

RSNA 2018  
TOMORROW'S  
RADIOLOGY TODAY

# Daily Bulletin

THE OFFICIAL NEWSPAPER OF THE RSNA ANNUAL MEETING • ONLINE AT [RSNA.ORG/BULLETIN](http://RSNA.ORG/BULLETIN)

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## EXCLUSIVE ONLINE CONTENT

Research Analyzes Higher Dosing of Brachytherapy in Cervical Cancer Patients



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TODAY  
25 High / 18 Low



WEDNESDAY  
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## Can Clinicians Lead Radical Redesign?

By Lynn Antonopoulos

*"It's a tough time in health care, and our clinicians and systems are struggling. We need to take a deep breath and go back to the science to effect change together."*

This was the overarching message in the Monday plenary session delivered remotely by Donald Berwick, MD, MPP, president emeritus and senior fellow of the Institute for Healthcare Improvement in Boston.

Dr. Berwick presented an historical examination of the state of the medical profession exploring the reasons former and current practices are inadequate for delivering the type of health care patients demand and that physicians strive to provide.

"Years ago, medical professionals had a social contract that assumed a nobility in the profession. The understanding was that when something went wrong, the profession would take care of the problem. This was a hero's approach," Dr. Berwick said.

He noted, however, that in the second half of the 20<sup>th</sup> Century, studies revealed an appalling number of avoidable errors and lapses in health care.

"The response to the gap between what medical professionals were doing versus what *could* be done brought about a new era in which additional scrutiny was applied and payment incentives were attached to performance. This was war on the



profession," Dr. Berwick said.

Scrutiny and value incentives did not improve health care and, more likely, were demoralizing to doctors. Instead, Dr. Berwick recommended a model known as the "Triple Aim" of health care.

"We must provide better care for individuals, better health for populations and lower per capita cost through improvement. Only redesign will get us there," he said.

CONTINUED ON PAGE 14A

## Brown Fat May Affect Cancer Progression

By Michael Bassett

Brown adipose tissue (BAT) activity is greater in patients with active malignancy than in comparable BAT positive patients without active malignancy, according to a study presented on Monday.

This suggests that BAT — also referred to as "brown fat" — plays a role in cancer progression, said Miriam Bredella, MD, professor of radiology, Harvard Medical School.

Adipose tissue is known to influence the development and progression of different cancers. In her presentation Dr. Bredella explained that white adipose tissue stores energy and becomes "dysfunctional" in obesity, increasing the risk of developing metabolic disease and cancer. BAT is metabolically active and is characterized by high mitochondrial content and high vascularity.

"Active brown adipose tissue refers to BAT that is visible on FDG-PET because it is metabolically active and takes up glucose," Dr. Bredella said. "Some studies suggest that BAT can also be 'non-active' or 'cold' on FDG-PET and does not take up glucose."

The purpose of this study was to determine the role BAT plays in cancer activity.

The study group included 142 patients, 121 of whom were female, with a mean age of 49 years. Those patients had lymphoma (38), lung cancer (23), gastrointestinal cancer (21), breast cancer (18), melanoma

(12), genitourinary cancer (11), thyroid cancer (10), and sarcoma/carcinoma of unknown origin (9).

The patients underwent <sup>18</sup>F-FDG PET/CT for staging or surveillance of malignant neoplasms and were BAT-positive on PET/CT. The researchers assessed BAT volume by PET/CT, and abdominal fat and paraspinous muscle cross sectional areas (CSA) by CT, and groups with and without active malignant disease on PET/CT were compared.

The groups were similar in age and BMI, and abdominal and muscle CSA. Patients with active malignant disease on PET/CT had higher BAT volume compared to patients without active malignancy (24±6 vs 12±2 cm<sup>3</sup>, p=0.009). In patients without active malignancy, BAT volume was associated with BMI and abdominal fat CSA (r= 0.56 to 0.58, p<0.0001) while there were no such associations in patients with active malignancy (p>0.2). No associations between BAT volume and age or muscle CSA were found (p>0.1).

What are the mechanisms through which brown fat plays a role in the



Bredella

development or progression of cancer?

"Brown fat is very vascular," Dr. Bredella said. "And studies have shown increased expression of the protein CD31 (a marker of angiogenesis in brown adipose tissue), which may lead to cancer development by favoring tumor growth through increased vascularity."

Dr. Bredella also pointed out that studies have been performed in animal models where different cancer types were implanted into brown fat, leading to accelerated

tumor growth, increased neovascularization, increased blood perfusion and decreased hypoxia.

