Enterprise Imaging

ENTERPRISE IMAGING MEASUREMENT, FUNCTIONALITY, AND KEYS TO SUCCESS

The results of this summit are being publicly shared in an effort to improve the success with which enterprise imaging solutions are deployed and adopted.

With the desire to complement current industry efforts to define and monitor the maturity and adoption of enterprise imaging technologies, executives from 24 healthcare provider organizations and 10 enterprise imaging vendors met just outside of Salt Lake City on June 29, 2017. Goals for the enterprise imaging summit included the following:

- Create a measurement vehicle for vendor performance.

- Enhance communication between vendors and providers to identify and protect against common failures in delivery and implementation of enterprise imaging functionality.

- Identify the keys to success and best practices for achieving expected outcomes from enterprise imaging.

- Define specific functionality expectations that provider customers have for today and for the future.

Expectations for Current and Future Functionality in Enterprise Imaging Solutions

Summit participants came together in focused groups to identify current and future functionality needs for enterprise imaging solutions. Participants had the goal of decreasing market confusion regarding what should be included in a core enterprise imaging solution.

VERTICAL 1
Capture

Current Functionality

- Capture functionality must store to a central archive.
- Ability to link and transmit to the medical record.
- Ability to tag images, the frame of reference, and observations by the physician. Tags such as the body part imaged and imaging specialty need to be standardized across vendors.
- Need to associate images with EMR-generated patient demographics.
- Tools for lightly editing images.
- Standard guidelines for image capturing (lighting, contrast, distance, and color).
- EMR should be the source of truth for data captured.
- If images are captured on a mobile device, they must not store to the image library on the device.

Future Functionality

- Need to authenticate the image to the patient (facial recognition) and who captured the image.
- Point-of-care capture devices need to automatically and securely transmit location, demographics, and other pertinent metadata to the EMR.
- Need to be able to tag with more data for AI/deep learning.
- Ability to share and transmit without using unsecured devices (i.e. cell phones).
- Capture of tagging through voice recognition.
- Ability to capture/highlight the most important parts of a video and annotate videos.
- Capture device provides guidance based on prior images (based on distance, lighting, contrast, etc.).
- Ability to capture genomics data.
- Specialized tools across all specialties.
- Stronger security in all areas for capture functions.
- Centralized user and system management for mobile-device capture apps.

VERTICAL 2
Storage

Current Functionality

- Scalability and agnostic storage platform to support significant storage needs.
- Appropriate redundancy.
- Security governance.
- Immediate access to everything in storage and short-term caches in specialty viewers.
- Ability for vendors to access, monitor, and support the archive.
- Data-governance functionality that go beyond DICOM. Too much storage today is in native files. Functionality must force new images to be adequately documented.
- Patient-centric storage so that images for one patient can be easily correlated, found, and accessed.
- Encounter-based imaging, including the ability to monitor and mirror care visits in the EMR.
- Different stages of storing, including permanent and temporary storage.

Future Functionality

- Cloud storage (including a smooth transition from current storage).
- Ability to support provider M&A activities, including adding, merging, segmenting, and splitting archives.
- Data-access control and permissions—front-end system is a viewing and storage function.
- Multiple technologies for storage that will need to allow us to migrate and access without downtime.
- Advanced security, including strong password/access control and monitoring. Security must know trusted sources of upload from untrusted sources. Antivirus technology must be included in the image upload.
- Leadership in supporting and encouraging providers toward common standards and formats (such as XDS).
- Tools to deal with data corruption and image fidelity.
- Ability to migrate different file types to newer standards.
- Indexing that can support future analytics needs.
- Ability to monitor and clean up image metadata and tagging.
- Pattern technology for contextualization of incoming data.
- Management of full data life cycle. Smart technology for understanding length of storage.
- True vendor neutrality on images.

VERTICAL 3
Viewing

Current Functionality

- Single-platform viewer with the ability to provide specialty-specific tools based on user provision roles or groups.
- Available anywhere through secure remote and mobile access.
- Seamless integration with the EMR, including the indexing of content.
- Support of multiple types of formats, including the ability to define context of the specialized viewers.
- Ability to view images from multiple specialties.
- Clinical, contextual, and longitudinal view of captured patient images.
- Contextual content easily viewed while viewing images (i.e. EKG, video, reports, and documentation).
- Interdisciplinary, collaborative tools with physicians, delivered synchronously and asynchronously.
- Adequate retrieval speed.
- Viewer look and feel should be the same across all platforms.

