By Justine Cadet

Image-Enabled EMRs

Present Challenges, Future Hopes

With the national push toward EMR adoption being urged by the financial incentives of the HITECH Act and the mindset that "now is the time," healthcare executives, physicians, clinicians, IT leaders and IT vendors are scrambling to define the ideal method of incorporating medical images, most often native to PACS, into the EMR while improving interoperability among departments and without creating additional storage burdens.

Who needs what?

The current conundrum of how to provide image access in the EMR is currently being answered through links that spawn a web viewer. Consensus among CMIOs and IT leaders says EMR users should have access to all the images in their archive solution, as well as radiology reports—but concerns remain about how to store this data and the level of interoperability among the clinical IT systems in the hospital or healthcare enterprise. Also, questions abound on how to present images and data to the wide cross-section of clinical users who need them—in a robust, user-friendly format that meets individual needs.

"I have never met a person who's happy with the EMR [at his or her facility]," says Paul J. Chang, MD, medical director of enterprise imaging at University of Chicago Hospitals. He calls today's level of EMR interoperability and image integration very primitive, rooted in state sharing through web viewers that only allow the user to examine data or images that live elsewhere. Contemporary EMRs, Chang stresses, need to be expanded to include media such as waveforms, like EKGs, and physiologic data.

A lack of EMR-PACS-clinical IT systems interoperability can greatly affect physician workflow. Radiologists, for example, cannot interpret images in a vacuum, but need clinical context to provide proper interpretation to referring physicians or colleagues. Unfortunately, this context, such as a patient's history, is only available in a limited fashion in PACS, and therefore, the radiologist must spend additional time extracting that data from the EMR—meaning wasted productivity.

"The EMR is currently defined as a one-size-fits-all, results-review portal, designed primarily for primary care physicians or surgeons, making it inefficient for users across a healthcare enterprise who each have appropriate, idiosyncratic needs," Chang says. "Physicians have to bend to the will of the software, and health IT offerings are approximately 10 years behind the rest of the IT world."

Plenty of challenges remain, but where should clinical images reside? David Mendelson, MD, chief of clinical informatics for The Mount Sinai Medical Center in New York City, believes images should be stored in the PACS, instead of being re-archived in the EMR. He also sees the need for user access to *all* PACS images. Many

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PACS allow for the designation of key images, which "should be clearly indicated through the EMR's web viewer," he adds.

At Geisinger Health System in Danville, Pa., the focus is on simplicity for the user on the front end and ease of management and interoperability on the back end. Here, designated users have access to all the images created in the RIS/PACS, as well as images transferred from outpatient clinics and inpatient units through links in the EMR, says Chief Health Information Officer James M. Walker, MD. "Physicians are unaware they are being taken to the RIS/PACS when they click on an image, because it maintains the same look and feel of the EMR," he says. "It's very easy to make things confusing for the user, so we try to make it look like it's all one system, even though there are multiple systems working behind the scenes."

The other piece is radiology reports. At Geisinger, reports are either produced as an electronic note (not a pdf) within the EMR or run through the transcription system, which also feeds the EMR.

The data deluge & the enterprise

It's widely known that medical images, namely CT studies and other data-heavy exams, require massive storage and support solutions and strategies. And as more medical specialties jump on board with PACS, such as ophthalmology, pathology and colonoscopy as new systems expand to accommodate unique department needs, data requirements escalate. "You will begin to find institutions that don't buy a radiology PACS, but instead purchase an enterprise image management system," Mendelson predicts. "The radiology department will be forced to subscribe to that system as its image archive. Institutions can save money in this case by having an integrated image archive."

However, the archive still needs to be transparent to the radiologist or specialist, no matter where the image originated, and image management systems are not quite capable of this yet, according to Mendelson.

"We are in an era where cost containment continues to become a bigger issue than ever," he continues. "Even though the price of storage has dropped, it certainly isn't infinismal. You can now purchase 20 terabytes of storage from an acknowledged vendor for $60,000 to $120,000. Therefore, $100,000 might buy a mid-sized institution two to four years of storage. However, if all these images are duplicated in the EMR, not many departments are willing to budget an additional $100,000."

To construct an EMR that bridges across the multiple 'ologies, the application level should be a separate product than the enterprise archive—but needs to interface well with that archive. "Vendors are just beginning to build agnostic archives which can handle all types of data, whether they are segregated into different image volumes or integrated," Mendelson says. "However, there are different compression standards for different kinds of images, especially in pathology."