"Our preliminary investigation suggests a possible role of BAT in cancer activity and associated metabolic disturbances, but prospective longitudinal studies are necessary to assess the effects of BAT on cancer activity and progression," Dr. Bredella said. "In the future, modulation of BAT may play a role in cancer therapy."

Dr. Bredella received a 2018 Society of Skeletal Radiology Paper Award for this study.

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## Tuesday At a Glance



**Aberle**

### RSNA/AAPM Symposium

State of the Art in CT Imaging

10:30 | E451B

*Contemporary CT of the Indeterminate Lung Nodule: Where We Are and Why it Matters*

**Denise R. Aberle, MD**

Dr. Aberle will discuss the current role of low-dose

CT in lung cancer screening and early detection, including current approaches to the classification of indeterminate lung nodules. Dr. Aberle is professor of radiology and bioengineering at the University of California at Los Angeles (UCLA) and the vice chair for research at UCLA Radiological Sciences.



**McCollough**

### RSNA/AAPM Symposium

State of the Art in CT Imaging

10:30-NOON | E451B

*CT Technology — and Dose — in the 21<sup>st</sup> Century*

**Cynthia H. McCollough, PhD**

Dr. McCollough will discuss important considerations regarding the use

of low-dose CT, including diagnostic performance of the radiologist. She is the president-elect of the American Association of Physicists in Medicine and a professor of biomedical engineering and medical physics at Mayo Clinic College of Medicine and Science in Rochester, MN.



**Forsberg**

### New Horizons Lecture

1:30-2:45

**Arie Crown Theater**

*Oscillating Microbubbles — Driving Innovation in Ultrasound*

**Flemming Foresberg, MD**

Dr. Forsberg will discuss the use of gas filled microbubbles

as vascular tracers and contrast agents for ultrasound imaging and to improve the diagnostic capabilities of ultrasound imaging. Dr. Forsberg is a professor of radiology and director of ultrasound physics at Thomas Jefferson University in Philadelphia.

*Alexander R. Margulis Award and RSNA Gold Medals Presented today*

7:15-8:15

### RSNA Diagnosis LiveTM

*The RAD Files: The Truth is Out There* (E451B)

### Controversy Session

*Prostate Cancer Imaging: Is the Endorectal Coil Necessary?* (E350)

### Hot Topic Session

*Management of DCIS and Minimal Risk Lesions* (E450B)

8:30-10:00

### Educational Courses

### BOOST: Bolstering Oncoradiologic and Oncoradiotherapeutic Skills for Tomorrow

*Gastrointestinal-Oncology Anatomy* (S103AB)

*Lung-Oncology Anatomy* (S103CD)

8:30-NOON

### Series Courses

10:30-NOON

### Scientific Paper Sessions

**The Nordic Countries Present**

*Radiology the Scandinavian Way, Future Potentials* (E353C)

### BOOST: Bolstering Oncoradiologic and Oncoradiotherapeutic Skills for Tomorrow

*Genitourinary Prostate* (S103AB)

*Mediastinum and Pleura-Oncology Anatomy* (S103CD)

**View the full program and add sessions to My Agenda on the RSNA 2018 App or at [Meeting.RSNA.org](http://Meeting.RSNA.org).**

# Daily Bulletin

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# LI-RADS Algorithm Shows Promise in Liver Cancer Treatment

By Richard Dargan

*A new Liver Imaging Reporting and Data System (LI-RADS) algorithm that uses imaging to assess response to liver cancer treatment is effective at determining which tumors are viable and which have been eradicated, according to research presented Monday.*

First published in 2011, LI-RADS created a classification system for CT and MRI findings in patients with suspected hepatocellular carcinoma (HCC), the most common type of liver cancer. LI-RADS categories progress from definitely benign, or LR1, to LR5 or definitely HCC.

An update to LI-RADS in 2017 added a treatment response algorithm with three categories for treated liver tumors: viable, meaning that at least some of the cancer is still active; non-viable, which indicates the tumor is entirely destroyed; and equivocal, meaning that a definitive conclusion is not possible based on current information.

There has been little published data on the performance of this new algorithm for predicting the degree of necrosis induced in individual lesions by loco-regional treatments that focus on shrinking or eliminating the tumors through a variety of means, including radiation and chemotherapy, said lead author, Erin Shropshire, MD, a fourth-year radiology resident at the Duke University School of Medicine in Durham, N.C.