Future Functionality

- Patient engagement support and functionality, including functionality for viewing and exchanging image records. Patients should be delivered the right information for their images so they can glean and gather further data on their issues from Google. The patient view should be different from the clinical view.
- Patient-health record that has notes and images all available and contextualized.
- Imaging analysis and reading recommendations.
- Hanging protocols that can provide comparisons based on specialty or body part.
- Ability to tie a report or note to every imaging study.

VERTICAL 4
Interoperability/ Image Exchange

Current Functionality

- Formalization and agreement on capture and imaging standards. No clear standards for image exchange exist today.
- Ability to share images through the cloud instead of sharing through DVDs and CDs.
- Standards and agreed-upon methods for working with EMR vendors.

Future Functionality

- Clear data standard between imaging technologies and EMRs.
- More security with interoperability.
- Proper workflows to transfer images properly from different devices to the VNA so users can bill and document correctly.
- Standards to make clinical decision support vendor neutral.
- Information in a patient portal that patients can read and interact with.
- Correlation of clinical data with metadata with other types of data.
- International imaging, including HIE standards and pipes.
- Ability to share images across vendors or networks.
- Eliminate physical media for image sharing.
- Provide standard workflow for image sharing between hospitals:
    - Allow patients to share their images from EMR portal to another hospital
    - Create standard list of hospitals for image sharing
    - Create workflow for image intake and subsequent routing at receiving hospital

VERTICAL 5
Analytics

Current Functionality

- Tools for standardizing metadata that are consistent across vendors.
- Technical-analytics capabilities, including system-health monitoring and failure mitigation.
- Business analytics that provide an understanding of the activity of the organization, trends, institutions sharing, and the visualization of all traffic data.
- Clinical analytics that include comparing the pros and cons of the final diagnosis or ability to compare discrepancies between initial encounters and final exams.

Future Functionality

- Advanced cleaning and standardization of metadata.
- Machine learning and ability to track successful read rates and failures in machine learning.
- Analytics for non-radiology reporting.
- Tracking to see whether physicians/ clinicians found what they were looking for.

Identifying Common Delivery/Implementation Failures that Inhibit Enterprise Imaging Success

At the summit, vendors and providers discussed challenges observed by vendors and providers to understanding, focus, or experience that significantly impact the success of enterprise imaging solution deployments. Discussion leaders focused on developing powerfully constructive discussions that could enlighten all parties and enhance provider-vendor partnerships. The feedback from each group is shared below:

Provider Executive Recommendations for Vendor Leadership

Recommendation:
Current pricing from vendors will need to change. Instead of paying per click, providers will need to start paying their vendors based on performance. Also, many vendors charge by specialty. This goes against what the provider organization is looking to accomplish: to extend a solution across the enterprise. Future pricing could focus on lives covered instead of clicks or specialties.

Recommendation:
Many vendors do not approach enterprise imaging correctly. Instead of approaching enterprise imaging as offering functionality beyond radiology, vendors need to focus holistically on all of the specialties. Many vendors are approaching enterprise imaging with a checkbox mentality. Instead of developing deep and usable specialty functionality, many are too quick to tweak a radiology workflow and call it a non-radiology workflow.

Recommendation:
Vendors generally are too focused on sales instead of solutions. Providers need much more intense relationships with their vendors to make enterprise imaging work. Vendors need to ensure that what they sell are not components, but solutions to the challenges customers are facing. Sometimes vendors try to sell too much and expect the provider to rip out too much, and sometimes vendors are too willing to sell a piece of the solution. These approaches result in the customer not seeing the expected outcomes.

Recommendation:
Vendors are too weak when it comes to security. If a customer asks whether a vendor's system is patched, the answer must be "Yes." All solutions must run on the latest versions of Windows with the latest patches. That is basic functionality but is often not delivered.

Recommendation:
Innovation is a difficult topic for many provider organizations because there is a feeling that they heavily invest in a vendor's product but are still charged the full price. A better partnership between vendors and providers would include each group being recognized for the value that it brings.

Recommendation:
Some EMR vendors have started to do a good job of identifying the specific requirements for staffing and resources for their systems. Enterprise imaging vendors have not yet stepped up to share the resources providers need in order to implement and manage their systems successfully.

Recommendation:
Interoperability is too light of a focus for vendors. This creates a huge challenge for customers.

Vendor Executive Recommendations for Provider Leadership

Recommendation:
Providers often fail to prepare enough for the deep commitment of enterprise imaging journey. This preparation includes the investment of resources, personnel, and understanding. Organizations need to understand, prepare, and commit to the fact that these deployments often take years.

