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The Value-Based Model is Here — the Time for Action is Now

By Mike Bassett

While radiologists have been talking the value talk for several years now, it's time they started "walking the value walk," said Jonathan B. Kruskal, MD, PhD, during Tuesday's Annual Oration in Diagnostic Radiology.

While there has been much discussion within radiology about the specialty's transition from the volume to value era, the message simply is not getting across, Dr. Kruskal said in his lecture, "Strategies for Radiology to Thrive in the Value Era."

But change is coming. For example, Dr. Kruskal noted that his hospital has been notified that next year the Massachusetts Medicaid program will "substantially" shift from fee-for-service to a value-based model.

"So this is happening," said Dr. Kruskal, chairman of the Department of Radiology, Beth Israel Deaconess Medical Center in Boston, and professor of radiology, Harvard Medical Center. "This is the real world. We are starting to be paid on our value contribution and we have to get down to the nitty-gritty and understand what it is we can do as radiologists to add value to our customers."

"Ultimately, the major reason radiologists have not embraced the value concept is that

Strategies for Radiology to Thrive in the Value Era



Jonathan B. Kruskal, MD, PhD, delivers the Annual Oration in Diagnostic Radiology

we still don't know what value is, how to measure it, or how best to provide it to our customers," he said.

In a tweet sent to Dr. Kruskal during his talk, James Rawson, MD, of the Medical College of Georgia, interjected that radiologists need to understand that they don't

define value, "their customers do." Which means that radiologists need to know who their customers are (referring physicians and patients), how to talk to — not at — them, and then listen to them and act on their feedback.

CONTINUED ON PAGE 14A

Mahmood Named to RSNA Board

Umar Mahmood, MD, PhD, a leading researcher and sought-after mentor, joins the RSNA Board of Directors as the liaison for international affairs.

"Technology is rapidly changing how imaging is performed and interpreted, but a constant through many, many decades and throughout the world has been the steady hand of radiologists to use imaging to help people, both individually to diagnose disease, and collectively to better understand pathophysiology. RSNA throughout my career has always represented the pinnacle of radiology. To join the RSNA Board of Directors and to be given the opportunity as the liaison for international affairs to help bring radiologists together from around the globe to jointly improve our patients' lives is a profoundly meaningful honor for me."

Dr. Mahmood is vice chair for precision imaging in the Department of Radiology at Massachusetts General Hospital (MGH) and professor of radiology at Harvard Medical School. An accomplished researcher, he has received more than \$20 million in grant funding as principal investigator, primarily from the National Institutes of Health, for his research into the applications of molecular imaging to guide precision medicine, particularly in developing and applying PET



Mahmood

and optical imaging technologies for disease characterization and therapy optimization.

During his career, Dr. Mahmood has had a longstanding commitment to growing the next generation of physician scientists. He has guided more than 60 research trainees, many of whom have become academic medical faculty, and a number who have received their own research funding as principal investigator under his direct mentorship.

A committed volunteer, Dr. Mahmood currently serves as chair of the RSNA Research & Education (R&E) Foundation Grant Program and as a member of the R&E Foundation Board of Trustees. He has also served as vice chair of RSNA's Committee on Scientific Affairs, as an associate editor of *Radiology*, and as a chair or member of multiple other RSNA committees focused on advancing imaging sciences. Dr. Mahmood received an RSNA R&E Foundation Research Resident grant in 2000.

Additionally, Dr. Mahmood is chair of the Board of Scientific Counselors of the Clinical Center of the National Institutes of Health, a Fellow of the American College of

Radiology, a member of the Board of Directors of the Society of Nuclear Medicine and Molecular Imaging (SNMMI), and chair of the SNMMI Scientific Program Committee. He delivered the SNMMI Henry N. Wagner Jr., MD, Highlights Lecture in Oncology in 2014 and 2015, and received the Distinguished Investigator award from the Academy for Radiology & Biomedical Imaging Research in 2014.

Dr. Mahmood earned his bachelor's degree from the California Institute of Technology and his medical degree and doctorate in biophysics and physiology from Cornell University. His doctoral and post-doctoral work at Memorial Sloan Kettering Cancer Center focused on tumor energetics and membrane physiology, studied using 31P nuclear magnetic resonance (NMR) spectroscopy. He completed his radiology residency at MGH in 2001 and has maintained faculty appointments at MGH and Harvard Medical School since. During his more than 20 years at MGH he has conducted PET, optical, and MR imaging research, and has focused on translational efforts to better understand drivers of cancer, including the tumor microenvironment, cancer signaling pathways, changes in cancer metabolism, and the interaction of the immune system with tumors.

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Wednesday At a Glance

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7:15-8:15

Controversy Session

Imaging of the Pelvis: When is Ultrasound Enough?
(E350)

Hot Topic Session

Deep Learning for Mammography
(E450A)

RSNA Diagnosis Live™

Game of Bones: Radiology in the Seven Kingdoms (Case-based Competition)
(E451B)

8:30-10:00

Educational Courses

BOOST: Bolstering Oncologic and Oncoradiotherapeutic Skills for Tomorrow
Pediatric—Oncology Anatomy
(S103CD)

10:30-NOON

Scientific Paper Sessions

BOOST
Lymphoma—Oncology Anatomy
(S103CD)

11:00-1:00

3-D Printing Theater Presentations

(Learning Center)

11:00-2:00

Machine Learning Theater Presentations

(Machine Learning Showcase, North Hall)

12:15-1:15

Poster Discussions

(Learning Center)

1:30-2:45

Plenary Session

Annual Oration in Radiation Oncology

Personalized Medicine and Radiation Oncology
Daphne A. Haas-Kogan, MD
(E450A)

1:30-2:30

BOOST

Lymphoma, Pediatrics, Sarcoma—Science Session with Keynote
(S103CD)

1:30-6:00

Interventional Oncology

Series: Basic Science and Imaging
(S405AB)

2:30-4:00

Educational Courses

3:00-4:00

Scientific Paper Sessions

3:00-4:15

BOOST

Lymphoma—Case-based Review
(S103CD)

4:30-6:00

Controversy Sessions

Early Stage Prostate Cancer—To Treat or Not to Treat?
(E451A)

Evidence-based Interventional Radiology: How Long Can We Wait for the Evidence?
(E351)

MR Imaging Enhancers (Muscle Relaxants, Rectal Gel, Vaginal Gel): Are They Really Necessary?
(E353B)

The Doctor's Doctor or the Patient's Physician: Can Radiologists Simultaneously Be Both?
(N226)

LUNG-RADS™ or Not: Which Nodule Management Protocol Should Be Used for Reporting Lung Cancer Screening CT?
(N227B)

RSNA Diagnosis Live™
Neuro and MSK (Case-based Competition)
(E451B)

4:45-6:00

BOOST

Lymphoma-eContouring
(S104B)

Daily Bulletin

Wednesday

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The RSNA 2017 *Daily Bulletin* is the official publication of the 103rd Scientific Assembly and Annual Meeting of the Radiological Society of North America. Published Sunday, November 26–Thursday, November 30.

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The RSNA 2017 *Daily Bulletin* is owned and published by the Radiological Society of North America, Inc., 820 Jorie Blvd., Oak Brook, IL 60523.



