Keeping a Pulse on Hot Topics in Medical Imaging Informatics

Patient-centered radiology, artificial intelligence, deconstructed PACS and outcomes-based risk-sharing

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This market insight was developed as coverage of the Society for Imaging Informatics in Medicine (SIIM) annual meeting in Portland, Oregon, in July 2016.

Three hot topics were covered and detailed in a three-part series, which also was published online on diagnosticimaging.com:

- Next frontiers in imaging: patient-centered radiology and artificial intelligence
- Deconstructed deployment model for PACS
- Risk-based contracting and outcomes-based purchasing in imaging IT

SIIM16: BUILDING BRIDGES ACROSS BIG THREATS AND BIG OPPORTUNITIES

SIIM16 shed light on patient-centered radiology, artificial intelligence, and their confluence

The Opening Session - Wake-up Call for Patient-centered Radiology

The SIIM16 Opening General Session was presented by Rasu B. Shrestha, MD, MBA, chief innovation officer, University of Pittsburgh Medical Center, and president, UPMC Enterprises.

The talk took the top-down approach of putting medical imaging and radiology in the context of significant macro-level changes taking place in populations, technologies, and the healthcare system. These changes, which UPMC is capitalizing on, highlight growing opportunities for new care models, new technologies and patient-centered care.

More than ever, this healthcare transformation stresses the imperative to spur changes in imaging, both incremental as well as paradigm-changing, to move toward patient-centric radiology and value-based imaging.

Having lived through a century of “analog” radiology, followed by several decades of “digital” radiology, the next phase in medical imaging will be interoperability, analytics, and population health—one where “Context is King.”

In order to navigate into this next phase, medical imaging will need go through a number of transitions: from using technologies designed for regulation, to ones designed for empowerment; from having radiologists constantly at the edge of burnout, to taking joy in their everyday work; from continually adding to the complexity of workflows and processes, to spurring a new wave of simplification; from increasing bureaucracy, to a higher degree of meritocracy; from being merely report-generators, to becoming real physician consultants; and from being interpretation-centric to being truly outcomes-centric.
In a nutshell, this next big phase will have medical imaging move from “doing” digital to “being” digital.

The Closing Session - Reality Check on Deep Learning in Medical Imaging

Two days later in the Closing General Session & 2016 Dwyer Lecture, Eliot L. Siegel, MD, FSIIM, professor of radiology, University of Maryland School of Medicine, and chief, imaging services, VA Maryland Health Care System, gave the SIIM audience another eye-opening talk.

The gist of the session was that medical imaging may well be the ultimate frontier for artificial intelligence (AI), yet there is still a long way to go. AI may be winning against world champions at Jeopardy and chess, but it will be awhile before we can see AI “beat” radiologists — the imaging world champions. If computer-aided detection and diagnosis (CADx) never really took off in a big way, it is for good reason.

In fact, while it is often labelled as AI, deep learning is really only a sub-part of it, and the reality in medical imaging is that we are still at the stage of developing a collection of narrow, discrete deep-learning applications — by modality, by procedure, by use case, and using them in a supporting or managing function.

This will likely remain the case at least through the next decade or two, when we may be able to start seeing more general capabilities and more holistic uses of cognitive computing.

Overall, the talk would have comforted those who consider these up-and-coming technologies as a threat rather than an opportunity. It rationalized the fact that it will be many years before these technologies do make the leap forward from the current set of “narrow” and “weak” AI algorithms, to a more general, broad-based, human-level AI that may only then start to threaten to “replace” radiologists.

Perception Change from AI to IA

Both speakers agreed that these technology advances are not about “Man versus Machine”; rather, they are about “Man versus Man + Machine.” The misconception is due to the fact that right now, deep learning in medical imaging is right there at, or very close to, what Gartner calls the “peak of inflated expectations.”

The next leap can only happen once deep learning in medical imaging has also been taught to leverage omics data (radiomics, genomics, proteomics) and to comprehend a patient’s context at a broad level (natural language processing, structured reports, patient records, wearables data).
The radiology community has yet to come to terms with the looming threat of a radiologist replacement and embrace the technology with the confidence that it can make them better at what they do. This paradigm shift in perception from artificial intelligence to intelligence amplification (IA) is one that many industries have undergone over the past few years, and that radiology will likely realize over the next few years. As futuristic as it may seem, this is the evolution that will fast-track radiology into the era of cybernetics.

**Tying it All Together**

Medical imaging has decisively embarked on the journey to value-based imaging. The train has left the station. There, too, breakthrough advances, unimaginable only a few years back, are under way.