“With the shortage of transplant livers, loco-regional treatments have become important as a way to help reduce pain and symptoms in patients and act as bridges to a transplant,” she said.

For the study, Dr. Shropshire and colleagues evaluated the treatment response



Shropshire

*With the shortage of transplant livers, loco-regional treatments have become important as a way to help reduce pain and symptoms in patients and act as bridges to a transplant.*

Erin Shropshire, MD

algorithm in 45 patients who had undergone transarterial embolization, also known as bland embolization, for potential HCC. In transarterial embolization, small particles are injected into a liver artery to block the tumor’s blood supply. If the treatment is effective, the oxygen-starved tumor will shrink and die.

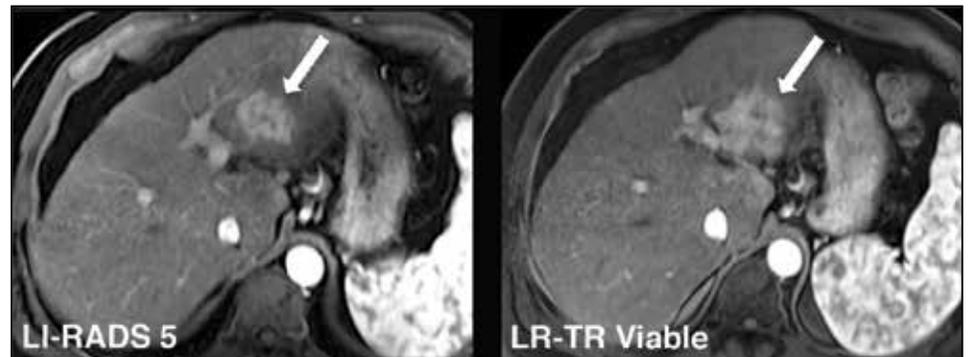
Three radiologists independently assessed all tumors before embolization using LI-RADS criteria. After treatment, the radiologists re-evaluated the tumors with the 2017 treatment response algorithm. The patients subsequently underwent liver transplantation, allowing the researchers to directly examine their livers and correlate the status of the tumors with the LI-RADS treatment response algorithm.

The treatment algorithm performed strongly in predicting viable tumor. Of the 26 tumors identified as viable by the algorithm,

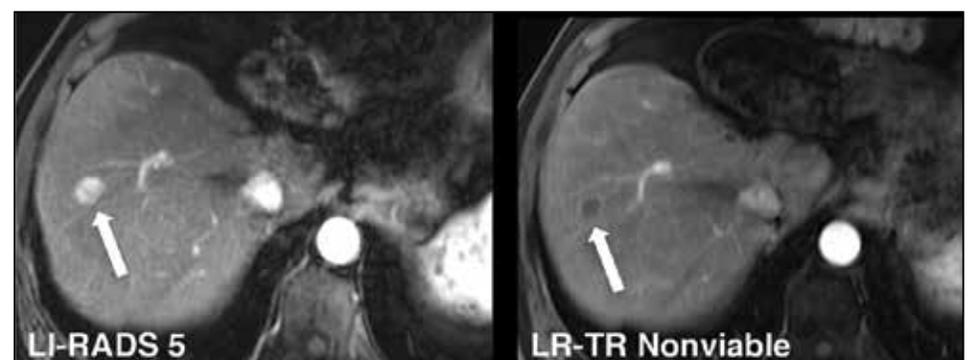
24 were confirmed on pathology. The algorithm delivered a finding of equivocal in 17 lesions; subsequent examination revealed 12 of these 17 lesions to be incompletely necrotic, suggesting that an equivocal determination is likely to represent a viable tumor.

#### Treatment Response Algorithm Effective

Dr. Shropshire said the overall results for the treatment response algorithm were



**LI-RADS 5 and LR-TR Viable:** Hypervascular lesion in the left hepatic lobe maintains masslike arterial phase hyperenhancement after embolization. LR-TR Viable: This lesion was <100 percent necrotic at histopathology.



**LI-RADS 5 and LR-TR Nonviable:** Hypervascular lesion in the right hepatic lobe with no residual enhancement after embolization. LR-TR Nonviable: This lesion was 100 percent necrotic at histopathology.

similar to those of published data on LI-RADS, meaning that the algorithm appears to be working as well as existing methods. The algorithm’s effectiveness at identifying incomplete tumor necrosis could be useful in selecting patients for additional treatment.

“The algorithm was pretty effective at saying, ‘Yes, there is viable disease here,’ or ‘No, this lesion is not non-viable,’” Dr. Shropshire said. “But we still have room for improvement with lesions that are equivocal.”

