



CHALLENGES IN PATIENT-CENTERED RADIOLOGY:

Is AI the answer?

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Medicine has entered a new era of patient engagement, in large part due to the ubiquity of online patient portals. Patients now have unprecedented access to their medical records online, which has introduced a new level of transparency to healthcare¹. For many specialties, the path to patient engagement is obvious. However, for radiologists, who are often in the background and not patient-facing, patient engagement is a challenge. Radiology, as a field, has always been driven by innovation and technology. While the last 50 years have seen tremendous and almost continuous advances in medical imaging technology, the radiology report has hardly changed at all. Radiology reports are complex and highly technical documents, written in medical language, and intended for a physician audience. The 21st century Cures Act² has, for better or worse, brought the radiology report out of the dark by giving patients immediate access to health information. This means that patients are not only reading radiology reports directly but in many cases reading them before talking with a doctor.

While many challenges exist as radiology transitions to a new era of patient-centered care, hospitals and imaging centers have an opportunity to leverage recent advances in AI-based technology to engage patients via radiology reports.

Immediate access to reports has many theoretical advantages. Informed patients may be more prepared for conversations with their doctor, and more able to fully participate in treatment decisions. Further, patients who read their own imaging results are by definition engaged, and patient engagement has been shown to lead to improved outcomes^{3,4,5}. If that engagement is rewarded with comprehension, an engaged patient can become an empowered patient.

The problem is that radiology reports are not intended for patients. These highly technical documents are often not readable by a patient audience and confuse rather than empower our patients. Thus, while patient access to health information has tremendous theoretical benefits, in practice these benefits are not realized.



Radiology becoming patient-centered

Much has been written about what it means to be patient-centered in radiology. Radiologists traditionally have little direct patient contact, so options available to other physicians are logistically challenging for radiologists to implement. In an ideal world, the radiologist would sit down for a consultation with each patient after the imaging exam, talking through the findings in plain language while pointing them out on the screen. The radiologist would speak to the patient in plain language and the patient would leave the imaging center with a full understanding of the results. Alternatively, the radiologist might produce two reports, one for the referring clinician and one for the

A Technological Solution

The problem with the options described above is that they increase, perhaps double, the radiologist's workload. This is a problem that begs for a technological solution. Rather than producing a second report, what about transforming the standard report into a more patient-friendly format? This approach could leverage the work the radiologist is already doing, the work they are trained to do, to create a version of the report that is easy-to-read and actionable for the patient without disrupting workflows.

Artificial Intelligence (AI) is becoming increasingly prevalent in radiology practice. Many radiology AI applications are focused on image interpretation, however more recently these technologies are being applied to radiology reports as well, and may hold the key to scalable patient engagement for radiologists and imaging centers. By leveraging advances in machine learning (ML) and natural language processing (NLP), it is possible to transform the radiology report into a patient readable format automatically, without disrupting radiologist workflow. The end result of AI report translation may take several forms, depending on the degree to which the original report is altered. NLP has been used to extract structured elements from radiology reports such as medical terms and phrases, which can then be linked to lay-language definitions or diagrams displayed to the patient in an interactive, on-demand format. This strategy maintains the integrity

of the radiologist's original dictation, while supplementing the medical jargon with explanations to make the content more accessible, useful, and actionable to the patient. Maintaining the original report has several advantages, including avoidance of medicolegal pitfalls associated with translating medical text. If the patient is merely receiving supplemental educational information alongside the original report text, the risk of misinterpretation is minimized. On the other end of the spectrum is a true AI translation from medical jargon to lay language. This is currently an area of research interest but has not been performed in practice in large part due to concern over misinterpretation that could lead to an incorrect conclusion being presented to patients. **A 3rd and more radical possibility is to completely reimagine the radiology report, and present patients with a simplified, image-rich summary of their radiology report in a format that is unrecognizable compared with the original "physician version" of the text. This is perhaps the holy grail of the AI approach to patient-centered reporting and may be where the field is headed.** In the near term, we are likely to see a hybrid approach where NLP-driven embedded plain-language explanations are supplemented with individualized graphical content for certain report types.

Hospitals and imaging centers can benefit from the increased patient engagement made possible by these innovations. Potential return on investment may take several forms, including patient satisfaction, patient and referring



patient, in technical and lay language respectively. In practice, neither of these approaches are feasible at scale. Radiologists are busy, and even a minimal disruption to the typical workflow can cause delays in image interpretation with negative downstream effects.

If the radiologist can't consult with the patient or produce a separate lay-language report, perhaps the standard report could be made more patient-friendly. This could theoretically be accomplished by simply creating a single report in plain language, such that it is accessible to both physician and patient. However, many physicians would argue that the use of technical medical language is critical to precise physician-to-physician communication. Further, radiologists are trained to think, write, and speak in a professional medical context. Accurate conversion of medical language to lay language is quite challenging and is not something radiologists are trained to do. Anyone who has attempted to translate a complex medical paragraph into lay language knows that it is time consuming and much harder than it looks.

provider loyalty, or differentiation from competitors in the marketplace. Patient-centered reporting strategies may also provide a novel way to engage patients for other purposes beyond communicating results. Once a patient is engaged, particularly via an online platform, that engagement can be leveraged to provide additional services such as online scheduling or tracking of follow up imaging recommendations, thus driving revenue while improving patient care. The radiology report, rather than being a lifeless document, could become the hub from which the patient has access to a number of previously siloed services offered by their doctors and imaging providers.

Patient-centered care in radiology is evolving. Today's patients have come to expect, and often rely on, access to their own medical information including imaging results. The 21st Century Cures Act means patients will now have that access immediately, in many cases viewing results before talking with a doctor. Most information in the medical record is currently intended for physicians, however as new technologies enable more patient-centered content, patients may come to expect this type of engagement from their providers. This is a challenge, but also an opportunity for hospitals and imaging centers to leverage new technologies and employ novel and scalable patient-engagement solutions. ■

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