So, where do these two potentially massive transformations, one in why we practice radiology and one in how we do it, meet?

The answer is elementary: the IA-empowered radiologist will gain more automated tools, deeper insight into their patients, and higher confidence in piloting the patient care pathway—essentially more time and resources to deliver a truly patient-centered radiology service.

Brought together by Richard H. Wiggins III, MD, FSIIM, CIIP, University of Utah Health Sciences Center and newly appointed SIIM chair, Shrestha and Siegel deep-dived into two of the most interesting developments going on in medical imaging.

But even more interestingly, they were able to shed light on the big promise that lies at their confluence, and tied it all together into one cohesive, motivating, take-home message.
DECONSTRUCTED PACS: 12 TIDBITS ON THE MARKET HYPE, REALITY, CAVEATS AND PROSPECTS

**SIIM16 provides a reality check on the deconstructed deployment model for PACS**

There are few topics that create more controversy and inspire more animated “spils” in the imaging informatics marketplace today than the topic of deconstructed PACS. Market hype and a strengthening track record as a viable radiology PACS replacement alternative are causing disruption in the established PACS industry. The probability of it severely altering revenue flow in imaging IT, while yielding a profound impact on vendors’ go-to-market strategies, make deconstructed PACS one of the hottest, most debated matters in this industry.

A deconstructed PACS approach consists of uncoupling the different functions offered by a conventional, all-in-one PACS system into its constituent elements while being able to make independent, vendor-neutral purchase decisions for each one. Typically, this PACS “deconstruction” results in broadly four modular, hardware-agnostic solution components: image management and archiving, diagnostic and clinical viewing of images, enterprise workflow orchestration, and imaging analytics—along with all the necessary “plumbing” middleware (enterprise master patient index (MPI), DICOM tag morphing, and open standards such as HL7, FHIR, DICOMweb, XDS, among others.)

Where do things stand right now on various fronts?

1. **Market Perception:** Yes, the deconstructed PACS model might be somewhat over-hyped, but it is not merely a “marketing gimmick” or a coordinated effort led by a few industry consultants to spur confusion in the marketplace, as some opponents to the model would like to describe it. With the frustration of previous generation proprietary PACS systems still very much present, the imaging market (in particular hospitals, integrated delivery networks and health systems) is finally giving it the serious consideration it deserves.

2. **Market Adoption.** So, how far ahead are we on the adoption curve? In essence, the US market is probably just past the Innovator phase and entering the Early Adopter phase: a few dozen IDNs and health systems (out of ~2,000 IDNs and ~1,000 health systems) have or will implement a deconstructed radiology PACS replacement. This translates into a current US market penetration of deconstructed PACS in the low single digits—and growing.
3. **Adoption “Sweet Spot.”** Based on early adoption patterns, the deconstructed PACS approach is being implemented at the larger ends of the provider spectrum. Currently, the market “sweet spot” seems to be in the large to very large health systems, such as IDNs and geographically distributed radiology groups, with dynamic merger-and-acquisition activity and which operate a multi-vendor, multi-PACS imaging IT environment.

4. **Decision Makers.** IT departments, notably the chief information officer (CIO) or the chief medical information officer, have been the most influential stakeholders in defending the strategic direction for deconstructed PACS, as well as driving subsequent purchase decisions and funding.

5. **Adoption Drivers.** Much of the early adoption of the deconstructed PACS model is being driven by the IT mandate to achieve higher vendor independence in their PACS replacement plans, compel standards adoption to avoid any future vendor lock-in, consolidate vendor relationships in imaging IT, drive economies of scale, and optimize otherwise disparate radiology service lines by thriving to unify, harmonize and virtualize inconsistent reading environments.

6. **Business Rationale.** There is no evidence yet in the marketplace of a strong financial incentive to take on a deconstructed PACS approach, partly because of the cost of reconstructing PACS. Early adopters seem cognisant of the fact that any tangible return on investment (ROI) or any significant reduction in the total cost of ownership (TCO) will take time to materialize, and have not jumped on the opportunity due to financial considerations. That being said, the modular and phased deployment models associated with deconstructed PACS make for a less capital-intensive and more flexible financial model.

7. **Market Potential.** With more enterprise viewers now FDA-approved for primary diagnostic reading, this makes the deconstructed PACS an entirely viable, tried-and-tested PACS replacement solution. However, in practice, enterprise viewers are being leveraged mainly as universal clinical viewers, not as primary image viewers—with few exceptions, notably Visage. This may limit the market potential to radiology and breast imaging, and limit its potential in other image-intensive clinical departments to constitute a comprehensive multi-ology imaging IT platform.