Dosage

Tip of the Day

In CT contrast studies, lowering kVp can reduce both radiation and contrast dose.

Tickets Not Required for RSNA 2017 Sessions

All sessions at RSNA 2017 are filled on a first-come, first served basis. Please be aware that adding sessions to My Agenda in Meeting Central does not reserve a seat; it is provided to assist you in managing your meeting schedule. Visit any Information Desk for more information.

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Excitement, Questions Surround Role of Radiology in Artificial Intelligence

By Elizabeth Gardner

A standing-room-only crowd turned out to hear foremost experts discuss how artificial intelligence (AI) and machine learning (ML) are impacting radiology at Tuesday's RSNA/American Association of Physicists in Medicine (AAPM) symposium.

The discipline now upending radiology as we know it — applying big-data processing power and techniques to digital images — is developing rapidly, but will need the trained brains of radiologists to make it into a daily tool for diagnosis and treatment.

“There is a lot of excitement and also a lot of questions,” said Paul E. Kinahan, PhD, moderator of the symposium, “Machine Learning in Radiology: Why and How?”

Dr. Kinahan, vice chair of radiology research and head of the Imaging Research Laboratory at the University of Washington, Seattle, noted that dozens of exhibitors at this year's meeting, many of them exhibiting for the first time, are offering AI-based products.

During the session “Harnessing Artificial Intelligence,” presenter Keith Dreyer, DO, gave a high-level explanation of the complexities involved in teaching computers to read



Dreyer

images. The audience was split among radiologists, physicists and vendors of AI tools.

“Machines are getting smarter faster than people are,” said Dr. Dreyer, vice chair of radiology and director of the Center for Clinical Data Science at Massachusetts General Hospital, Boston, and chair of the American College of Radiology's Commission on Informatics.

He said early science-fiction depictions of AI that all but replace the human brain have given way to less complex, but immediately useful ML, which, for example, tells Amazon customers what other products they might be interested in based on past purchases.

“It's not as sexy as AI, but it is a necessary foundation for AI to take hold,” Dr. Dreyer said.

“It's not as sexy as AI, but it is a necessary foundation for AI to take hold,” Dr. Dreyer said.

Getting Involved in AI

A major obstacle to developing AI for imaging is the lack of what Dr. Dreyer

called a “healthcare AI ecosystem.” He said radiology needs universally accepted ways to develop and incorporate AI, similar to the DICOM image standard, in order to make it easy for developers to create new applications and integrate them into imaging devices and clinical information systems.

Dr. Dreyer urged audience members to get involved in the first important task of developing medical imaging use cases. One of his slides showed a matrix of thousands of tiny squares, each one representing the intersection of a radiology specialty, an imaging modality, a part of the body and the lab and/or pathology findings that inform the imaging study. Each square is a possible use case for AI that will need clinicians to help develop the rules.

AI for Cancer Treatment

In his presentation, “Assistive AI for Cancer Treatment,” Antonio Criminisi, PhD, a principal researcher at Microsoft in Cambridge, U.K., described the company's InnerEye project and how it can help pinpoint the location of tumors for targeted radiotherapy.



Criminisi

The technology is based on a principle similar to the one that drives the Microsoft Kinect game system, which senses human movement and “builds” a replica of the body inside the game. Dr. Criminisi's team is teaching the InnerEye software to analyze pelvic images and identify anatomical structures, particularly the prostate, to speed the now laborious task of locating exactly which spots to radiate.

In another example, the team combined images of a brain tumor from six different imaging modalities in order to quantify changes in tumor volume.

“This technology is not for doing things that you already know how to do well, but to do things that you wish you were able to do,” Dr. Criminisi said.

But perfecting AI isn't as important as getting it to work well enough for daily use, Dr. Dreyer said, noting the broad spectrum of accuracy among human radiologists.

“Do you need AI to be at the top?” he asked. “Or would it be enough for it to be somewhere in the middle, which is easier to achieve? I would argue there are many places on the globe where it would be adequate to have a good solution.”

Jackson is RSNA President-Elect

Valerie P. Jackson, MD, is president-elect for 2017. An expert in the field of breast imaging, Dr. Jackson is the executive director of the American Board of Radiology (ABR), a position she has held since 2014. She previously served on ABR's board of trustees from 2001 to 2010.

As president-elect, Dr. Jackson will support RSNA's mission in promoting excellence in the care of patients and health care delivery through education and research.

“My goals for the coming year are to continue to keep RSNA the premier organization for radiology research and education in the world,” Dr. Jackson said. “The RSNA Board and the organization's many volunteers listen to feedback and continue to evolve the programs for the annual meeting, as well as for activities outside of the meeting. I am proud to be part of such a responsive, forward-thinking organization.”

Dr. Jackson received her medical degree in 1978 from the Indiana University School of Medicine, and completed her residency at the Indiana University Medical Center in 1982. She is the Eugene C. Klatt Professor Emeritus and has held numerous academic appointments at Indiana University School of Medicine over the years, including chairman of the Department of Radiology and Imaging Sciences.

Dr. Jackson has published more than 100 peer-reviewed articles and 20 books and book chapters with an emphasis on breast imaging and radiologic education. She has

served on the editorial boards and as a manuscript reviewer of multiple journals. Dr. Jackson also served as associate editor and consultant to the editor for *Radiology*.

An RSNA member since 1982, Dr. Jackson has served the Society in numerous roles, including as chair of the Refresher Course Committee and chair of the Breast Imaging Subcommittee of the Scientific Program Committee. She served as a member of the *RSNA News* Editorial Board from 2005 to 2008, and has been a member of the Public Information Advisors Network since 1997. She served RSNA as first vice president from 2008 to 2009 and was a member of the RSNA Centennial Committee. She served on the R&E Foundation Board of Trustees from 2009 to 2015 and joined the RSNA Board of Directors in 2012.

She has held committee or leadership positions in a number of radiologic organizations, including the Indiana Radiological Society (IRS), American Roentgen Ray Society, Association of University Radiologists, Radiology Research Alliance, Academy of Radiology Research, Society of Breast Imaging (SBI) and the American College of Radiology (ACR).

The recipient of numerous honors throughout her career, Dr. Jackson is a fellow of the ACR and has received the gold medals of the IRS, SBI and ACR. The Valerie P. Jackson Education Fellowship also recognizes her work with ACR. Dr. Jackson delivered the Annual Oration in Diagnostic Radiology at RSNA 2002.



Jackson

RSNA 2017 Gold Medalists



RSNA recognized three outstanding members with the Gold Medal award during Monday's opening session: Roderic I. Pettigrew, PhD, MD; J. William Charboneau, MD; and George S. Bisset, III, MD, are pictured left to right with RSNA President Richard L. Ehman, MD (far right).

Ergonomics

Question of the Day

Q To minimize visual strain, what should be the ambient lighting in a radiology reading room?

[Answer on page 13A.]



Manual MR Processes to Automated Accuracy What a Contrast



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Breaking the Siege on Healthcare Services

By Lynn Antonopoulos

In 2011, when a series of peaceful, pro-democracy demonstrations in Syria led to an excessive military response against protesters, hospitals became detention centers and military forces targeted medical personnel and facilities, leaving people with nowhere to go for medical help.

