HIMSS-SIIM Enterprise Imaging Community Roundtable: How Enterprise Imaging is Leveraged for Patient Care from a Distance

Q&A

Below are questions that registrants have asked to be answered during the roundtable during the Q&A portion of the call:

How does planning encounter-based imaging into your Enterprise Imaging strategy help with epidemic management?

o *Alex Towbin:* The big benefit of having an encounters-based imaging workflow for us was that we did not have to create a large number of new orders in a short time period. We were able to leverage the encounter and ad-hoc workflow to implement medical photography.

Health systems are at various stages in their EI adoption. Will the current COVID crisis restrain the adoption of EI or will it reinforce the need for one? If it reinforces the need, which hospital segments are going to speed up adoption?

o *Les Folio:* I believe the pandemic is supporting need for EI, especially based on how Toby mentioned how digital pathology allowed continued workflow (where pathologists not digital were not prepared) as Veronica mentioned tele-dermatology allowed patient care to continue. The multimedia nature helps describe and educate when the physical presence is not practicable.

o *Les Folio:* Recent events demonstrate that being digital (not relying on physical slides) is disaster planning; while the first step in becoming multimedia. Interactive reporting (linking from text to images and annotations) guides clinicians when not physically present.

o *Toby Cornish:* The current COVID crisis will likely encourage those labs without an investment in digital pathology to invest in at least a small amount of slide scanning and storage capacity interfaced to the LIS. Validating a small system for clinical use will likely be seen as necessary for disaster preparedness. This issue is exacerbated in a situation like COVID due to an aging population of practicing pathologists who are most at risk during a pandemic.

o *Alex Towbin:* I believe the COVID-19 pandemic will help to solidify the need for EI as this technology helps clinicians care for patients remotely.

COVID has shown us that patients are ready and able to use telemedicine for much of their care delivery. Enterprise imaging enables telemedicine. As the billing hurdles related to telemedicine are removed, this will become a more standard workflow for patients and clinicians.

What are folks doing to insure quality of noisy CT's?

- *Les Folio:* Improved iterative reconstruction and consistent technical protocols avoid "noisy CT's" while slashing radiation exposures in half, see below 5 year summary we published from NIH CC:

  - Kovacs WC, Yao J, Bluemke DA, Folio LR. Opportunities to Reduce CT Radiation Exposure, Experience Over 5 Years at the NIH Clinical Center. Radiat Prot Dosimetry. 2017 Aug 1;175(4):482-492. doi: 10.1093/rpd/ncw377

- *Alex Towbin:* Noisy CTs are not a new problem. In general, a user's tolerance of image noise is based on their experience and frame of reference. For example, because the early emphasis on radiation dose reduction was centered in children, pediatric radiologists have become more accustomed to noisy CTs than their adult radiologist colleagues. The vendors have implemented lots of new technology to help reduce the visual noise. These technologic breakthroughs are continuing today as machine learning is being used to reduce image noise. In general, we are balancing two goals: minimizing excess radiation and maximizing image quality to be able to answer the clinical question.

Where is imaging the best benefit during the COVID 19 crisis?

- *Les Folio:* From the radiology perspective, the chest x-ray and chest CT in supporting diagnosis, surveillance and documenting resolution. At NIH we also create simulated chest x-rays through full thickness multi-planar reconstructions (FTMPR) that look just like chest x-rays for improved comparison. We are also making an improved right/ left marker (X-Clometer) that quantifies the upright angle of portable chest x-rays for better differentiation of effusions (even though not common) from COVID pneumonia. Lastly AI efforts (e.g. IPDLE) will no doubt improve collective knowledge on imaging findings in COVID, see our IEEE publication draft below (open for comment):

  - Iteratively Pruned Deep Learning Ensembles (IPDLE) for COVID-19 Detection in Chest X-rays http://arxiv.org/abs/2004.08379

- *Alex Towbin:* A number of bodies have issued position statements regarding radiologic imaging for COVID

  - The American College of Radiology has released a statement regarding Recommendations for the use of Chest Radiography and Computed Tomography (CT) for Suspected COVID-19 Infection
  - The Fleischner Society has released a Consensus statement entitled The Role of Chest Imaging in Patient Management during the COVID-19 Pandemic: A Multinational Consensus Statement from the Fleischner Society

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With all of the web conferencing tools available and in use currently, do this replace the need for image data exchange, since the viewing functionality and need could potentially be met with a screen share session?

- o *Les Folio:* Web conferencing supplements image data exchange, will not replace it; for example data management of discrete elements. We have an invited article on how web conferencing can supplement clinical care with tips and tricks for clinicians in consideration with JCAT that will describe this in detail.

- o *Toby Cornish:* In pathology, we are using web conferencing for a lot things we used to do face-to-face at multiheaded microscopes. If you have ever seen a multiheaded microscope you will immediately understand that it is impossible to socially distance while using one. We have moved all resident and fellow "double-scoping" (the core of clinical education for residents and fellows) to web conference sessions. We have also moved pathology participation in tumor boards and our daily quality assurance / consultation to web-based sessions. All of this web conferencing uses simple digital cameras we already have on all our microscopes. While this has solved many of the issues with clinical and educational conferencing during the COVID crisis, it can't really be used to review and report on cases from a distance. For that you really need to be bulk scanning slides to whole slide images (WSIs) and reviewing them using specialized viewers.