8. **Adoption Limits.** The integration and interfacing effort required in reconstructing the technology stack can be expensive and technically challenging in a multi-vendor scenario and is probably realistically achievable only by the larger IT-savvy organizations. As such, there is a high degree of scepticism about the ability of the deconstructed PACS model to gain ground in smaller-scale organizations and hospitals. It appears so far that the model may only “make sense” for the larger organizations.

9. **Tie to Enterprise Imaging (EI).** A deconstructed PACS approach may contribute, but is absolutely not a pre-requisite to implementing a successful EI strategy. In fact, many institutions are already achieving positive outcomes from EI initiatives they have built over fairly conventional PACS and VNA systems. This fact serves to highlight that EI success is less about technical IT considerations and more about change management, stakeholder alignment, and leadership in governance.

10. **Vendor Strategy.** Deconstructed PACS have revived the ever-lasting industry debates about the “right” vendor approach to take in imaging IT: multi-vendor, best-of-breed, single-vendor, single-source are all back on the table, with larger vendors obviously defending the latter.
11. **Technical Caveat.** In their own defense, the larger vendors that are able to cater to all of the technology stacks comprising a deconstructed PACS emphasize that only with a single-vendor approach can all of the imaging data and related information flow seamlessly and efficiently between the different modules. In addition, they also highlight the customer benefits of having a “single throat to choke” in managing a single vendor relationship.

12. **Strategic Caveat.** Many argue that deconstructed PACS are not the way to go in trying to achieve an integrated, multi-ology imaging platform beyond radiology. While it may be a viable radiology PACS replacement alternative, the fact that each specialty has its own viewing, tooling, and workflow requirements would mean the model has to be replicated in every specialty, which would essentially defeat its original purpose.

In the end, success in deconstructing PACS deployments boils down to good governance: striking the right balance between clinical, operational and IT forces that shape enterprise imaging dynamics is key. As evident among early adopters, the most successful enterprise imaging initiatives, including those deconstructing PACS, are those where IT—the bearer of enterprise imaging IT—and radiology—the traditional owner of PACS—have partnered under a transparently defined and well-balanced collaboration framework.

**HAS THE TIME COME FOR SHARED-RISK CONTRACTING IN IMAGING IT?**

**SIIM16 helped uncover significant baby steps toward outcomes-based purchasing**

In what seems to be an ongoing trend with no end in sight, consolidation in the US healthcare industry continues to progress on every front. Merger-and-acquisition activity in 2015 reached a record high, giving rise to ever-larger payer entities, health systems and accountable care organizations (ACOs), integrated delivery networks (IDNs) and physician groups—including in radiology—all amidst some major vendor shakeup.

Perhaps the biggest corollary trend to this seemingly unstoppable consolidation drive is the shift of risk across the healthcare value chain. Significant risk transfers are being carried over by the new shared-risk agreements and payment models that are slowly but surely being inked between healthcare payers and providers.
The Inevitable Shift of Risk from Payers to Providers and Patients

Close to 800 public and private ACOs, with a growing catchment of approximately 20% of the US population, are at the table with their payer partners at various stages of developing and implementing new types of risk-sharing contracts.

While there is no clear indication as to which of the ACO, the capitated or the bundled payment model will ultimately prevail, these new payment structures all have one thing in common: they have providers take on much of the financial risk, which, under the conventional fee-for-service payment models, used to be borne single-handedly by the payers.

This also holds true for the newly introduced payment structures under Medicare Payment Reform (MACRA), of which Merit-Based Incentive Payment System (MIPS) will likely be the main model used to remunerate radiologists’ professional services.

What’s more, with increasing insurance premiums and co-pays that incentivize them to be more engaged in and responsible for their own health, the patient is essentially being led to absorb some of the risk, too.

Next Logical Step: Shared-risk Contracting with Vendors

As a natural consequence of this shift of risk onto their customers on the provider side, the large imaging vendors have stepped up in their financial willingness and organizational readiness to take on more risk.

Under risk-based contracting, just like they get paid by payers based on the value and outcomes of their healthcare services, providers pay vendors based on the value and outcomes a technology solution has provided—not a preset price.