In a Tuesday morning session, Abdulrahman Masrani, MD, radiology resident at the Mallinckrodt Institute of Radiology at Washington University, shared a creative method to leverage social media platforms and deliver radiological services to patients in areas under siege.

Dr. Masrani and his colleagues established the Tele-Radiology Relief Group (TRRG) in February 2015 with the assistance of the Syrian American Medical Association. It began as an addition to a pre-existing Tele-ICU project and consists of a group of American and Syrian radiologists who provide diagnostic reports to healthcare professionals in the area.

The need for radiology services is critical, according to Dr. Masrani. “There is a deficiency of medical supplies and significant expense to obtain them. Local medical staff lack properly trained radiologists, and there is only one post-grad, third-year

resident serving 400,000 people,” he said. “Clinicians have no access to the sophisticated software or technological advancements available in the United States.”

The team devised a seemingly simple process providing service via social media. Healthcare workers in Syria publish cases as private posts on Facebook including detailed medical histories and other patient information. Then, they use WhatsApp or Telegram to notify volunteer radiologists of the pending post. Radiologists, working remotely from the United States and Saudi Arabia, view the cases and report findings as comments on the posts.

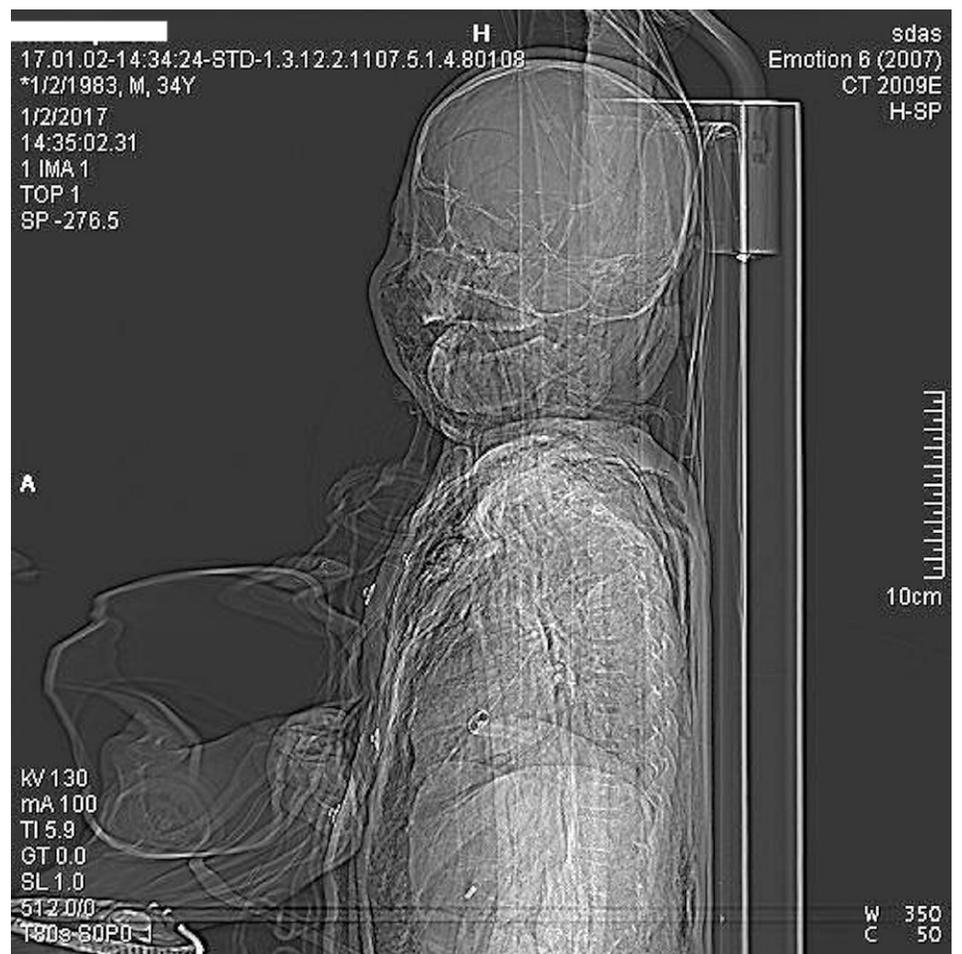
Since the beginning of the program, the TRRG has provided reports for 475 studies: 359 CT scans, 10 with contrast, 112 plain radiographs and four ultrasound studies. These figures represent the studies for which the clinicians in Syria required assistance and are only a portion of the total studies taken.

Protocol and Connectivity Challenges

Dr. Masrani said his team experiences many challenges including issues with protocoling and contrast. The staff at the site are most skilled with ultrasound imaging and prefer it over other modalities. Conversely, they require more assistance with CT scans but have difficulty timing scans after injecting contrast dye. The result is a lack of contrast and overall suboptimal imaging.

Additional problems exist with connectivity. “There is severely limited phone and internet access, so even after images are captured, several hours may pass while clinicians access a computer, load the images, connect to the internet, upload the images to Facebook and wait for the response,” Dr. Masrani said.

The delays cause complications with care. Patients are transported away from the imaging facility hours before



Topogram of a pediatric patient ventilated on Ambu bag due to lack of portable ventilators

a radiologist can review and assess the images, so additional images cannot be taken, and providing an accurate diagnosis is challenging.

In some severe trauma cases, the radiologist may discover a life threatening injury, and clinicians must negotiate for patient transfer to nearby Damascus for care. “It is only nine miles away, but sometimes negotiations are unsuccessful, and the patient does not survive,” Dr. Masrani said.

Despite these serious concerns, the team is confident about the value of social media for delivering radiology services. They have considered expanding the program to other besieged areas, however, they hope to first

improve connectivity and increase their work volume before engaging additional volunteers.

There is a deficiency of medical supplies and significant expense to obtain them. Local medical staff lack properly trained radiologists, and there is only one post-grad, third-year resident serving 400,000 people.

Abdulrahman Masrani, MD



Masrani

Gauging the Effectiveness of 3T Multiparametric MRI – with and without an Endorectal Coil – in Prostate Cancer Detection

By Nick Klenske

Because prostate cancer is a complex condition encompassing a broad range of disease and numerous stages, using imaging to detect and manage the disease is extremely difficult.

Multi-parametric MRI (mpMRI), an emerging form of functional imaging, has gained importance in the detection and characterization of prostate cancer, which remains the most common malignancy among American men.

While mpMRI has proven effective for detecting significant prostate cancer lesions, the imaging tool is limited in the detection of smaller cancer foci. One possible way to remedy this shortcoming is to pair an endorectal coil (ERC) with the mpMRI, according to presenters of a Tuesday session.

“Small lesions require improved images with even higher magnetic fields, which



Mirak

is where the use of an endorectal coil could apply,” said presenter Sohrab Afshari Mirak, MD, with the UCLA Prostate Imaging Research Group, during a session on Tuesday.

Dr. Mirak presented the findings of a UCLA study comparing prostate cancer detection using mpMRI with and without ERC with whole mount histopathology (WMHP). Conducted

from June 2009 to December 2016, the study comprised 429 prostate cancer patients who underwent 3T mpMRI prior to robotic prostatectomy.

