posted on the image portal login page. There was no broadcast message about the integration to patients who did not have an existing imaging portal account. These patients learned about the integration through self-discovery or via word of mouth from providers or imaging staff.

The new process for patient access to online images began when they logged in to the EHR patient portal. Upon viewing a radiology report, a patient could click a link (Fig. 1A) to view the images in the image portal (Fig. 1B). The integration used a
Fig. 1. Integration of the electronic health record patient portal with the patient portal to the PACS gives patients online access to medical images and interactive radiology reports without separate accounts. (A) Illustration of radiology report in the electronic health record patient portal demonstrates a link (blue arrow) to launch images and interactive reports. (B) Screenshot demonstrating interactive report (right) side by side with patient-facing image viewer (left). The interactive report contains a hyperlink (blue arrow) to the key finding. Once the patient clicks on this link, the image viewer navigates to the relevant image (left) with the helpful annotation (ie, the yellow arrow) placed by the radiologist during report creation. This mechanism allows the patient to conveniently access the study, scroll all images, and quickly and confidently navigate to the annotated key findings for a potential better understanding.

Fig. 2. Cumulative unique patients (y axis) accessing online medical images through patient portal integration plotted versus time (x axis). Several thousand unique patients (first point on left side of graph) accessed their images online in the first partial month after portal integration on September 10, 2019. The number of cumulative unique patients who accessed images through portal integration rose steadily during the 5-month period after integration.
uniform resource locator-based, study-specific connection with authentication managed by encryption keys between portals. The patient experience was streamlined such that the two portals effectively behaved like one, and some users may not have observed that separate applications were involved.

Because the image portal simultaneously displayed images and interactive reports, patients could quickly navigate to relevant images with annotated findings by selecting hyperlinks within the reports created by the radiologists (Fig. 1B). Such interactive reports have been described previously and have potential to improve report clarity and expedite review by report consumers [7].

To assess the impact of patient portal integration on patient access to images, we retrospectively reviewed unique-patient access to the image portal for 5 months both before and after the integration took place. The decision to use 5 months of data after integration was based solely on that being the most current period at the time of data collection. The period of 5 months before integration was chosen to be a comparison period of matching length. Our institutional review board considered this HIPAA-compliant quality improvement study to be a program evaluation, rather than human-subjects research, and determined more formal review was not required.

OUTCOMES AND LIMITATIONS

A comparison of the number of unique patients who accessed their medical images in a long-standing online image portal for 5 months before and after integration was conducted via the Armitage et al asymptotic z test for comparing Poisson distributed counts [8].

For the 5 months before integration, when all image access was attributable to direct patient login to the long-standing image portal, 1,925 unique patients accessed their images online. For the 5 months after integration, when all image access was indirect through the EHR patient portal, 13,202 unique patients accessed their images online. Cumulative unique patients accessing their images online over 5 months after portal integration are summarized in Figure 2. Nearly 7-fold more patients accessed their images online when offered a new pathway in the patient EHR portal compared with the long-standing option of separate direct login to a patient image portal ($P < .001$; Fig. 3).

The integration was the primary driver of the improvement in patient engagement in their images. Furthermore, this mechanism goes beyond the delivery of images and traditional plain text-only radiology reports, by also distributing interactive multimedia reports directly to patients using their pre-existing EHR portal accounts (Fig. 1B). Compared with plain text-only radiology reports, interactive multimedia reports have been shown to improve communication to consumers, and patients are no exception [7]. It is reasonable to expect that patients may better understand their results if they have direct access to interactive reports and corresponding images. Additionally, it has been found that implementation of hyperlinks for the creation of multimedia reports did not produce a significant difference in dictation times for radiologists but did help clinicians extract relevant information [7]. With many radiology malpractice lawsuits related to communication errors, supplying patients with direct access to their imaging studies and reports could serve to improve communication and perhaps decrease unnecessary litigation [4].

A key component of the 21st Century Cures Act places patients in charge of their health records. The
Office of the National Coordinator of Health Information Technology Cures Act Final Rule specifies interoperability requirements generally outlined and set forth by the Cures Act. The Final Rule mandates patients have access to their records without delay. Patients are being empowered to directly access their own results, and imaging results are no exception. EHR patient portals are a convenient way for patients to access their imaging results, but historically these have been limited to plain text-only reports. The vast majority of US institutions rely on CDs, despite associated logistical issues and costs, to share medical images with patients and providers.

Our study has several notable limitations. We did not directly survey patients to measure whether their improved access enhanced their satisfaction or understanding. We provided patients access to interactive radiology reports, but we did not measure how often patients clicked on the interactive elements. Our institution should be less reliant on CDs to distribute images to patients, but we did not evaluate for actual time or cost savings.

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Amy L. Ellenbogen, MD, and James T. Patrie, MS, are from Radiology and Medical Imaging, University of Virginia Health System, Charlottesville, Virginia. Cree M. Gaskin, MD, Vice Chair of Clinical Operations and Informatics, Division Chief of Musculoskeletal Imaging and Intervention, and Associate Chief Medical Information Officer, Radiology and Medical Imaging, University of Virginia Health System, Charlottesville, Virginia.

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Amy Ellenbogen, MD: University of Virginia Health System, Radiology and Medical Imaging, 1215 Lee Street, Charlottesville, VA 22903; e-mail: ale2t@virginia.edu.