The US market is currently witnessing what seems to be an accelerating pattern of large-scale, long-term, enterprise-level partnerships between vendors and IDNs through managed equipment services (MES)-type contracts built around shared accountability, including shared gains and vendor penalties.
While not fully shared-risk contracts, the risk element in these multi-hundred-million dollar deals is maturing at an increasing pace. Similarly, while they pertain mainly to capital purchasing of big-iron imaging equipment, some of these deals extend into the less capital-intensive areas of patient monitoring and informatics as well.

**Existing Business Models Containing Risk Mitigation**

In effect, any IT system’s service-level agreement (SLA) that provisions vendor penalties, typically against under-performance or downtime, is essentially a way of mitigating financial risk between the vendor and the customer—of course provided the SLA is enforced and these provisions executed.

The same can be said about the application service provider (ASP) and other related managed services models applied to imaging IT, which tend to be purchased by providers through operating expenses (OPEX).

Although these managed service models have not been adopted in a significant way in the US—with a few notable exceptions, including Philips Healthcare in radiology PACS, and to a lesser extent McKesson and Carestream Health—they are becoming more attractive as imaging IT infrastructures become more service-oriented and virtualized.

In the same vein, the new generation of cloud-based software-as-a-service (SaaS) and infrastructure-as-a-service (IaaS) imaging informatics solutions, with the various usage-based pricing models they entail, push the risk mitigation agenda even further.

Over the next few years, we can expect to see risk-sharing in imaging IT gain more ground, while various existing business models evolve further toward outcomes-based operational purchasing.

**Which Metrics Could Be Used for Risk Contracting in Imaging?**

Clearly, the ability to pinpoint the quality outcomes and quantify the added value of imaging technology, most likely through analytics, is a prerequisite step to any effort on the part of vendors and customers to agree and contract around various key performance indicators (KPIs) or outcomes metrics.

“What are the outcomes of imaging?” is perhaps the most challenging question posed to the field of radiology as it embarks on its transition to value-based imaging. There is clearly no single answer to this question, but a growing body of possibilities and pointers.

At a high level, the discussions are advancing around the feasibility of tying imaging technology investments to the same outcome metrics that health systems are being measured on and benchmarked against.

For example, some organizations are inching closer to finding more robust ways of quantifying imaging technology’s impact on reducing the average length of stay (LOS), the 30-day readmission rate, the mortality index, the 30-day mortality rate, the time to service in the emergency department, the Medicare Spend per Beneficiary (MSPB) index or the complications index. This appears to be feasible in patient care pathways that involve a large imaging component.

This is similar for measuring the impact of imaging on HCAHPS scores, which would indicate a better patient experience from imaging episodes, or on Core Measures, which would indicate greater care compliance in the appropriate use of imaging.

**Developing Outcomes Metrics Specific to Imaging**

Drilling down into metrics that are more directly attributable to imaging, vendors and providers are starting to tap into some existing resources—such as the Physician Quality Reporting System (PQRS), the Healthcare Effectiveness Data and Information Set (HEDIS) or the National Quality Forum (NQF)—in which between 2-5% of
the outcomes metrics laid out pertain to imaging. In addition, new metrics are under development notably though the American College of Radiology (ACR) Imaging 3.0 or RADPEER initiatives.

In the not-so-distant future, we can start to envision a higher degree of shared-risk contracting around outcome metrics specific to radiology. These will likely stem from imaging IT vendors working with some of their close customer partners.

The Next-generation Vendor Pitch

Here’s, anecdotally, how a vendor pitch might sound under a shared-risk selling approach:

“We are in a position to commit to the fact that our latest imaging workflow and collaboration platform can help drive measurable improvements in the productivity and quality metrics of your imaging service line.

They will drive shorter report turnaround times and time-to-access to imaging equipment, and higher relative value units (RVU) per radiologist, patient throughput, and asset utilization. They will further drive incremental increases in the in-sourced study volume currently being outsourced, in the proportion of inaccurate interpretations corrected through peer review, and in the average time spent by radiologists consulting with physicians.

As is, the licensing costs for this solution in an organization of your size would be $1 million, though we are willing to deploy it at-cost and have you reward us $10,000 for every percentage point increase to each of these outcomes metrics.”

Time will tell whether providers will develop a bigger appetite for this type of working arrangement with their vendors, and, if they do, whether vendors will be able to execute on the deep internal transformations required by these new business models.

As some vendors start to elevate this type of conversation with some of their customers, for example by implementing the Capability Maturity Model Integration (CMMI) of the CMMI Institute, it seems that the imaging IT industry is indeed starting to move in this direction.
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