Innovation, value and quantitation in a patient-centric radiology environment: A roundtable discussion on the future of radiology

Mary Beth Massat

TECHNOLOGY

TRENDS

The Radiological Society of North America's 2014 scientific exhibition and annual meeting was a reflection of the first 100 years of the RSNA's existence. As the RSNA rounds the corner and heads into its next century with the 2015 edition, radiology and radiologists are faced with numerous opportunities as well as many challenges. How will radiologists embrace and adapt to the value-based world when they are still reimbursed on a volume-based structure? What role will informatics play in the continued innovation of radiology? What can radiologists do to become more visible in a patient-centered healthcare model? And what can radiologists do to adapt to an increasingly quantitative medical imaging environment?

To help answer questions like these, Applied Radiology gathered together some of today's foremost radiologists to share their perspectives on innovation, value-based practice, patient-centered health care and the movement toward a quantitative imaging environment. On the panel were Ronald L. Arenson, MD, FACR, President of the Radiological Society of North America and the Alexander R. Margulis Distinguished Professor and Chair of the Department of Radiology and Biomedical Imaging at the University of California, San Francisco; Spencer Behr, MD, Assistant Professor of Clinical Radiology and Director of Fellowship for both the Abdominal Imaging subspecialty and the Department of Radiology and Biomedical Imaging at the University of California, San Francisco; Rajesh Krishnamurthy, MD, Section Chief, Radiology Research and Cardiac Imaging at Texas Children's Hospital, Houston TX; Lawrence Tanenbaum, MD, FACR, Vice President and Medical Director East Region – Director of CT, MR and Advanced Imaging, RadNet, Inc., Los Angeles, CA.

Applied Radiology (AR): This year's theme/focus of the RSNA is "Innovation is the Key to our Future." In your opinion, what are the key innovations that radiology and radiologists will need to embrace in order to adapt to a value-based practice?

Ronald L. Arenson, MD, FACR (RA): Over the past several years, there have been numerous advances in information technology. These tools can be invaluable to radiologists in the diagnosis, management and treatment of our patients. Advances in decision support systems and cloud technology, for example, have contributed greatly to improving workplace efficiency

Mary Beth Massat is a freelance writer based in Crystal Lake, IL.

and creating stronger communication channels among the healthcare team.

Radiologists need to participate in the development of value-based systems by leadership groups in hospitals and practices. They need to be viewed as part of the solution rather than part of the problem. Where radiologists provide excellent patient care and are viewed as strongly supporting their referring colleagues, they are likely to be treated fairly in these evolving financial models.

Lawrence Tanenbaum, MD, FACR

(LT): There is a paradigm shift occurring in how we perform MR studies. In the past we've created long scans with multiple sequences without much scientific justification for all the images we generate and read. That's changing. We are seeing an increased emphasis on patient comfort and shorter scan experiences—from academia to clinical practice— reducing patient discomfort and maximizing throughput.

Big data also offers opportunities that can impact both value and efficiency. I can see if we are efficient scan-to-scan and patient-to-patient. I can identify if patients are expressing discomfort through motion leading to scan repeats and if technologists are comfortable with all exam types by searching for atypical setup delays. We all need to pull useful information from our scanners, PACS and administrative systems to further enhance the value that we provide to our patients.

Of course, there is the continued momentum towards quantitative imaging and advanced characterization of

## TECHNOLOGY TRENDS

## Contributors



**Ronald L. Arenson, MD, FACR,** President of the RSNA and Alexander R. Margulis Distinguished Professor and Chair of the Department of Radiology and Biomedical Imaging at the University of California, San Francisco, CA.



**Spencer Behr, MD**, Assistant Professor of Clinical Radiology and the Director of the Fellowship for both the Abdominal Imaging subspecialty and for the Department of Radiology and Biomedical Imaging at the University of California, San Francisco, CA.



**Rajesh Krishnamurthy, MD,** Section Chief, Radiology Research and Cardiac Imaging at Texas Children's Hospital, Houston, TX.



Lawrence Tanenbaum, MD, FACR, Vice President and Medical Director East Region – Director of CT, MR and Advanced Imaging, RadNet, Inc., Los Angeles, CA.

disease and injury with the use of perfusion, permeability and diffusion imaging which add value beyond anatomy. With CT, in addition to reducing dose, techniques such as dual energy add to the value of the information we now provide.

**Spencer Behr, MD (SB):** Technology can be both a gift and a bane—clinicians can freely look at images and the report. However, to help them understand the value of that imaging data, we need to make ourselves readily available, using technology, to both clinicians and patients. We are the experts of interpretation, that's where we can direct the dialogue and not get lost in the shuffle. That's the value we can provide.

Yet we can't just rely on technology, we need to cultivate our relationships. I've answered emails to patients... and when I talk to the ED physicians about the patient case, I produce my most fruitful reports. With clinical decision support, I sometimes wonder if we aren't further removing ourselves from the decision tree. Let's use the technology that's in our hands—our smartphones—to text our colleagues and inform them at that moment that something is going on with their patient.