Recommendation:
Providers often ask vendors for quotes without knowing what their organizations want to accomplish. Providers need to do more work up front and have better alignment on the scope and desired goals. When the provider customers do not know what they want to accomplish, vendors are put at a significant disadvantage. How can a vendor provide an adequate solution to customers who do not know what they want to solve?

Recommendation:
The views of clinical users must be included in an enterprise imaging strategy. Today, the number of image users and viewers dwarfs the number of image producers, and if the systems are built only by the producers, we will miss the mark.

Recommendation:
The C-suite really needs to lead out with enterprise imaging, but today, enterprise imaging is relegated to a position of limited resources and alignment. That hurts the likelihood of success. The message of value to the C-suite is lacking today, and that is a challenge. Vendors and providers need to work together to educate C-suite leaders.

Recommendation:
Governance is difficult to set up because it takes a group of people who are willing to govern as well as a group of people who are willing to be governed. Leaders from many departments need to be drawn into this conversation. If a provider organization does not have multiple departments and specialties involved in the governance, they don't have a true governance model, and the governance will die on the vine.

Pitfalls and Keys to Success in Achieving Desired Enterprise Imaging Outcomes

Summit participants agreed that (1) improved patient care, (2) cost savings, (3) improved clinician productivity, (4) improved data security, (5) improved analytics, and (6) strengthened interoperability are key outcomes that they expect to be realized through enterprise imaging adoption.

While these outcomes are goals for almost all organizations with enterprise imaging strategies, summit participants worked to define common pitfalls that make organizations fall short of realizing these outcomes and keys to success for obtaining these outcomes.

Cost Savings

Pitfalls

- Inability to overcome fears regarding a single point of failure, including a much higher risk of leaked patient health information.
- Switching costs between vendors.
- Early adopters may not realize the benefits and therefore might not reap them.
- Optimization at each step of the process does not optimize the whole process.
- It is difficult to accurately calculate ROI when multiple departments exist (size of data, number of connections).
- Alignment between vendors and providers can create surprise costs that hurt ROIs.

Keys to Success

- Buy and hold vendor solutions. If you have access to capital, purchasing offers better long-term value than subscriptions offer.
- Provide all information at the point of care to prevent redundancy while finding ways to make the system redundant without holding on to other expensive systems.
- Find ways to make HR reductions, specifically by supporting fewer total systems, but also create a better experience so that employee morale is better (leading to lower turnover).
- Mine and monetize imaging data for efficiency gains.
- Maximize opportunities for improved clinical efficiencies, such as:
  - Standardized workflow
  - Elimination of manual processes
  - Reduction in repeat imaging
  - Reduction in repeat visits caused by a breakdown of the clinical workflow
  - Patient-submitted images and avoiding office visits
- Reduce costs through combined hardware and software support.
- Utilizing cloud technology can reduce costs.
- Reduce data-center costs with a decreased footprint and a smaller total archive.
- Centralize purchasing decisions for imaging equipment such as equipment for point-of-care ultrasound.

Improved Care

Pitfalls

- Data overload—too much information hides the critical data.
- Weak interoperability, resulting in repeated exams and increased doses.
- Weak patient privacy.
- Failure to accurately measure the benefits of enterprise imaging.
- Failing to assess the voice of the end user (Did efforts actually improve care?).

Keys to Success

- Leverage enterprise imaging to provide telehealth/telecare services.
- Ensure that images are available in a longitudinal view that allows for an assessment of change over time.
- Enable and encourage collaboration between caregivers.
- Scale resources across enterprise.
- Transparency for patients will help patients engage better.
- Build analytics across patient populations in order to track and respond to trends.
- Build in clinical decision support to prevent harm (i.e. unnecessary surgeries, missed diagnoses, etc.).

Improved Physician Productivity

Pitfalls
- Inefficient user interfaces driven by poor design and/or poor tailoring to the needs of specific departments.
- Lack of hard data to measure productivity.
- Slow retrieval of data—every half-second counts.
- Over-customization resulting in the inability to upgrade.
- Ineffective support and training, specifically after implementations and upgrades.

Keys to Success
- Create and help clinicians truly have a one-stop-shop experience.
- Proactively deliver clinically relevant data and images when needed. The data and images should be customized to a clinician context.
- Effective and reliable voice-dictation software with error-prevention tools.
- Coded data and reports, which result in the quick retrieval of images.
- Very focused efforts to measure productivity.
- Utilization of accessible, standards-based metadata.

Analytics

Pitfalls
- Lack of a complete and accessible data set.
- Lack of normalization of federated data, making analysis very difficult.
- Lack of standardization, which inhibits analytics.
- Not compensating for how DICOM-wrapped reports inhibit analytics.
- Lack of proper tagging.
- Fragmentation of imaging archives.
- Shooting for utopia and not solving real problems.