In the future, storage architecture may allow a radiology department to store its source images in the PACS and mirror them in the EMR, thus serving as the facility's disaster recovery or business continuity solution in the event of a PACS catastrophe. "But, the current problem with this is the images are being stored in both systems, and today the mirroring is not accomplished cleanly between the two disparate systems," Mendelson notes.

Enterprise image management systems are beginning to emerge as hospital executives recognize their archive systems share common infrastructural components, Chang says. "All the hospital is purchasing through its EMR vendor is a workflow solution to leverage its existing storage infrastructure," he says. "This is the first step toward virtualization or cloud computing. However, virtualized storage requires sophisticated data management, such as enterprise content management, depending on the content and the use of that content."

Eventually, Chang predicts, hospitals won't buy their own storage, but use cloud computing. However, he opines that this model is still several years away because the network capability is not yet up to par.

Images in the EMR: The Challenges

"Even with today's highly standardized interfaces—such as lab to EMR—the interfaces are still expensive, labor intensive and require constant, high-level human interaction to keep them functioning," Walker says. "When the interfaces between order entry, electronic medical administration record (eMAR) and pharmacy, along with EMR and radiology images, are highly compatible and well standardized, then modular architecture might be suitable. This model is common outside of the medical field. Unfortunately, EMRs are nowhere near this level of definition yet, and may not reach that point for the next five to 10 years."

The reason for many of these challenges is that the interfaces have not been well defined, Walker notes. For example, current EMRs should allow the physician to tag pathology reports as abnormal, but unfortunately, the pathology system is unable pass the flag across the interface into the EMR. Also at Geisinger, the RIS/PACS can not fully communicate with the EMR on the status of orders and studies, and the synchronization of that interface requires a great deal of human resources, he explains.

One challenge for reports and images in the EMR is lack of clarity when updates occur. "If post-processing an image on a workstation takes two days, the user needs to remember to upload the images to PACS, as well as the other archives," Mendelson says. He notes that the updating process for reports is more efficient as they are more easily integrated into the downstream systems, but fewer people receive post-processed images, so it has received less attention.

"This problem only becomes exacerbated as the images get further distributed, allowing people to comment on them in different places," Mendelson notes. "All the information, including updates, should be synchronized and available in all the places that the images and reports are stored. Every time a copy gets added, the complexity of how to keep these all in sync becomes slightly more difficult. "

Another big hindrance remains in sharing images across organizations because PACS vendors do not all use the same "flavor of DICOM," Walker says. He adds that DICOM needs to be become more standardized, so images can be sent across health systems to be read by interpreting physicians.

In fact, Mendelson, under the auspices of the Radiological Society of North America (RSNA), is spearheading a pilot project to start exporting images from PACS to personal health records (PHRs). This is currently under review by the National Institutes of Health (NIH) as a major source of funding. There are parallel projects to export images to regional health information organizations. Such projects may serve to educate clinicians and vendors on how to transfer images outside of a single organization in a more efficacious manner.

Images in the EMR: The Future

A variety of specialists desire image-enabled EMRs, but want them designed and optimized to support different workflow requirements without having to launch a separate EMR. "For instance, an oncologist doesn't want the same EMR designed for a primary care physician," Chang says. "An oncologist's preference tends to lie in therapy response, for example, and the ideal EMR should recognize wants and preferences of the various specialties."

"An ideal EMR would know what each individual doctor needs, and optimize its presentation to support that person's workflow," Chang says. He compares this type of customization of presentation states to the personalized nature of the Amazon.com or iGoogle.com Web pages, which anticipate the needs and optimizations of the user.

Known as loose coupling, this type of customization allows content in the database or archive to be loosely connected to the actual web view, allowing for the creation of complete customization of the web view. In this structure, the EMR would be loosely communicating with various systems such as PACS, a billing archive, a pathology archive, among others, requiring no need to duplicate or recapitulate data in the EMR. The images will, therefore, reside in the PACS. It would only appear to the user that they live in the EMR through improved interoperability and service-oriented architecture (SOA)-web services.

However, Walker cautions that this type of ultra-customization contradicts some EMR usability studies, which have stressed the need for consistency across an enterprise. "While EMRs can be customized for different settings, the core features also must be recognizable, or it can lead to confusion and could potentially detract from efficiency and safety," he says. Walker adds that more research needs to be done on the effects of customization.

"There needs to be a move toward enterprise archives, but that will only occur when archive vendors truly support mixed data types in an intelligent fashion. We're not quite there yet," Mendelson says. "And idyllic architecture would allow you to throw independent application solutions, to allow for the different handling of images in radiology, as compared to cardiology or pathology." CMIO