In total, 871 consecutive WMHP localized lesions were included. The authors examined 260 patients with 529 lesions with ERC and 169 patients with 342 lesions

without ERC. The two groups were then compared based on overall and index lesions, tumor location and size, Gleason Score (GS) and staging.

“What we found was that the overall and index tumor detection rates were slightly – but not significantly – higher for the ERC group,” Dr. Mirak said.

The overall detection rate for the ERC study group was 50.3 percent, compared to 48.2 percent for the non-ERC group. No significant difference was found when

considering tumor size, level, GS or staging.

“We did, however, achieve a significantly higher detection rate for posterior and peripheral prostate cancer lesions when using ERC,” Dr. Mirak said. “But for anterior and transition prostate lesions, the opposite is true, with detection rates being significantly higher in the non-ERC group.”

Dr. Mirak notes that there were limits to the study. For example, it was retrospective and utilized a single referral institute, excluded patients with treatments other than prostatectomy and did not pair the ERC and non-ERC groups.

Despite these limitations, Dr. Mirak believes the study’s findings are of importance. “This study shows that when it comes to detecting prostate cancer lesions, there are particular advantages to using 3T mpMRI with and without an endorectal coil,” he said. “For this reason, depending on the individual patient, we utilize both methods at UCLA.”

This study shows that when it comes to detecting prostate cancer lesions, there are particular advantages to using 3T mpMRI with and without an endorectal coil.

Sohrab Afshari Mirak, MD



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MRI Helps Predict Motor Deterioration in Parkinson's Disease Patients

By Richard Dargan

MRI-based measurements of the brain's white matter can help predict which Parkinson's disease (PD) patients will go on to develop motor deterioration, according to a study presented Tuesday.



Minett

Parkinson's disease is a progressive disorder of the central nervous system characterized by motor symptoms such as tremors, trembling, stiffness in the limbs and impaired balance and coordination. It affects one to two of every 1,000 people, according to the National Institutes of Health, and prevalence is rising as the population ages.

Thais Minett, MBBS, PhD, FRCR, a fourth-year trainee in Cambridge, United Kingdom, and colleagues explored the use of diffusion tensor imaging (DTI) with MRI to detect changes to the brain's white matter on a microstructural level and see if these changes are predictors of declining motor impairment in PD.

The researchers compared 120 patients with early PD and 48 healthy controls. Participants underwent clinical, motor and DTI investigations at baseline and 18 months later. The researchers analyzed DTI-generated measures of mean diffusivity and fractional anisotropy and investigated their relationships with motor function. Mean diffusivity reveals how restricted diffusion of water is within the white matter, while fractional anisotropy represents the degree of directional diffusion.

At baseline, patients with PD had significantly higher widespread mean diffusivity

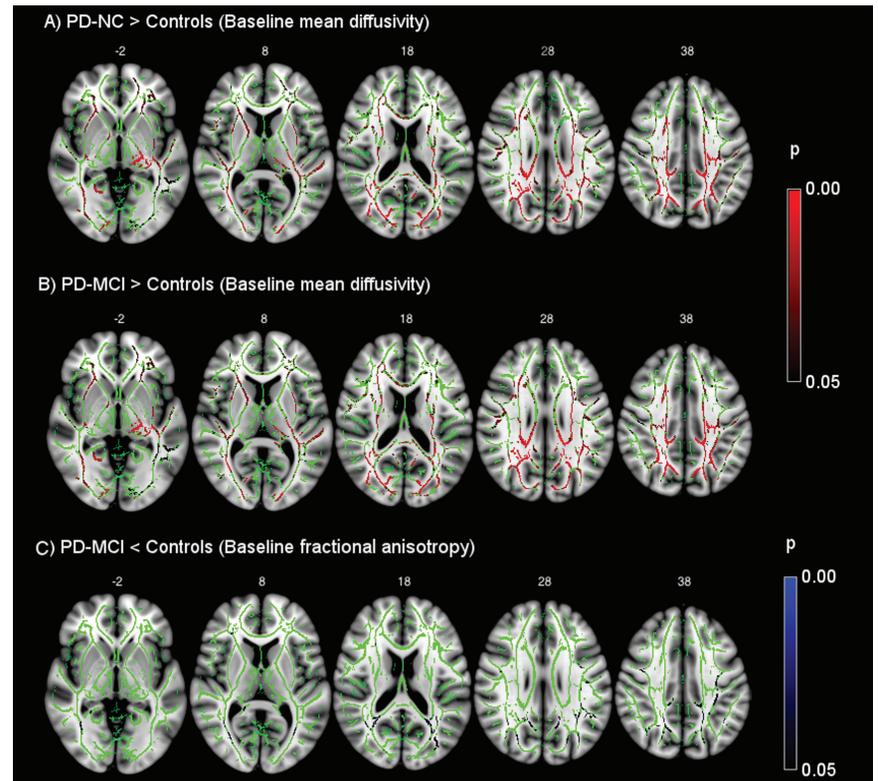
Identifying a group with high likelihood of poor outcome may have important clinical relevance in terms of predicting prognosis and, therefore, the care pathway needed.

Thais Minett, MBBS, PhD, FRCR

than controls. Baseline mean diffusivity was a significant predictor of worsening motor impairment in PD, while fractional anisotropy was not a significant predictor.

"It may be that fractional anisotropy reduction only occurs later in the course of disease progression," Dr. Minett said. "Our cohort comprised of newly-diagnosed Parkinson's disease cases who had a mean disease duration of six months."

Another possibility, she said, is that mean diffusivity measurements are inherently more sensitive than fractional anisotropy for detecting differences in white matter microstructure, as mean diffusivity is more uniform across the brain than fractional anisotropy and therefore less affected by registration errors in relation to voxel size.



Regions at baseline of increased mean diffusivity and reduced fractional anisotropy ($p < 0.05$ corrected). First row: in red, voxels with significantly reduced fractional anisotropy between patients with PD and controls. Bottom row: in blue, voxels with significantly increased mean diffusivity between patients with PD and controls. Results are shown overlaid on an MNI152 template and the mean FA skeleton (green). Z-coordinates are displayed.

"If mean diffusivity is sensitive but directionally non-specific, any process leading to white matter microstructural degeneration would cause mean diffusivity to invariably increase, whereas fractional anisotropy provides more specific information as it depends on the underlying arrangement of the fibers," Dr. Minett said.

The results suggest that mean diffusivity measurements could play a role in determining optimal care for patients with early PD, according to Dr. Minett.

"We could infer from my results that the groups of patients with higher mean diffusivity would have more motor deterioration than those with lower mean diffusivity," she said. "So, identifying a group with high likelihood of poor outcome may have important clinical relevance in terms of predicting prognosis and, therefore, the care pathway needed," Dr. Minett said. "More importantly, it may help in identifying a group with particular high need for therapeutic intervention who can be the subject of future trials."

Core Laboratory Finds Significantly Less Coronary Artery Disease on CTA

By Richard Dargan

Readers at a blinded central core laboratory found significantly less coronary artery disease on coronary CT angiography (CTA) than clinical site radiologists and cardiologists, suggesting an opportunity to reduce follow-up testing, according to research presented Monday at RSNA 2017 and published in the online edition of the journal *Radiology*.