Keys to Success
- The tools to capture/acquire the data, images, and metadata.
- Centralized or well-coordinated data management.
- Small, practical wins go a long way. Focus on incremental success.
- Information management strategy (governing strategy) that focuses on defining desired outcomes and identifying low-hanging fruit and easy wins. Vendors can help to identify easy wins.
- Create live data and real-time surveillance (dashboard).
- Analytics piece needs to be digestible to end users.

Data Security

Pitfalls
- Software and hardware upgrades.
- Poor access management.
- Overall employee compliance.
- A lack of an overall governance will lead to many of the major pitfalls. Planning is critical to helping your organization protect against and respond to ransomware, malware, and other top data-security risks.

Keys to Success
- Work with vendors who design software with security in mind.
- Centralized monitoring of possible threats—this includes data monitoring.
- Care rollout of increased access through mobile, home, and extended healthcare networks.

Interoperability

Pitfalls
- Interoperability is currently point-to-point instead of network based.
- Working across multiple operating systems and vendors creates hurdles.
- Networks do not allow communication with other networks.
- Cost/budget for individual interfaces.

Keys to Success
- The industry must find a secure mechanism to exchange information without point-to-point interfaces.
- Ability to have temporary access to images.
- Patient-consent mechanism to enable better sharing.
- National efforts to create an EMPI or single patient identifier.
- Improvement of standards that simultaneously address clinical and technical needs.

Measurement Vehicle for Enterprise Imaging Adoption, Progress, and Success

Summit participants worked intensely before and during the summit to create a vendor-specific measurement vehicle that will monitor the success of different enterprise imaging technologies.

Vehicle Development

The task of initially defining this vehicle was undertaken by four provider leaders:

- Rasu B. Shrestha, MD, MBA: Chief Innovation Officer, UPMC

- Alexander J. Towbin, MD: Associate Chief, Operations and Radiology Informatics, Associate Professor of Radiology, Cincinnati Children's Hospital

- Paul G. Nagy, Ph.D: Associate Professor of Radiology and Radiological Science, Deputy Director, Johns Hopkins Medicine Technology Innovation Center

- Christopher J. Roth, MD: Assistant Professor of Radiology, Vice Chair, Information Technology and Clinical Informatics, Director of Imaging Informatics Strategy, Duke Health

Scope:

To be administered only to organizations who have in place multi-specialty/multi-department governance and at least one of the following (all of the following must be across multiple specialties/departments):

- Functionality for the capture of DICOM data and at least one of the following: visible light images, video, audio, or waveforms.

- Storage of images in a single enterprise archive or in a federated but connected set of archives.

- Viewing of images through a universal viewer integrated into the EMR.

Measurement Vehicle:

- Current Radiology PACS:

- Current Cardiology PACS:

- Other Specialty Viewers (scopes, ophthalmology, ortho, etc.):

- Current VNA:

- Current Enterprise Viewer:

- Visible Light Image Capture Solution:

- Current Image-Exchange Solution:

Comments:

1. Technically, how is your enterprise imaging strategy structured?

    a. Technical approach by specialty (comments):

Questions	Radiology	Cardiology	Pathology	Wound Care/Dermatology, Ophthalmology, Endoscopy, Point-of-Care Ultrasound, Other
• Included in enterprise archive? (All/Most/Some/None)				
• Ingesting visible light images or waveforms? (Yes/No)				

Questions	Radiology	Cardiology	Pathology	Wound Care/Dermatology, Ophthalmology, Endoscopy, Point-of-Care Ultrasound, Other
• Standards in use (DICOM, XDS, DICOMweb)				
• Studies are accessible from the EMR via the universal viewer? (All/Most/Some/None)				
• Electronic (non-CD) image exchange with outside organizations (Ingesting, Exporting, Both)				
• Real-time, virtual clinician consultation (Live, Implementing, Planning, Interested, No Plans, Not available)				
• Viewing and interpretation of external images (Live, Implementing, Planning, Interested, No Plans, Not Available)				
• How well does your enterprise platform integrate with your specialty tools? (Very Well/Well/Acceptable/Poorly/Very Poorly)				
• Contextual data linked to images (i.e. radiology reports, pathology reports, and operative notes)? (Yes/Some/None)				
• Do you have an electronic process for the ingestion of patient-submitted images (i.e. second opinions, dermatology, pathology, etc.)?				
• Images are electronically matched to patient record in the EMR at time of acquisition? (Yes/No)				