Future research will examine the treatment response algorithm in other types of loco-regional treatments.

“Since we only used bland embolization in the study, there are still lots of unanswered questions,” Dr. Shropshire said. “We would like to look at other kinds of embolization, like radioactive embolization and chemoembolization, and we would like to tweak the accuracy of the algorithm to improve its positive predictive value.”

# Chest MRI Effective in Screening Children for Lung Disease

By Michael Bassett

*Pediatric chest MRI provides high image quality and can be an effective technique for screening large groups of children for lung and airway diseases, such as asthma, according to research presented Monday.*

According to presenter Alice Pittaro, MD, Erasmus Medical Center, Rotterdam, Netherlands, pediatric chest MRI is a relatively new technique that is slowly replacing CT in pediatric thoracic imaging.

“But it remains challenging in a clinical setting,” she said. “Only large centers have built up enough experience to routinely use this technique. The Erasmus Medical Center is one of the leading centers in thoracic MRI in Europe, having used this technique in the clinic since 2009.”

In this study, two end-inspiratory and end-expiratory breath-hold chest MRI scans were performed on each of 3,150 healthy children (81 of whom were excluded from final analysis because of missing data). Image quality was assessed using a 5-point scale, from poor (score 1) to excellent (score 5). Incidental findings were classified as clinically relevant or clinically non-relevant.

Dr. Pittaro and her colleagues determined that the median image quality was good-to-excellent (4.5 on the 5-point scale). In addition, they found 1,400 incidental findings (64 relevant and 1,336 non-relevant) in 1,182 of the children in the study.

The most common potentially relevant incidental findings were severe trapped-air (>25 percent lung lobe volume), severe tracheomalacia collapse (>70 percent), and large atelectasis/consolidation (>10 percent of lobe volume).

The most common clinically non-relevant incidental findings included mild trapped air, atelectasis, mild tracheomalacia, and small parenchymal nodules.

#### Technique May Help Predict Asthma

“This was a unique opportunity to screen a large group of healthy children for possible determinants of lung and airways

diseases — asthma, in particular,” Dr. Pittaro said. “The clinical importance of the study is that chest incidental findings are quite common in the pediatric population and need to be correlated to the clinical conditions of the children.”

Specifically, she pointed out that radiologists should be aware that more than one-third of asymptomatic children may have a clinically non-relevant incidental finding. Furthermore, she said, small areas of trapped-air or limited consolidations are quite common in healthy children and likely to have no clinical relevance.

However, while relevant thoracic inci-



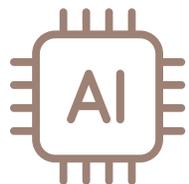
Pittaro

dental findings were rare in the study population, the researchers did find that more than half of the clinically relevant incidental findings were severe trapped-air.

“At this point we cannot say if these children are potential asthmatic children, because they are symptom free,” Dr. Pittaro said. “However, we will follow this cohort until 18 years of age, so we will have the ability to see who

will develop asthma and who will not, and to compare the amount of air trapping seen at this time point. In this way, we will determine the real prevalence of air trapping in children with asthma.”

