Clinical content platforms drive enterprise imaging strategies

Mary Beth Massat

Enterprise imaging is a term that's been tossed around radiology for quite some time. But what really is the definition of enterprise imaging? Is enterprise imaging simply the sum of its parts—a VNA, a zero-footprint viewer, and an image exchange or image-enabled EMR?

Not exactly, cautions Rasu Shrestha, MD, MBA, Chief Innovation Officer, University of Pittsburgh Medical Center and President, UPMC Technology Development Center. "VNAs, image mobility, cloud-based solutions … any one of these technologies, on their own, are not conquering what we need. The bigger value proposition is more intelligent middleware that truly enables the workflow. The focus shouldn't merely be on VNAs or application silos. Rather, [it should be on] what we can do to enable intelligent workflows on top of the VNAs."

Workflow. It's at the heart of every medical specialty, especially radiology. As the US healthcare system transitions to a value-based care model, technology should be viewed as an enabler of an enterprise imaging workflow that embraces a patient-centric approach to the delivery of care, Dr. Shrestha says.

"We want technology to be invisible, so that in the 15 minutes a primary care physician spends with a patient, they can glance at the record and piece together information from across the (department) silos," he explains. "What we really want is the clinician interacting with the patient and focused on meaningful conversations. This need for a patient-centric approach to care is true for radiologists, who by the nature of what they do, often have scarce direct interaction with patients, but often are inundated by key decisions that need to be made around the care of these very patients."

A fundamental question that has not yet been addressed is: What constitutes an electronic medical record (EMR) and what aspects of a patient's care should be in the EMR? says Eliot Siegel, MD, Professor of Diagnostic Radiology at the University of Maryland School of Medicine. While Dr. Siegel acknowledges the importance of enterprise imaging, he notes that enterprise imaging will change as the industry expands and better defines what is meant by an "EMR." Over time, the EMR has evolved from basic, primitive billing or lab tracking systems to the multispecialty repository of patient data that it is today.

"In radiology, our expectations are to archive all medical images (and reports) from a medicolegal perspective," Dr. Siegel explains. "Our images are thought of as an integrated part of the medical record." Other 'ologies' may not share this view. For example, an endoscopy video of the stomach or esophagus may be recorded but then erased when a new study is written on top of it, or destroyed after a limited period of time.

"We need to figure out how to get lab studies, patient medication notes, operative notes, imaging and pathology reports, discharge summaries—all saved in a "Tower of Babel" of noninteroperable formats, into a single standard or normalized format," he adds. Dr. Siegel explains that for regions of interest, quantitative measurements and CAD observations to be accessible to the EMR, they need to be tagged using approaches such as the National Cancer Institute's Annotation and Image Mark-up "standard." Other clinical specialties, such as dermatology, are similarly looking at combining a Lexicon with a standard method of tagging features, measurements, and other areas of interest.

Another significant challenge is the interoperability of these different workflows as it relates to the EMR and enterprise imaging. Dr. Siegel points out that IHE has expanded its efforts to other specialties, and the importance of achieving multidisciplinary agreement about means of handling workflow and patient data using standards such as HL7 and DICOM.

Implementing clinical content platforms

The lack of adherence to standards by vendors is one challenge that all healthcare organizations still face, even with the efforts to promote the use of standards across the industry over the last decade, says Dr. Shrestha. "What the industry needs to focus on is getting at data liquidity across different silos in an organization," he explains. "Companies are all
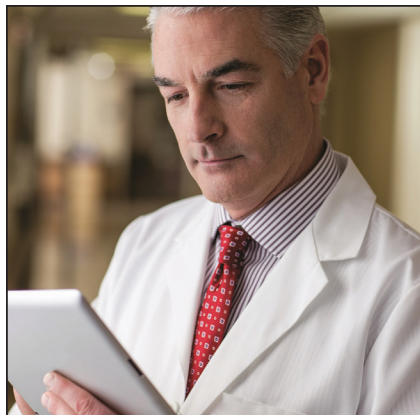
FIGURE 1. Carestream's Clinical Collaboration Platform can help make patient records more accessible to referring physicians and clinicians and is also designed to provide physicians with easy access to images on mobile devices such as tablets.

over the spectrum in terms of adherence to standards."