Detection of significant coronary artery disease on CTA yields important prognostic information that may trigger downstream testing and coronary revascularization. The PROspective Multicenter Imaging Study for Evaluation of chest pain, or PROMISE, a trial of coronary CTA at 193 North American sites, found that CTA identified more coronary artery disease and led to 50 percent more coronary catheterization than functional testing strategies such as stress echocardiography and nuclear stress testing. However, the greater number of coronary catheterizations in the CTA arm did not reduce heart attacks or death.

"The higher rate of positive test results and downstream testing is a barrier to adoption of coronary CTA," said Michael T. Lu,

Our results suggest we can safely call less (disease), which would address a major limitation of coronary CTA and reduce downstream testing for our patients.

Michael T. Lu, MD, MPH

MD, MPH, director of research in cardiovascular imaging at Massachusetts General Hospital and assistant professor of radiology at Harvard Medical School, both in Boston.

In the new study, Dr. Lu and colleagues compared coronary CTA interpretations by six readers at the PROMISE central core laboratory with those of the 582 clinical site readers for significant coronary artery disease — defined as 50 percent or more blockage in the artery — in 4,347 PROMISE subjects. Core laboratory readers were blinded to all clinical information; site readers interpreted CTA as part of the standard clinical workup for chest pain.

Results between the two groups were substantially different. The core laboratory found 41 percent less significant coronary artery disease than clinical site readers. Despite identifying less disease, the core

laboratory had similar predictive power for heart attacks and cardiovascular death.

There are a number of potential explanations for why site readers called more significant disease than the core laboratory, Dr. Lu said. Chief among these are U.S. clinical practice incentives that punish false negatives while accepting a high rate of false positives. Access to the patient's medical record may also paradoxically lead to more positive findings, as current cardiovascular risk calculators overestimate actual risk.

"As a clinical radiologist who reads coronary CTA, my key takeaway is that systematic factors lead readers to call more disease," Dr. Lu added. "Our results suggest we can safely call less, which would address a major limitation of coronary CTA and reduce downstream testing for our patients."

In a commentary following Dr. Lu's pre-



Lu

sentation, Jonathon Leipsic, MD, associate professor of radiology and cardiology at the University of British Columbia in Vancouver, noted that readers in the clinic face frequent interruptions and time constraints that are largely absent from the core laboratory. U.S. medicolegal pressures also bias clinical readers toward calling more disease, he said, noting that the more conservative medical management approach is often preferred in the less litigious environments of Canada and the United Kingdom. Possible solutions to the overcalling of disease, he said, include the use of fractional flow reserve derived from CT and the employment of deep learning algorithms to help remove human bias, potentially reducing unnecessary follow-up tests.

Radiologists Should be Storytellers to Entice Readers

By Jennifer Allyn

Most radiologists see the radiology report as instrumental in the imaging value chain, providing an essential communication link between radiologists and other healthcare providers. Yet, in this era of bundled payment schemes, when the proportion of funds allotted to different specialties depends on perceived value, few studies have identified who views radiology reports and considers them valuable.



Alvin

month follow-up, 24,204 (77 percent) of all reports were viewed, while 7,289 (23 percent) were never viewed.

“One in five reports were never viewed, which has both cost and safety implications for the healthcare system, as well as further questions on the value of the radiologist to those departments or providers with high non-viewing rates,” said Dr. Alvin.

Outpatient providers were significantly more likely to never view the report

(33 percent of the time) compared to both emergency room and inpatient providers (17 percent and 11 percent, respectively). Departments significantly more likely to not view study reports included orthopedics (31 percent), neurology (28 percent) and internal medicine (28 percent).

“Some specialists certainly feel confident in interpreting images themselves,” said Dr. Alvin. “However, when searching for a tiny brain metastasis on multi-sequence MRI imaging, or a possible recurrent lung cancer presenting as a slowly enlarging soft tissue opacity, many specialists rely on the radiology report because some things are easier to miss than others.”

Value Added Opportunity

According to Dr. Alvin and his team, whether or not the radiology report is read

speaks to the perceived value in what the radiologist provides.

“If a patient presents with known pancreatic cancer, the radiologist doesn’t provide much value in reporting that the pancreatic cancer is there,” said Dr. Alvin. “However, the radiologist can impact patient management with high value by identifying whether or not the cancer is resectable based on vascular involvement or the presence of a small pulmonary embolism.”

What would increase the viewing rates of radiology reports remains unknown,

“One in five reports were never viewed, which has both cost and safety implications for the healthcare system, as well as further questions on the value of the radiologist to those departments or providers with high non-viewing rates.”

Matthew D. Alvin, MD, MBA

according to Dr. Alvin. “Some studies advocate for structured reporting to increase non-radiologist satisfaction with the reports while some radiologists adjust their reporting style after one-on-one feedback with specific providers,” said Dr. Alvin. “However, even with non-critical imaging, the question

arises as to why these imaging studies were performed in the first place if no one is actually viewing the results. We must ensure radiation and costs are controlled and not wasted.”

Reports Go Unread

New research, presented Tuesday, looked at how often radiology reports are viewed and at the providers most likely to never view a report.

“The radiology report is a contradictory story. You need it to be both detailed and succinct with the findings portion being the logical set-up to the story, while the impression portion is the more straightforward, right-to-the-point diagnosis portion of the story,” said Matthew D. Alvin, MD, MBA, radiology resident at Johns Hopkins Hospital, Baltimore. “No single ‘storyteller’ will tell the same story in the exact same way and our study considered whether or not this affects readership.”

The study looked at 31,493 imaging orders at a single quaternary care academic medical institution over a one-month period for 18,547 unique patients. At five-

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Radiology to Play a Pre-Clinical Role in the New Paradigm of Dementia Diagnosis

By Mike Bassett

As healthcare shifts to a new paradigm, the current role of radiology in evaluating and managing dementia is going to evolve into a larger, more pre-clinical role in rendering personalized risk profiles and predictions of how patients are going to respond to therapy.

That was the message relayed by Jeffrey R. Petrella, MD, professor of radiology, Duke University School of Medicine,

during the Monday session, “The Imaging of Cognition — Dementia,” on the role of imaging in the clinical evaluation and management of dementia. The session was one of a full day of sessions devoted to dementia at RSNA 2017.

In dementia, there is a widening gap between what is going on in research and how radiology is practiced in the reading room, Dr. Petrella said.

“What we are doing every day in the reading room seems to have stagnated,” he said. “When a patient presents with a clinical problem of memory impairment we use some descriptive terms that are not necessarily uniform. And many times we don’t address the clinical question that our referring colleagues are looking for.”

Dr. Petrella said much of this is based on what he calls an old paradigm of dementia where physicians follow a decline in a patient’s cognitive level until it reaches

an “arbitrary point called dementia.” At that point, therapy is prescribed for those patients.

The new paradigm is characterized by the potential of biomarkers as a means to early diagnosis, as well as the recognition that dementia is not a single entity, Dr. Petrella said.

“In the new paradigm, the emphasis is on the early preclinical or prodromal stage of dementia where there is a clinically silent pathology,” Dr. Petrella said. “The idea is that treatment can be more effective before patients suffer irreversible neuronal loss.”