# Radiology: Artificial Intelligence

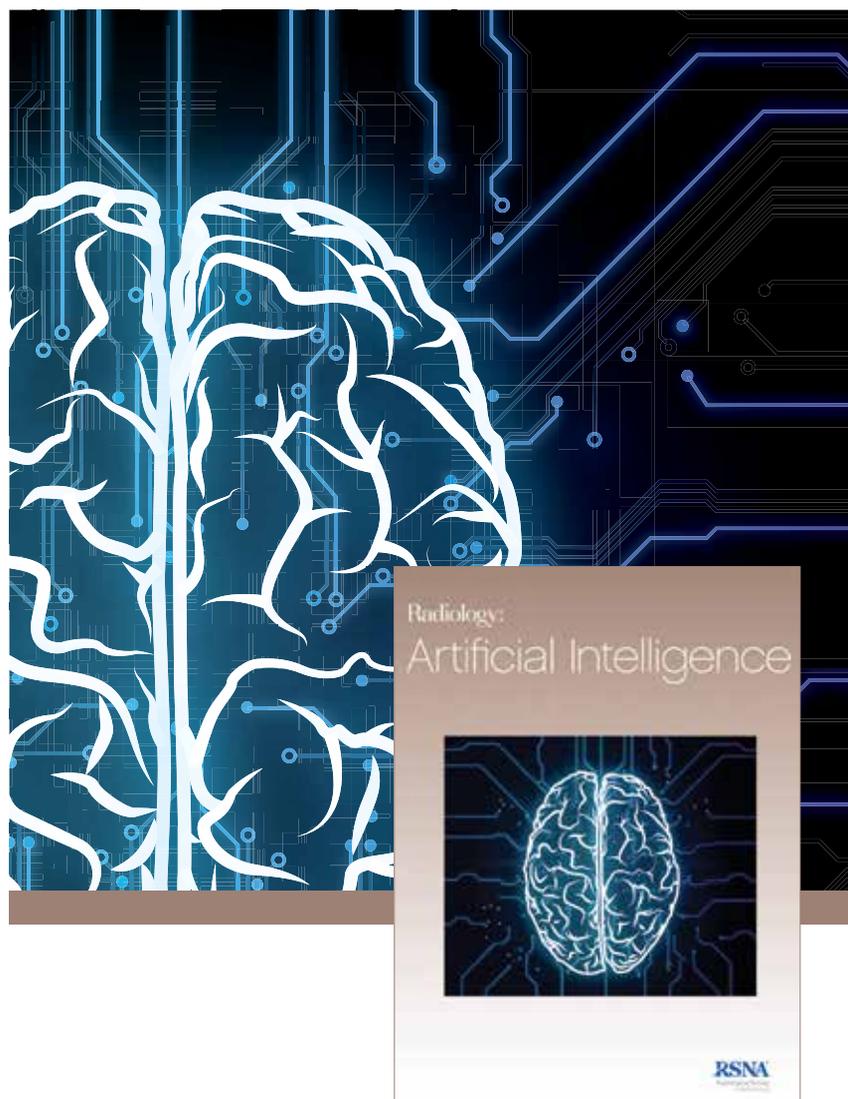


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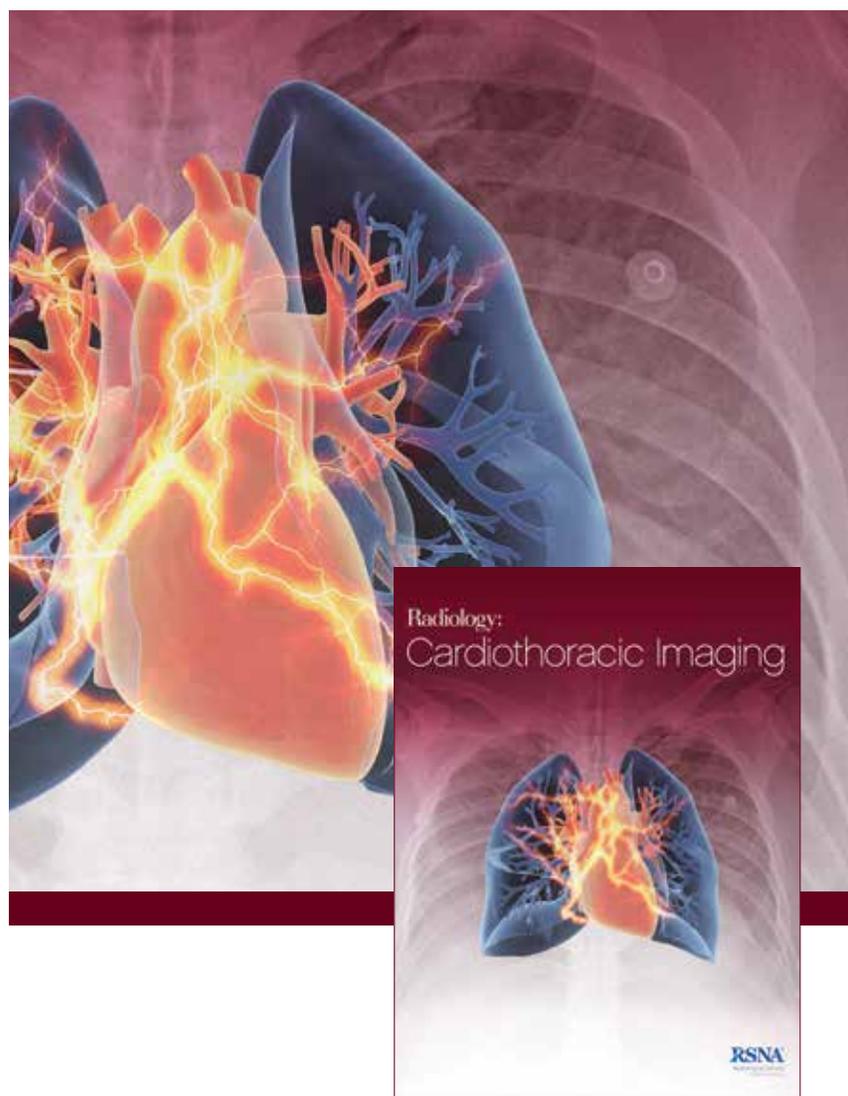


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# RSNA 2018 Gold Medals

RSNA's highest honor — the Gold Medal — will be awarded to three individuals during today's plenary session.