## Rajesh Krishnamurthy, MD (RK):

There is a fundamental shift in our approach to innovation. The biggest change is in how we use technology in the past we've used it for innovation, to accrue new tools for diagnostic accuracy. Now, we are moving away from that and the endpoint has changed dramatically—we are using technical innovation to change patient management, outcomes, cost of healthcare, and patient satisfaction. At Texas Children's Hospital, there are three mechanisms for evaluating technology: safety, efficiency and quality. An example of safety is reducing sedation and radiation exposure; efficiency is improving throughput; and quality is improved patient outcomes and enhanced patient satisfaction. This kind of change in approach requires envisioning the next three to five years and requires strategic planning. Our focus has shifted beyond one-year budget cycles from an administrative perspective, and unites radiology and administration to look at technology assessments longer term. That's the value that radiology can provide.

**AR:** What is needed for radiology and radiologists to become more visible to patients as healthcare moves to a patient-centered care model? How can technology help?

**RA:** It is imperative that radiologists are recognized as important members of the patient's medical team. While medical imaging advances have made radiology central to modern medicine, it is information technology that will best help radiologists to demonstrate their value in the patient's continuum of care, from informatics tools that streamline the radiologist's workload allowing for greater attention to patient needs, to improved reporting capabilities and image sharing tools that allow a more direct line of communication with patients and the rest of their healthcare team.

**SB:** The challenge of technology is that information can be taken out of context. So we need a filter and that can include being more available — making our patient care more accessible. For example, once a clinician or a patient sees the results, we need to be increasingly available for their questions.

**RK:** The shift in focus to patient-centric health care will put radiology at the forefront of patient care, and make us more visible. I believe that is key. We need to put technology to good use. As TECHNOLOGY TRENDS

> an example, we are developing a program for point-of-care, 15 minute, free breathing, unsupervised cardiac MR imaging in children, which decreases the need for sedation and improves throughput. It's a cutting edge program that requires a certain technical prowess to obtain rapid, high-resolution 3D morphology, function and flow information as a single integrated dataset in small patients with complex congenital heart disease. These are examples of changes in practice where we put next generation technology to good use: improve safety, efficiency and quality.

> LT: As we move to patient-centric healthcare, patient comfort concerns will promote a push to shorten exams. There are things we can do with technology to make MRI, for example, more comfortable. The more spacious 70 cm bore is becoming a standard and manufacturers are making significant inroads in substantially reducing MR related noise. The next big technological advancement will be reducing the number of scans we acquire-shifting from 'show me the newest technique' to 'how can we design an MRI that answers the clinical need but also gets the patient off the table sooner.' Synthetic MR technology can perform a single scan and provide all the standard and additional contrasts that we need for diagnosis-so in five minutes we can capture all the axial scans that previously took 30 minutes to acquire. These days your PET scanner might be built into an MR. With time-of-flight PET, we get boosts in spatial resolution and speed.

> In CT, we can substantially lower dose with iterative reconstruction and by tuning to lower kVp energy ranges while maintaining or improving image quality. Perfusion exams at 70 kVp lower dose by up to 45%. These are innovations in clinical practice. Dual energy CT is another great innovation in medical imaging. We can now acquire dual

energy data on several single source platforms, some modestly priced. Spectral imaging allows tissue characterization based on at atomic number and retrospective rich interrogation of the exam data. There are reduced artifacts associated with implanted hardware or devices. These capabilities should avoid unnecessary follow up exams and decrease non-diagnostic studies that lead to repeat exams.

**AR:** What is your view on informatics gaps? What technology is still needed, and what is the next big hurdle for radiology informatics?

**RA:** Informatics has been an exciting area over the last several years. With the rapid growth of precision medicine, artificial intelligence, clinical decision support, language and image processing, and other advanced systems for improving workflow, I think one of the biggest hurdles is going to be managing the wealth of data that is now available. RSNA Image Share, which allows safe, secure sharing of medical imaging records, and similar initiatives are important steps in closing the gaps in medical histories and optimizing patient care.

**RK:** The informatics revolution is one of the most exciting things to happen in radiology in the last 20 years, but I still think that it's in the early stages of maturation. Too many providers and options are trying to distinguish themselves in the marketplace and that leads to confusion. The conventional model of EMR does little to support the needs of specialized fields like radiology or pathology. A pediatric population's needs are rarely met with an adult based model. There is no integrated solution, and the metrics are imperfect and arbitrary.

It is not enough for informatics solutions to talk to each other from a hardware or software standpoint, we need to bring it to the level of the end-user. What we need is a dashboard that is nimble enough to collate information across the entire spectrum of health care, somewhat similar to the DICOM standard in image management, and allow flexibility for the end-user, so we can grab and populate what we need for our own unique situation without being swamped by the avalanche of options. Metrics are constantly evolving and our ability to gather usable information is currently very limited. The information is out there, but not being compiled smartly and put to use on a day-to-day basis.