“In addition to quantifying anatomy, which is really something we can do now, we are also on the cusp of quantifying vascular lesion burden,” he said. “So quantification is something we’ll be seeing.”

Imaging Shifts to Pre-Clinical Stage

He also suggested that when it comes to dementia, radiology is going to see a change in emphasis from differential diagnosis to prediction. Much of that will come down to the “three B’s” — biomarkers, big data and bioinformatics.

For example, radiology will be able to use data available in huge databases to create quantitative predictive models and turn

In the new paradigm, the emphasis is on the early pre-clinical or prodromal stage of dementia where there is a clinically silent pathology.

Jeffrey R. Petrella, MD

those predictive models into personalized risk assessments. Dr. Petrella pointed out this is currently being done in the Autism Brain Imaging Data Exchange (ABIDE) study in the Netherlands.

So what will radiologists be able to offer their referring physicians in the near future?

“There will still be a descriptive component to our reports, but we’ll also be seeing quantitation not only of atrophy, but of vascular disease, as well as a characterization of atrophy patterns, and a comprehensive assessment of a patient’s molecular profile,” he said.

“We will be putting this together in informatics models to convey personal risk assessments. This will give a much better product and be more helpful to our referring clinicians,” Dr. Petrella said.



Petrella

Annual Oration in Radiation Oncology Presented Today

How Personalized Medicine will Transform Radiation Oncology

Daphne Haas-Kogan, MD, will present the Annual Oration in Radiation Oncology, entitled, “Personalized Medicine and Radiation Oncology,” on Wednesday, Nov. 29, at 1:30 p.m. in Room E450A.

Dr. Haas-Kogan will focus on how personalized medicine has already changed radiation oncology and how it will change the specialty in the future. She will discuss the promise of radiomic imaging, which is successfully defining imaging biomarkers based on quantitative descriptions of tumor phenotypes to improve predictions of treatment response and prognosis while reducing radiation doses to organs at risk and maximizing doses to cancerous lesions.

In addition, Dr. Haas-Kogan will discuss the commitment needed from radiation

oncologists to engineer drugs and design approaches that target a tumor specifically while sparing a patient’s normal tissues. Finally, she will explore the new class of MRI devices that is creating a paradigm shift in radiation therapy delivery.

Dr. Haas-Kogan is chair of the Department of Radiation Oncology at Dana-Farber Cancer Institute, Brigham and Women’s Hospital and Boston Children’s Hospital. She holds the Radiation Oncology Endowed Professorship at Harvard Medical School and is a member of the Association of American Physicians.

She received her MD from UCSF and also completed a radiation oncology residency and post-doctoral fellowship in molecular neuro-oncology. She received a

1997 RSNA Research Scholar Grant for her work in molecular determinants of the cellular response to ionizing radiation. While at UCSF she served as vice chair for research and as educational program director.

Throughout her career, Dr. Haas-Kogan has maintained a productive, well-funded basic science laboratory in which she investigates signaling aberrations in human cancers, including adult and pediatric brain tumors. She has been the principal investigator on many grants funded by NIH/NCI, philanthropic organizations and industry collaborations.

Dr. Haas-Kogan is a member of the Blue Ribbon Panel appointed to inform the scientific direction and goals of the National Cancer Institute’s Cancer Moonshot.



Haas-Kogan

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A Digital Footprint Helps Radiologists Reach Patients

By Lynn Antonopoulos

Radiologists can become an active force in promoting public understanding of their role in healthcare and in increasing the power of their patient advocacy through both social and traditional media and digital technology.

In a Tuesday education session, speaker Wendy Sue Swanson, MD, MBE, FAAP, Chief of Digital Innovation and author of the Seattle Mama Doc Blog for Seattle Children's Hospital, urged radiologists to "be a willow, not an oak" in the digital landscape.

The session highlighted the value of leveraging digital communication tools to allow for deeper and more far reaching networks. "It is the opportunity of our time to be more connected to ideas and to each other than ever before," said Dr. Swanson, adding, "We should use every channel available to tell the public what we know and what we are accomplishing."

Today's patients have access to an overabundance of information related to healthcare, and radiologists and other physicians must compete to provide accurate and relevant information.

Referring to data from a recent *FACTANK* poll conducted through Pew Research Center, Dr. Swanson noted that 77 percent of Americans own a

smartphone. Of those polled, one-third admitted to self-diagnosing a medical condition by performing an online search. "Forty percent of the online diagnoses were actually successful," she said.

Influential Advocates

Radiologists can learn from celebrities like talk show hosts, Jenny McCarthy and Jimmy Kimmel, who have, in effect, joined the healthcare arena by using their strong voices, public exposure and digital reach to talk about medical issues personal to them. In 2004, McCarthy created distrust about thimerosal in

the measles, mumps, rubella (MMR) vaccine when she claimed it was responsible for her son's autism.

This year, Kimmel told his viewers about his newborn son's heart defect and used the emotionally charged situation to make a statement about politics and the Affordable Care Act

(ACA). Dr. Swanson cited these examples to stress their impact and said, "Social media is no longer irrelevant. Translate what you think patients and families

Social media is no longer irrelevant. Translate what you think patients and families should know about, and let them know what care you can provide.

Wendy Sue Swanson, MD, MBE, FAAP



Swanson

should know about, and let them know what care you can provide."

Many Methods, One Goal

Dr. Swanson referred to herself as an early adopter of Facebook, and today she reaches people with her online blog, Facebook and Instagram posts,

Tweets and weekly podcasts. Moving beyond a digital footprint, she said physicians should focus on creating a digital fingerprint.

To get started, she said radiologists should first identify a problem they would like to solve and then find a good channel to solve it. "Use social media to pose an important question. Create a rich profile that defines who you are not only online but in real life. Use pictures and provide links to important journal articles. Socialize what you do to make it more accessible."

For hesitant adopters, she said regardless of comfort level, a well-crafted LinkedIn account is a must.

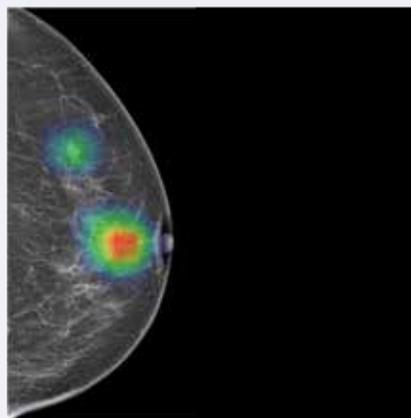
Accessibility and transparency are increasingly important as patients demand more from healthcare providers, but Dr. Swanson also recommended following "Elevator Rules" when sharing information online. "Remember everybody is watching, be nice, never be anonymous and never discuss patient-specific information."

Visit Meeting.RSNA.org/DailyBulletin to watch a video interview with Dr. Swanson.

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FEMALE

Gold Medalist:
Carly Lockard (center)

Silver Medalist:
Fern Adams (left)

Bronze Medalist:
Meike Vernooij (right)

On Giving Tuesday, 2017, participants gathered along the Lake Michigan shoreline to support the RSNA Research & Education (R&E) Foundation by walking or jogging in the annual 5k Fun Run. The 766 registrants raised a total of \$30,600 to benefit the Foundation.