## William J. Casarella, MD

A dedicated interventional radiologist, leader and educator, William J. Casarella, MD, is a pioneer in interventional radiology (IR) who helped to develop the life-saving angioplasty and diagnostic angiography techniques that are now used daily in cardiology, vascular surgery and neurosurgery.

Dr. Casarella, now retired, served as a radiology professor and chair of the Department of Radiology at Emory University, Atlanta, from 1981 to 2004, and as executive associate dean for clinical affairs from 1999-2013.

His path to radiology began after Dr. Casarella graduated cum laude from Yale University in 1959 and earned his medical degree at Harvard Medical School in 1963. After finishing a rotating internship at the University of Pennsylvania, Dr. Casarella entered the U.S. Army and became a flight surgeon in Korea and the U.S. before completing his residency at Boston City Hospital.

Following his radiology residency at Columbia-Presbyterian Medical Center, New York, Dr. Casarella held a number of radiology positions at Columbia before becoming chief of the cardiovascular radiology section in 1970 — a position he held for 11 years. During this time, which was before the introduction of CT and MRI, Dr. Casarella used vascular radiology techniques to explore and treat clinical problems including GI bleeding, portal hypertension and malignant tumors.

After he was recruited by Emory University in 1981, Dr. Casarella began building a legacy of achievements that included recruiting top scientists and clinicians to the radiology department and building one of the country's premier radiology residency training programs.

In 1973, Dr. Casarella worked with colleagues to found the Society of Cardiovascular Radiology which evolved into the Society of Interventional Radiology (SIR). Dr. Casarella has served as president of the American Board of Radiology, the American Roentgen Ray Society (ARRS) and the Society of Cardiovascular & Interventional Radiology.

Along with publishing more than 100 research articles and numerous book chapters, Dr. Casarella has served as a manuscript reviewer for journals including *Radiology* and *RadioGraphics*.

A longtime RSNA member, Dr. Casarella presented the RSNA Annual Oration in Diagnostic Radiology in 1987. Among his numerous honors, Dr. Casarella has received gold medals from SIR, ARRS and the American College of Radiology.

## Sarah S. Donaldson, MD

A world-renowned expert in pediatric radiation oncology, Sarah S. Donaldson, MD, is an influential educator, role model and a leader in reinforcing relationships between radiation oncologists and radiologists. Her work with every aspect of childhood cancer has been the hallmark of her long and distinguished career.

Dr. Donaldson is the Catharine and Howard Avery Professor in the Department of Radiation Oncology at Stanford University and director of mentoring in the Department of Radiation Oncology at Stanford University School of Medicine.

After graduating from Harvard Medical School in 1968, she completed a radiation oncology residency at Stanford University, joined the faculty in 1973 and has remained at Stanford for her entire career.

Dr. Donaldson has contributed greatly to the success of Stanford's Department of Radiation Oncology, serving as associate chair and deputy clinic chief from 1997-2011. She was instrumental in building the Pediatric Hematology/Oncology Program and served as the inaugural chief of pediatric radiation oncology at the Lucile Salter Packard Children's Hospital.

Her research has focused on pediatric radiation oncology and the effects of cancer therapy on long-term survivors. She served as Stanford's residency program director in the Department of Radiation Oncology from 2001 to 2009 and is currently Stanford's mentoring director. In 2017, Stanford established the Sarah S. Donaldson Inaugural Mentorship Award in the Department of Radiation Oncology.

At RSNA, Dr. Donaldson has served on the Board of Trustees of the Research



Casarella



Donaldson



Levine

and Education Foundation and the Public Information Advisors Network. She was elected the RSNA second vice president in 2003. In 2005, she was elected to the RSNA Board of Directors and served as the liaison for science from 2005-06, for publications and communications from 2007 to 2010, then served as chairman and president-elect before serving as president in 2013.