**SB:** There is a need to create more uniform reporting to report our findings in a clear and rapid way—we are moving toward it with the acceptance of Bi-rads, Li-rads, Pi-rads, but these words need to be in the report. We need to generate more templated reports structured reports—with a delicate balance that allows us to describe in some level of free form yet enables us to search the text for keywords.

LT: We need to harness the opportunity of big data. One of my goals overseeing almost 300 imaging centers is to standardize efficiency and quality by using big data to see what our centers are doing-from radiation dose levels to increasing the value of our exams. The domain knowledge of the radiologist is critical in interpreting the significance of "the numbers." We need to harvest the opportunity to benchmark. Reimbursement will be increasingly entwined to registries. There are opportunities for innovative applications that use registries for appropriateness determination. Sharing of data among centers and organizations is going to be essential.

**AR:** How is RSNA helping radiology and radiologists to adapt to an increasingly quantitative diagnostic environment?

RA: Through its publications and annual meeting, RSNA provides a wide assortment of educational opportunities and resources in quantitative imaging. In 2007, RSNA organized the Quantitative Imaging Biomarkers Alliance (QIBA) to bring together researchers, healthcare professionals and other stakeholders in advancing the use of quantitative imaging and the use of biomarkers in clinical trials and practice. RSNA encourages the adoption of QIBA protocols and profiles and also hosts the Quantitative Imaging Data Warehouse, an image archive that supports operational needs for basic quantitative imaging research, as well as secondary image and data analysis.

**AR:** What can radiology and radiologists do to adapt to an increasingly quantitative diagnostic environment?

**RK:** Quantitative imaging is an important component of our future—it's the only way to move from our current qualitative morphology-based approach to an approach that takes into account all aspects of tissue function like biomechanics, flow, perfusion and metabolism. Many evolving therapies will become dependent on imaging quantitation for assessment of efficacy and prognosis.

Although our research community has been focused on developing these tools, the lack of penetration of these tools into the clinical sphere is concerning. Vendors highlight the tools as a technical breakthrough, which allows them visibility in the marketplace. They are sold as a standalone procedure, and processed independently in automated or semi-automated fashion. This has affected the perception of quantitation in the eyes of practicing radiologists who are not called upon to render an interpretation of these numbers. They think that this is "soul-less radiology," and there is a concern for commoditization of the whole field of quantitative imaging. The problem is that we are depriving these tools of their clinical context-what is the role of these quantitative imaging biomarkers in changing patient management, patient care, and outcomes? For that we need large three- to five-year studies, and this can only happen with multi-disciplinary clinical collaboration and funding. This will lead to a greater integration of the quantitative markers into practice and allow the imaging experts to make sense of the numbers for patient care. We have done this to a large extent in my field, which is pediatric cardiac imaging, and this may serve as an example for other specialties in radiology. We need to demonstrate the role of quantitation in patient management and prognosis, and use it as a metric for novel targeted therapies.

LT: It's an enticing opportunity – and some areas have already taken off. We are quantifying liver fat and iron. But we aren't doing as well with diffusion coefficients-they don't translate well across facilities. One compelling technique is DTI imaging for the diagnosis of mild traumatic brain injury. Unfortunately we are not yet able get consistent values day-to-day and scanner-to-scanner. We are using quantitation for perfusion and permeability based advanced characterization of patients with brain tumors, which provide better insights particularly in treated cases, taking us well beyond what day-to-day structural imaging can provide.

**SB:** In a quantitative environment, we report changes—absolute measurements—to RECIST for many chemo-

therapy trials. It is additional work and increases our time, but it comes back to value-based practice. That's how we can deliver value, through clear and concise reports that state a 20% change in the tumor versus a slight decrease or marked increase...what do those words really mean?

If we want to maximize the return, then we need to collaborate with non-radiologists: what do they want, what are they looking for? We need to speak to our audience.

**AR:** As President of RSNA, Dr. Arenson, you have hoped "to continue to advance (patient-centered care and radiology's evolution from volumeto value-based practice) and encourage the development and use of informatics tools to improve the care we provide to our patients." Reflecting back on this past year, have you and the RSNA accomplished what you set out to do, and what still needs to be done?

RA: Moving from volume- to value-based practice is an ongoing pursuit. It is a difficult transition, as radiologists continue to be reimbursed on a volume-based model. There is still plenty to be done, but we have made significant strides toward our goal. More than ever, radiologists are cognizant of the changing landscape in our specialty and the need to adapt the way we practice. Campaigns such as RSNA's Radiology Cares, as well as the American College of Radiology's Imaging 3.0, provide invaluable resources and toolkits to assist radiologists in becoming more patient centered; and informatics tools such as RSNA Image Share allow radiologists to securely share medical images with patients using personal health record accounts.