How Weight is Lost Can Slow Knee Cartilage Degeneration

By Jennifer Allyn

Once cartilage is lost in osteoarthritis (OA), particularly in the knees, the disease cannot be reversed. The question of whether or not the degeneration could be slowed by different weight-loss regimens was a hypothesis investigated and shared in a Tuesday session.

“We know that losing weight benefits knee health by decreasing weight-bearing pressure and reducing the knee joint load,” said Alexandra S. Gersing, MD, from the University of California, San Francisco. “What we did not know was the effect of weight loss on osteoarthritis specifically and the inflammatory markers of the disease.”

The study looked at 760 male and female patients with a body mass index greater than 25 who were enrolled in the Osteoarthritis Initiative (OAI), a U.S.-based study focused on the prevention and treatment of knee osteoarthritis. The patients all had risk factors for OA or had been previously diagnosed with mild to moderate OA.

Patients were categorized into groups according to the amount of weight they were asked to lose over a 48-month period versus a group with stable weight. They were further categorized into groups regarding the weight loss method — diet and exercise, diet only or exercise only.

Changes in the right knee were assessed at baseline, 48-, and 96-months using 3T MRI. T2 relaxation time changes of cartilage composition, including laminar and texture analysis as well as morphological knee abnormalities, were



Gersing

assessed with Whole-Organ Magnetic Resonance Imaging Score (WORMS). These times were analyzed using mixed random effects models to calculate associations between the amount of weight loss and the regimen used.

In the weight loss groups overall, progression of cartilage WORMS was significantly lower than in the controls over 96 months. Patients who lost weight showed significantly less T2-value increase in the bone layer of all compartments compared to those with stable weight, suggesting less cartilage degeneration over 96 months.

“It is a known fact that weight loss means less pressure on the knees,” Dr. Gersing said. “Patients with weakened knees who experienced pain or a disability — or who compensated for these

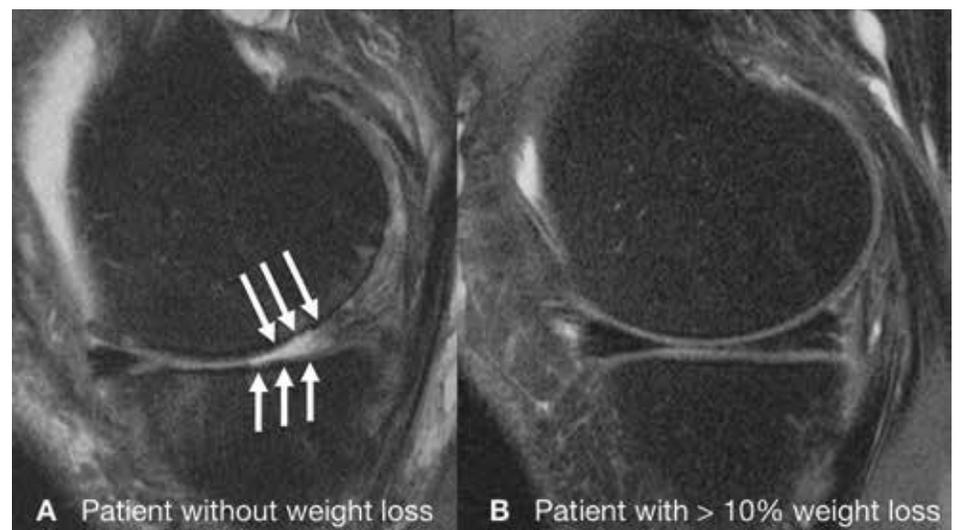
things with a change in gait — probably felt better after weight loss and therefore moved a bit more, making slight gains in preventing further cartilage loss.”

Rates of increase in cartilage T2 were lowest in the diet and diet and exercise groups compared to the control group, while weight loss through exercise alone showed no significant difference in change of T2 over the 96 months.

This study adds to the information about which types of weight loss are most beneficial for patients who need to

lose a significant amount of weight to slow the progression of knee cartilage degeneration.

“Other lifestyle changes are needed, beyond exercise, to reduce the risk of osteoarthritis or prevent further losses in the beginning stages of the condition,” Dr. Gersing said. “Patients and doctors should work together to develop individualized therapy strategies and lifestyle interventions in order to prevent future degeneration.”



Knee joint of a patient without weight loss (A) showing severe cartilage defects after 48 months, and intact knee joint of a patient with a substantial amount of weight loss (B)

Diagnostic Imaging Plays Increasingly Critical Role in Drug-Related Issues

By Nick Klenske

Illicit drug abuse is a serious issue around the world and, in particular, in the U.S., where cases of drug abuse — and death — are skyrocketing.

“At 246 deaths per million people, the U.S. has the highest rate of drug-related deaths in the world,” said Arie Neymotin, DO, of the Emory University School of Medicine, speaking on Tuesday during a session in the RSNA Learning Center.

When treating overdoses and other drug-related issues, diagnostic imaging is uniquely positioned to provide a rapid and correct diagnosis. But because drug use can alter a patient’s mental state and respiratory function, clinicians often struggle to get an adequate history or physical exam.

“Whenever a patient arrives in the emergency room (ER) showing signs of possible drug use, diagnostic imaging will play a critical role,” Dr. Neymotin said. “But in order to narrow the differential of diagnosis, radiologists must be able to correlate the patient’s clinical history with the imaging findings.”

Knowledge of pathophysiological pathways can help diagnostic radiologists recognize specific imaging appearances related to the illicit use of drugs.

For this reason, diagnostic radiologists should make an effort to be aware of the latest trends in illicit drug use, Dr. Neymotin said.

A case-in-point is K2, the synthetic marijuana that is now the second most popular drug among U.S. teenagers. The drug, which is composed of industrial chemicals intended to mimic the effects of THC, can be linked to small airways diseases.

“The findings of small airways disease are often non-specific, with the differential considerations including hypersensitivity pneumonitis, respiratory bronchiolitis and infectious bronchiolitis,” he said. “In this case, knowing the patient’s pertinent history will help narrow the differential and ensure appropriate treatment.”

Knowledge of Illicit Drugs is Critical

In hospitals across the country, an all-too-common ER scenario is a patient showing

signs of opioid use.

“As the findings on a CT may initially be subtle, the clinical scenario plays an important role in identifying early signs of hypoxia,” Dr. Neymotin said. “Knowing the patient’s history of drug use, an opioid receptor antagonist, such as naloxone, can be used to reverse respiratory depression and avert an ischemic injury.”

Another popular trend in drug use is what is commonly referred to as “chasing the dragon,” a method of inhaling vaporized heroin that can cause a specific pattern of leukoencephalopathy, a result of toxins being released when the drug is heated in aluminum foil. As toxic leukoencephalopathy can also be caused by chemotherapy and immunosuppressive drugs, clinical history is essential to differentiating the potential causes.

“These are examples of how a basic level of awareness about current trends in



Neymotin

illicit drug use can go a long way in improving imaging accuracy,” Dr. Neymotin said. “Knowledge of pathophysiological pathways can help diagnostic radiologists recognize specific imaging appearances related to the illicit use of drugs.”