She was the first female president of the American Board of Radiology as well as the American Society for Radiation Oncology (ASTRO).

Dr. Donaldson has authored or co-authored hundreds of peer-reviewed scientific articles, book chapters and review articles and has served on the editorial boards of numerous publications.

Among her numerous honors, Dr. Levine has received gold medals from the del Regato Foundation, the American Radium Society, the American College of Radiology and ASTRO.

## Deborah Levine, MD

A highly respected diagnostic radiologist, researcher and educator, Deborah Levine, MD, is widely recognized for revolutionizing fetal MRI and for her groundbreaking research in high-risk obstetrical and gynecological ultrasound (US). Equally dedicated to academic publishing, Dr. Levine has served for a decade as the Senior Deputy Editor of *Radiology*, helping to guide the RSNA journal into the digital age.

Dr. Levine has served as the director of obstetric & gynecologic ultrasound (US) and vice chair of academic affairs at Beth Israel Deaconess Medical Center (BIDMC), Boston, since 2011, and as a professor of radiology at Harvard Medical School, Boston, since 2008. Dr. Levine, who earned her

medical degree from University of California, San Francisco, focuses her clinical work on outpatient US and her research on obstetric and gynecologic imaging.

During her residency at University of California San Diego, Dr. Levine began researching the use of US to assess the postmenopausal pelvis and adnexal cysts — topics she investigated throughout her career. In 2010, she published a highly-regarded *Radiology* report setting guidelines to decrease follow-up of physiologic adnexal cysts. Her early research was supported by a 1995 RSNA Research Seed Grant to assess chorionic separation after amniocentesis.

As a radiology instructor at Harvard Medical School, Dr. Levine began her pioneering work using MRI as an adjunct to US in obstetrics. At Harvard, her laboratory published use of the ultrafast sequence (HASTE) for superior visualization of the fetus.

As vice chair of academic affairs at BIDMC, Dr. Levine oversees the programs that train medical students, radiology residents and fellows, and supervises the mentoring program for junior faculty in the Department of Radiology.

Her service to *Radiology* began in 2004 when she joined the journal's editorial board, culminating in her current role as senior deputy editor, which she assumed in 2008. Dr. Levine, who also served as editor of the RSNA *Daily Bulletin* from 2007 to 2010, is the author of more than 200 manuscripts, chapters and reviews as well as five books.

Among her numerous leadership positions, Dr. Levine served as President of the Society of Radiologists in Ultrasound in 2016. Dr. Levine received the American Board of Radiology's Lifetime Service Award in 2015.

# Emotional Intelligence Enriches Learning Environment

By Lynn Antonopoulos

Educators must look beyond mastery of a certain domain of radiologic knowledge and develop a set of social and emotional intelligence skills to better understand their own emotional states and recognize how their interaction with others affects their role as educators.

"Social and emotional intelligence is a skill set that anyone can practice and develop," said Robert Percarpio, MD, assistant professor of radiology at Geisel School of Medicine, Dartmouth, NH. "The first step is to be aware of these skills, and then we can make a conscious effort to improve them in ourselves."

In a session that focused on his early experiences as an educator, Dr. Percarpio discussed the surprising anxiety that crept into his work and interventional radiology speaking experiences as he grappled with



Percarpio

how to balance his clinical productivity and patient care with the responsibility of resident education and presenting a consistent learning environment.

For Dr. Percarpio, the solution came in the form of training in social and emotional intelligence.

"The majority of radiology education is experiential and collaborative work between the attending radiologist and the resident at the workstation or in the IR suite," he said. "This is where

social and emotional intelligence can have a big impact."

Social and emotional intelligence refers to a set of skills, traits or competencies that relate to one's own emotions and social interactions with others. It can be better understood when divided into four domains: self-awareness, self-management, social awareness and relationship management.

"Self-awareness and self-management focus on ourselves and relate to our personal emotional management. We pause and reflect about our mental state and determine whether it may be negatively affecting our behavior. If it is, that's a good time to take a timeout to reset and come back with an improved state of mind," Dr. Percarpio said.

Social awareness and relationship management refer to our interactions with others.

"In social awareness, we determine whether we are attuned to the emotions of others and if we are able to exhibit empathy. Relationship management relates to how we function with teamwork or mentorship, coaching or conflict," he said.

In the educational environment, these skills become important because opportunities for learning can be lost if a resident feels overwhelmed, unappreciated or anxious. Educators who are able to detect these roadblocks can be objective and try a different approach.