There is one emerging standard that Dr. Shrestha thinks will allow for a smoother path to interoperability—FHIRE (Fast Healthcare Interoperability Resources). According to the HL7 website, "FHIR combines the best features of HL7's Version 2, Version 3 and CDA product lines while leveraging the latest web standards and applying a tight focus on implementability. FHIR defines a set of 'Resources' that represent granular clinical concepts. The resources can be managed in isolation, or aggregated into complex documents. Technically, FHIR is designed for the web; the resources are based on simple XML or JSON structures, with an http-based RESTful protocol where each resource has predictable URL. Where possible, open internet standards are used for data representation."[1]

Its benefit is in the ease of implementation, with the HL7 website stating that multiple developers have had simple interfaces working in just one day. FHIRE is based on Web standards such as XML, JSON, HTTP, Atom, OAuth, etc., and provides concise and easily understood specifications. Further, FHIRE address the challenge of

variability of healthcare data caused by diverse processes by defining a simple framework for extending and adapting the existing resources.

"Looking at the needs around "inter-ology" collaborative workflows, whether it be radiology/cardiology or radiology/pathology, there are commonalities in terms of digital content. However, it's primarily about the patient, they are common across these collaborations that need to happen throughout the care continuum. Enabling intelligent workflows across these ology interactions, whether that is storing data in the VNA or enabling the workflow through a mobile app or zero footprint viewer, these interactions when done efficiently and effectively improve quality, decrease costs and brings the most value back to radiology," says Dr. Shrestha.

The best of both worlds

Carilion Clinic (Roanoke, VA) is a network of community and specialty hospitals serving 1 million patients throughout western Virginia. Thomas R. Stuckey Jr., MBA, Director, Technology Services Group and Mahesh C. Tailor, Director, Technical Services, have implemented the Hitachi Content Platform (HCP) and Hitachi Clinical Repository (HCR) at the health system's data center. The HCP is the central storage system for the health system's VNA, the HCR, which currently houses all the facilities' radiology and cardiology PACS data. According to Stuckey, phase one of the rollout includes radiology and cardiology, with orthopedic, wound care, and ultrasound in the planning stages.

"We are consolidating all our data into a single repository so we don't have to maintain silos of storage, with the next evolution being big data and analytics," explains Tailor. "We are looking to mine the metadata located in the HCR so we can take that data and correlate it to patient records and

make better decisions, such as knowing how often a patient is exposed to radiological imaging so we aren't overexposing a patient multiple times."

Tailor and Stuckey are also addressing the issue of multiple viewers for different types of images. By having a single viewer that can be pulled up in the VNA through the hospital's EMR solution, they can avoid managing multiple applications and corresponding software updates. It also provides a consistent view for the user across all the "-ologies." Today clinicians can pull up radiology images from the PACS in the EMR; Tailor and Stuckey hope to begin doing the same for the cardiology PACS.

"It's the best of both worlds," says Stuckey. "While the data is in the VNA and accessible with the enterprise viewer, the departments can still have their native solutions." In terms of their individual workflow, nothing really changes, Tailor adds.

Another key benefit of the VNA is they can migrate data to newer technologies without impacting the department applications. Currently 90% of the hospital's radiology imaging data now resides on the VNA, which uses spinning discs; with tape, retrieval times were a minimum of 90 seconds; now the imaging data appears within seconds after the request. "It's a vast improvement for our clinician and they no longer have to prefetch priors because the data is so quickly retrieved."

Multi-site enterprise repository

At the 900-bed Reggio Emilia Hospital (Reggio Emilia, Italy), Marco Foracchia, PhD, IT Medical Systems Manager, is overseeing the ongoing implementation of Carestream's Clinical Collaboration Platform, fulfilling the need for an enterprise-wide clinical image repository and distribution system. The solution links the hospital with five rural satellite healthcare facilities.

Dr. Foracchia and his team recog-

nized the need for a collaborative platform after performing an analysis of all existing imaging equipment to determine types of data output, number of exams and images, media types, status of storage and the actual or potential clinical value of media not stored or improperly stored.

"We realized that up to 79% of our non-DICOM images were not properly or securely archived," says Dr. Foracchia. "This meant they were not part of the full patient clinical portfolio, which was unacceptable."

Additionally, physicians in the hospital's Epilepsy Center were accessing a patient's prior data in only one-third of their cases because it was not archived or managed in a way that was accessible. The analysis also uncovered that 36% of patients who could have had a follow-up consultation at a location closer to their home were instead required to go to the main hospital because their clinical data could not be distributed to other locations.