**Ergonomics
Answer**

[Question on page 14A.]

A 25-50 lux

Q&A courtesy of AAPM.

Survey Shows Patients Prefer to Get Immediate Test Results

By Elizabeth Gardner

For patients nervous about imaging exam results, would it help to get immediate results rather than making them wait for their next primary care visit or a notification by mail? And how onerous would it be for radiologists to be available for that service?

Those are the questions radiology resident David Mihal, MD, of the University of Cincinnati College of Medicine and the Cincinnati Children's Hospital (CCH) Medical Center sought to answer in research he conducted at Cincinnati Children's Hospital.

As it turns out, even if patients ultimately decide to wait and get the results from their primary physician, they appreciate having the option of immediate notification, according to results presented by Dr. Mihal in a Tuesday session.

The pilot test conducted in the CCH Department of Radiology showed that radiologists appreciated having the option for immediate results as well, and did not feel inconvenienced by the extra few minutes it took to deliver the results.

Dr. Mihal began the study after learning that 20 percent of patients (or more often parents, because many of the patients were children) were uncertain about how they were going to get their results, and had

We feared having far more patients than we could possibly handle and potential interruptions in routine patient care, but that is not what happened.

David Mihal, MD

expressed anxiety to the technologist doing the exam.

"They want to know, is it broken or not? Can he go back to soccer practice?" Dr. Mihal said. Technologists hesitated to bother busy radiologists with requests for immediate results.

The objectives of the study were to formalize a procedure for immediate reporting, to have at least 90 percent of patients be aware of the option, and to have at least 80 percent of patients satisfied with the option.

Technologists Survey Nervous Patients

The four-phase study, which initially included seven radiologists and 30 technologists, started by having techs screen outpatients to identify those who were nervous about their results or simply requested them. In the second phase, the front desk staff checked for patients who didn't have a follow-up appointment scheduled with another provider, and offered them the option of immediate results.

In the third phase, all radiography outpatients were offered immediate results as part of a questionnaire at check-in, though they were advised that getting the report would involve an extra 10 to 20 minutes of waiting. In the fourth phase, the wait-time noti-



Mihal

fication was eliminated from the questionnaire. Patients also completed a follow-up survey about their reactions to having the immediate reporting option available. By the end of the study, 77 patients had completed the survey.

Each successive phase tripled the rate at which patients used the service. By the fourth phase, an average of one patient a day was asking to get results immediately, up from one patient a month in the first phase. Perhaps more important, 97 percent of patients understood that immediate results were available, and 92 percent of patient

comments on the availability of the service were positive.

The additional burden on radiologists was negligible, and they reported being happy that they could deliver results to anxious patients.

"We feared having far more patients than we could possibly handle and potential interruptions in routine patient care, but that is not what happened," Dr. Mihal said. "Instead, patients were easily narrowed down to those who needed fast answers."

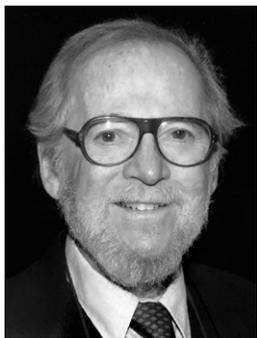
Dr. Mihal's work was awarded an RSNA Trainee Research Prize.

Annual Oration in Diagnostic Radiology Dedicated to Bosniak

The Annual Oration in Diagnostic Radiology was dedicated to the memory of Morton A. Bosniak, MD, a passionate educator who pioneered the field of visceral angiography and developed the Bosniak classification.

Born on November 13, 1929, Dr. Bosniak received his medical degree from SUNY Downstate Medical Center, Brooklyn, NY, and began his radiology residency at New York Hospital-Cornell. His training was interrupted by two years of military service as a captain in the U.S. Air Force. After completing his residency, he held faculty positions at Monifore Hospital, Bronx, NY, Boston University Medical School, Boston, and Albert Einstein School of Medicine, also in the Bronx.

From 1960 until his retirement in 2002, Dr. Bosniak was a professor of radiology at New York University (NYU) Langone School of Medicine, New York City. After his retirement, he became a professor emeritus of radiology at NYU. Dr. Bosniak created the first abdominal imaging fellowship in the U.S. and was the founder of NYU Langone's Abdominal Imaging Section. He established a yearly radiology course at NYU that bears his name and attracts more than 500 registrants every year.



Bosniak

His signature work, the Bosniak classification, is known to every radiologist and any physician who treats patients with renal disease. The classification is applied worldwide and is the foundation of all further refinement in the diagnosis of kidney disease.

Dr. Bosniak was the first to document the safety of partial nephrectomy for renal cell carcinoma and the first to describe the indolent nature of small renal neoplasms.

A respected leader and mentor, Dr. Bosniak served as president of the Society of Uroradiology and of the New York Roentgen Society. He was awarded an RSNA Gold Medal in 1996 and received the Pollack Medal of the Society of Uroradiology in 2000.

Last fall, the Society of Computed Body Tomography and Magnetic Resonance awarded him its gold medal posthumously. The Morton A. Bosniak Research Award from the Society of Abdominal Radiology is named in his honor.

Dr. Bosniak died in September 2016.

The Value-Based Model is Here — the Time for Action is Now

CONTINUED FROM COVER

"And value," Dr. Kruskal maintained, "is really reflected in costs to the patient and the system, the quality and perceived quality of services, the experience of the patient and other customers, and outcomes."

The Reading Room Door Should Always Be Open

Dr. Kruskal described strategies that radiologists can follow to add value, such as providing appropriate and efficient care; delivering excellent service and data-driven and data-supported care; being visible, valuable, accessible and affable team members; learning and improving continuously; providing unambiguous reports and communication; and engaging their customers and stakeholders.

And being visible, accessible and affable to patients doesn't happen by sitting in front of a PACS monitor, Dr. Kruskal said. He added that the door to the reading room should always be open so that radiologists are available and ready to help improve outcomes.

Dr. Kruskal noted that the quality of a radiologist's product — the report — also needs improving, so that what the radiologist sends out is representative of the kind of professional service they aim to provide. Reports should be actionable, clearly reported and with no variation.

"Why not commit to this as a practice quality improvement (PQI) opportunity?" he asked. "I would love every practice in this country to say that in 2018 they were each going to undertake a PQI project to improve their reports."

Dr. Kruskal also said that radiologists add value by practicing appropriate and efficient radiology, as well as continuously learning — and improving.

"We have to take peer review and peer learning more seriously," he said. "If we truly desire to add value and improve care by improving our performance, we have to shift from collecting retrospective and underreporting discrepancy data and embrace prospective peer learning — now."

Dr. Kruskal concluded by referring to the late Dr. Richard Baron's RSNA 2016 presidential address in which he said, "We as radiologists must extend our gaze beyond the constraints of the image to gain a broader perspective on the patient experience."

"It's absolutely all about the patient experience indirectly back to your primary customer, the referring physician," Dr. Kruskal said. "We have to take this seriously."

We are starting to be paid on our value contribution and we have to get down to the nitty-gritty and understand what it is we can do as radiologists to add value to our customers.

Jonathan B. Kruskal, MD, PhD



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