2. From an end-user perspective, how well is your enterprise imaging strategy working?

    a. Are your healthcare-professional users able to easily access all relevant images across the enterprise in the appropriate patient context (e.g. EMR)? [Always, Often, Sometimes, Never]

    b. Are users able to access images from their mobile devices? [Yes/No; Comments]

    c. Do users have a secure means to capture images from their mobile devices and securely upload those images to the enterprise archive? [Yes/No; Comments]

    d. What is your mechanism for exchanging images with external entities? [None, Physical Media Only, Non-Physical Exchange Only (i.e. image sharing), Mix of Non-Physical and Physical]

    e.   Do users have the ability to do metadata mapping for encounter-based imaging (i.e. labeling body part for wound imaging)? [Yes/No; Comments]

    f.   How are patients accessing images? [EMR/Patient Portal, Image-Specific Portal, CDs]

    g.   Does your enterprise imaging strategy incorporate encounter-based (non-order-based) imaging? [No, Planned, Partially, Full Deployment]

3.   What are the perceived outcomes of your enterprise imaging (EI) work?

    a.   Compared to our pre-EI days, clinician satisfaction with image access has: [Significantly Decreased, Decreased, Stayed the Same, Increased, Significantly Increased, Unknown]

    b.   Compared to our pre-EI days, overall cost (operational, technical, image management) has: [Significantly Decreased, Decreased, Stayed the Same, Increased, Significantly Increased, Unknown]

    c.   Compared to our pre-EI days, collaboration around patient care relative to imaging has: [Significantly Worsened, Worsened, Stayed the Same, Improved, Significantly Improved, Unknown]

    d.   Compared to our pre-EI days, clinician productivity relative to imaging has: [Significantly Worsened, Worsened, Stayed the Same, Improved, Significantly Improved, Unknown]

    e.   Compared to our pre-EI days, patient data security relevant to imaging has: [Significantly Worsened, Worsened, Stayed the Same, Improved, Significantly Improved, Unknown]

    f.   Compared to our pre-EI days, centralized imaging-data management (preventing data loss, integration within EMR, information lifecycle management) has: [Significantly Worsened, Worsened, Stayed the Same, Improved, Significantly Improved, Unknown]

    g.   Compared to our pre-EI days, patient engagement in terms of imaging: [Significantly Worsened, Worsened, Stayed the Same, Improved, Significantly Improved, Unknown]

4.   Best practices/governance

    a.   Does your organization have an enterprise imaging governance structure? [None, Departmental/Ad Hoc, Part of IT/PMO Steering Committee, Multidisciplinary-Team Structure]

    b.   Does your organization have a documented enterprise imaging strategy? [Yes/No; Comments]

    c.   Do you have enterprise procurement requirements in place for new modalities/image capture devices? [Yes/No; Comments]

    d.   How is enterprise imaging supported from a technical standpoint? [Enterprise IT, Departmental IT, Both; Comments]

    e.   Is enterprise imaging part of your strategic priority of your organization, and is it financially supported?

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Summit Attendees

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Barry Stein: Chairman, Information Technology-Medical Director, Advanced Imaging and 3D Laboratory, Hartford Healthcare Corporation

Beth Gates: Head of Education and Clinical Programs, Philips

Bill Lacy: VP, Medical Informatics Business, Fujifilm

Bill Stoval: VP, Offering Management, IBM Watson Health

Boris Zavalkovskiy: Director, Diagnostic Services, Cancer Treatment Centers of America

Brady Anderson: Sr. Director, New Product Development, Philips

Brian Wetzel: Director of Diagnostic Imaging, Our Lady of Lourdes Memorial Hospital, Ascension

Calum Cunningham: VP, GM, Enterprise Imaging, Philips

Carlos Vasquez: VP and COO, Franciscan Health

Charles Sawyer, MD: VP, CMIO, Mission Health System

Cheryl Petersilge: Medical Director, Integrated Content and Enterprise Imaging, Cleveland Clinic

Christina Demur: General Manager, Cardiology IT, GE Healthcare

Christine Kao: Global Marketing and Growth Operations Director, Carestream Health

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Dan Marnach: IT Director, Avera Heart Hospital and North Central Heart Clinic

Daniel Corey: Neuroradiologist, Utah Radiology Associates

David Avrin: Professor of Clinical Radiology and Medicine, UCSF

Dawn Cram: IS Director, Enterprise Imaging, Ochsner Health System

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Mikael Anden: President, North America, Sectra North America, Inc.

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Rasu Shrestha: CIO and EVP, UPMC

Razvan Atanasiu: CTO, Enterprise Imaging, Hyland

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Ron Cornett: Director of IT, Radiology Ltd.

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