Using features from the Clinical Collaboration Platform, Reggio Emilia now identifies and manages a variety of data formats, making it available to all clinicians regardless of their location. Endoscopy videos were migrated first from multiple department systems, followed by concurrent access to radiology reports and oncology exams. Currently, the hospital is migrating EEG and ultrasound exams along with videos from OR suites and rehabilitation procedures.

"In the past, physicians could not view many types of prior exams because they were not available when they queried a local departmental system," Dr. Foracchia explains. "Having an enterprise-wide imaging repository also allows patients to be treated at a center that is close to their homes because their data is available throughout our network of facilities."

With the platform, the departments have reduced inefficiencies caused by limited access while at the same time preserving that department's specific workflow—important for maintaining clinical efficiency. Reggio Emilia Hospital has also achieved economies of scale by consolidating individual archives, reducing the cost of maintenance and management.

Handling non-DICOM data

Finding solutions for non-standards-based, non-DICOM data is a big challenge faced by healthcare systems and hospitals, including Unity Point Health Methodist-Proctor (Des Moines, IA) a health system that encompasses 32 hospitals—many of these being critical access hospitals—and 280 physician clinics. In 2015, Unity Point is on track to perform 1.5 million radiology and 500,000 cardiac imaging studies.

Matthew Bishop, Enterprise Solutions Architect, says in the case of sleep studies/polysomnography, DVDs are often used for the primary storage without any archiving system behind it. By using a solution such as McKesson's Clinical Data Exchange (CDE), Unity Point could securely manage the study and enable access to it. Then, clinicians would know that a study has been completed and also have a more complete patient record.

"Today clinicians are spending more time in the EMR for documentation," Bishop says. "The more of this specialty patient information that we can push into the EMR—the non-diagnostic image and report—then the more we can save (valuable) clinical time."

The perfect example of this, he explains, is the health systems' pulmonary function workflow being evaluated in the discovery phase of a CDE trial. Pulmonary function tests are currently performed at various hospitals and clinics throughout the health system; many facilities do not have an on-site pulmonologist, rather one that rotates between different sites. Studies are printed from the pulmonary function machine and stacked in the office to be read; the physician dictates the report, which is then transcribed and placed in another bin to be signed.

By using the CDE and a web interface, the PDF report and images could be uploaded and linked to the EMR. The reading physician would access it from any workstation, laptop, or even an iPad, in any connected facility. Using the EMR's embedded dictation software, the physician would dictate and sign the report right in the EMR, making it accessible to other clinicians.

"We would go from a workflow that could take up to six days and streamline it to within six minutes, if that is needed for urgent cases," says Bishop. "I've seen at least four other types of non-radiology and non-cardiology tests that require an image where a similar workflow could be applied."

Bishop also envisions using a clinical data exchange enabling different PACS at different hospitals to share images by using IHE's XDS standard and without replacing/adding equipment or merging patient records. This could become increasingly important as more facilities throughout Iowa, western Illinois and southern Wisconsin join Unity Point, one of the most integrated health systems in the US.