- o *Alex Towbin:* The web conferencing tools allow for exciting innovations such as virtual consults with Radiologists. With this type of tool, a clinician can review medical imaging with a radiologist at distance. However, this does not replace the need for enterprise imaging. The conferencing tools enable collaboration but do not replace the need for strategy, image capture, image distribution, and application of appropriate metadata.

What are the most important criteria to consider when selecting displays to read on?

- o *Les Folio:* Quality, brightness, compatibility, cost adoption across specialties.

- o *Alex Towbin*: Alex Towbin: The American College of Radiology, American Association of Physicists in Medicine, and the Society for Imaging Informatics in Medicine have jointly published a [Technical Standard For Electronic Practice Of Medical Imaging](#)

How to integrate First-reader mode considerations for AI in Medical Imaging.

- o *Les Folio:* In radiology, we have adopted a radiology preprocessor (RP) model, where non-radiologists (can be a college student) are trained in basic anatomy, PACS tools (especially annotations such as measurements and ovals) adding these before radiologist open the exam for interpretation. In our recent publication, we showed improved patient care in clinical trials through improved target lesion selection and measurement consistency over non RP workflows, in addition to earlier notification of

incidental critical findings, while cutting radiologist time by 30% (radiologist efficiency is now doubled since publication with improved tools, this continues to improve).

- Do HM, Spear LG, Nikpanah M, Mirmomen SM, Machado LB, Toscano AP, Turkbey B, Bagheri MH, Gulley JL, Folio LR. Augmented Radiologist Workflow Improves Report Value and Saves Time: A Potential Model for Implementation of Artificial Intelligence. Acad Radiol. 2020 Jan;27(1):96-105. doi: 10.1016/j.acra.2019.09.014

Is GDPR for Photo being considered?

o *Alex Towbin:* Yes, the Photo-Documentation Workgroup, led by Dr. Cheryl Petersilge is considering GDPR as we talk about the technical requirements related to sensitive photographs.

How does the user get patient context for capturing the photograph? Is the app you refer to embedded in the EHR/EMR and gets context from it or if it's standalone do they manually enter patient info?

o *Alex Towbin:* The different mobile applications work differently. However, all provide a way for you apply demographic metadata to photograph. The information can come from one of two routes: manual data entry or query of the EMR. At my institution, we require users query the EMR. Again, the different apps on the market offer different ways to accomplish this task. The vendor that we partner with embeds into our EMR. The user presses a button within the encounter that launches a QR code. The user then scans the code with their device before taking a photo of the patient. Alternate workflows are available if the provider is not sitting next to a computer.

Much has been said about using EI to facilitate remote workflows for diagnostic physicians, such as remote reading. What about doctor to patient interactions? What are you hearing about the incorporation of images into telemedicine sessions with patients?

o *Les Folio:* Patients get more out of reports that have images over text only reports without context, especially when they are interactive as they can click on descriptions that take them to the findings like clinicians do.

o *Alex Towbin:* Like at other hospitals, we are seeing a dramatic increase in the use of telemedicine. Currently, approximately 60% of all of our ambulatory visits are accomplished through telemedicine. The feedback from our patients is mostly very positive with the majority of patients stating a desire to continue telemedicine visits after COVD. For most of these visits, images are not incorporated. Instead, the providers is talking to the patient in real time and viewing what the patient is showing from their camera. At times, photographs are sent via email.

What would you say the pandemic has done in terms of your priorities or implementation needs?

- o *Les Folio:* The need to make image data publically accessible for deep learning training

- o *Alex Towbin:* COVID-19 has shifted all of our priorities. I am thankful to my colleagues in Information Services. They have dropped everything and have worked around the clock to rapidly enable our ability to provide care at a distance. This change has affected all corners of our IS team. For example, as employees have moved off site, our network team has worked to expand bandwidth and VPN access; our EMR team has created new ordersets and new orders to help providers care for COVID patients in a standard manner; and our enterprise imaging team implemented app-based photography for dermatology. These projects have taken immediate priority over the other operational projects.

What kind of storage increase does full digital pathology bring? Is there a rule of thumb; e.g. it will consume 10x what radiology consumes on an annual basis.

- o *Toby Cornish:* An average WSI may be between 250 MB and 2 TB depending on the image resolution (typically related to the total magnification, i.e., 20x v. 40x objective equivalent), the amount of tissue on slide, and the compression used. The total storage required also depends on the volume of slides produced in a lab. An medium sized academic lab might handle 300k slides per year, so for primary storage, you might generate 450 TB per year if all of those are digitized (average ~ 1.25 GB/slide); a large academic lab might handle 900k slides per year, or around 1.1 PB per year. The radiologists will need to weigh in on comparing that to their storage requirements. Anil may be able to share actual number for Ohio State.

- **Although some of the actions taken during the laser-focused implementations isn't repeatable outside the context of a pandemic, what learnings / processes can be re-applied to future implementations?**

- o *Les Folio:* Continue trend in consensus on imaging standards becoming as digital as possible, as well as including images in the EMR with mandated interoperability.

- o *Alex Towbin:* The importance of standard workflow, good governance, and detailed planning has helped us as we have rapidly expanded our scope.