Managing imaging data in a clinical repository or VNA also helps enable more robust analytics, something that is becoming increasingly important in a value-based care model that embraces evidence-based medicine. Even if facilities can't start the process of consolidating data due to financial or other constraints, Bishop says they can prepare for it by identifying all storage needs. While radiology and cardiology are large consumers of medical imaging, other departments may have greater storage needs. As an example, Bishop cites a 300-bed hospital epilepsy department that is generating 4-5TB of data each year from its epilepsy monitoring unit.
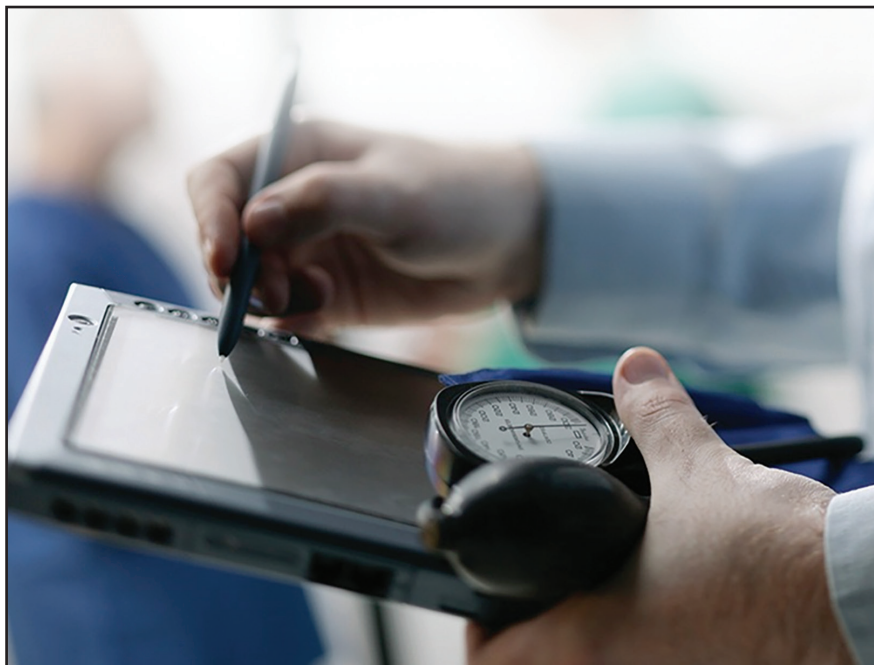
FIGURE 2. *Hitachi Clinical Repository is at the foundation of an enterprise-wide IT strategy supporting multi-departmental image and data types for successful implementation and adoption of electronic health record solutions.*

Preparing for enterprise imaging

So what can hospitals and radiology departments do to ready themselves for enterprise imaging? Making information accessible across an enterprise and simplifying IT infrastructure are two important steps in the right direction, advises Tomer Levy, General Manager, McKesson, Workflow & Infrastructure Solutions. "Complete the EHR by intelligently aggregating a relevant view of patient data from all the disparate networks into a single integration point ... essentially fulfilling the promise of the EHR — the right image, to the right person at the right time."

There are a number of regulatory requirements that diagnostic imaging solutions support — from critical results reporting to peer review, Arazi adds. As an example, Meaningful Use Stage 2 requires image results in the EHR to include an explanation or accompanying information to help referring physicians better understand the image.

It is also important to consult stakeholders throughout the enterprise for consensus so that technology acquisitions are adopted by the user community, says Dave Wilson, Chief Technology Officer, Hitachi Data Systems. "Consider how data must be normalized and accessed by other applications without destroying the original data — maintain it securely while still providing access to key caregivers, and always look to the future as 'we don't know what we don't know' and today's data will be tomorrow's information."

Hospitals want to make the best use of the information they are generating, Wilson adds. "Managing, analyzing and providing visualization of how to use this data is an area that hospitals are only starting to capture. There are many areas still beyond their reach that lead to "big data" analysis of patient data."

Wilson says that Hitachi is looking beyond the medical image content and at the entire enterprise, driving towards the 60% of unstructured content that is not being captured and enabled.

Augmenting the data that today's EMRs capture, HDS is looking at machine-generated data, patient-generated data and the means to display this content in context with the EMR.

Collaborating with other specialties is one area where radiology can utilize enterprise imaging to help improve patient care, Levy continues. For example, radiologists can give guidance on what diagnostic imaging tests are most appropriate for specific patients' conditions or help reduce radiation exposure.

"The ubiquitous access to images that has been created by the adoption of PACS and EMRs represents tremendous opportunities for collaboration, if we seize them and recognize that radiologists and cardiologists can be trusted advisors for diagnosing the patient," says Levy. "We also need to create incentives for the imaging specialists to focus on non-interpretation tasks like consults."

Clinical collaboration embraces that need for an integrated clinical pathway regardless of the specialty, which will all be connected by that patient-centered medical record, says Cristine Kao, Global Marketing Manager, Healthcare Information Solutions, Carestream. By their nature, Accountable Care Organizations are embracing collaboration with patient data at the center to provide the best care. This collaboration will need to encompass all aspects of a patient's care-- from cradle to grave, inpatient to home health.

For radiology, it's important to become part of the discussion regarding information exchanges or regional health information organizations (RHIOs), adds Kao. "Imaging is a critical part of the patient record, and we need to build that value of why it's important for referring physicians and patient to have access. If radiology is not part of that conversation now, it needs to be."

REFERENCE

1. http://www.hl7.org/implement/standards/fhir/summary.html. Accessed February 12, 2015.