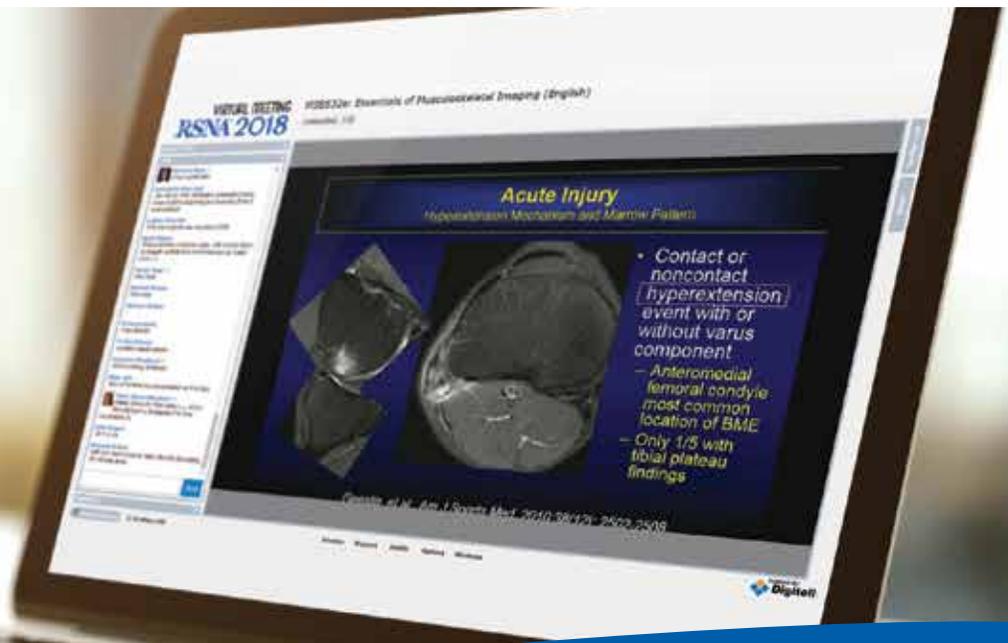
A more nuanced example of social intelligence is detecting impression management. "People manage behaviors to construct a personality which they value or want others to see," Dr. Percarpio said adding, "By recognizing this tendency in our residents, we can target better ways of educating."

In one hypothetical example of impression management, he shared a story of a junior resident who did not want to be perceived as incompetent after missing a large uterine mass on a CT study. When asked, the junior resident deflected by saying he saw it but forgot to mention it or didn't think of mentioning it.

"In this case, there is an opportunity to walk him back to recognize and correct the mistake. While doing so, you also reveal the true nature of the mistake and have a real chance for learning," he said.

Go to [RSNA.org/Bulletin](http://RSNA.org/Bulletin) to watch an interview with Dr. Percarpio.

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 December 1-6



# RSNA 2018 CELEBRATES EARLY-CAREER AND ESTABLISHED RADIOLOGISTS

*Exciting activities for radiology trainees and inspirational ceremonies for luminaries in the field are all part of RSNA 2018.*



During Monday's plenary session in the Arie Crown Theater, RSNA President Vijay M. Rao, MD, (second from left) presented Honorary Memberships to Paul M. Parizel, MD, PhD, (left), Sneha Bhargava, MD, (second from right), and Jacob Sosna, MD (right).

## What are You Most Excited to See at RSNA 2018?

*The Daily Bulletin stopped by the Residents Lounge on Monday to ask doctors the question: "What is of most interest to you at RSNA 2018?" Participants were eager to share what draws their attention at the meeting.*



*"I am looking forward to the neuroradiology lectures and updates," said **Faraan Khan, MRCP, FRCR**, fifth-year resident in neuroradiology at Atkinson Morley Hospital, London.*



***Brittany Lewis, MD**, a third-year resident in emergency radiology at Detroit Medical College and Wayne State University, Detroit, looks forward to the, "research presentations and how they can be implemented back at my institution."*



***Amy Hurley Dugdale, FRCR**, a third-year resident from Queen Alexandra Hospital, Portsmouth, UK, is looking forward to, "taking home the latest information and research on breast imaging."*



*"The alumni events, technical exhibits and getting to know other trainees," are some of the perks of the RSNA annual meeting said **William Winter, MD**, third-year resident at Vanderbilt, Nashville, TN.*



*Neuroradiology fellow **Noha A. Aboueldahab, MD**, from the University of Alabama at Birmingham, is most interested in learning, "the latest research and discoveries in neuroradiology."*



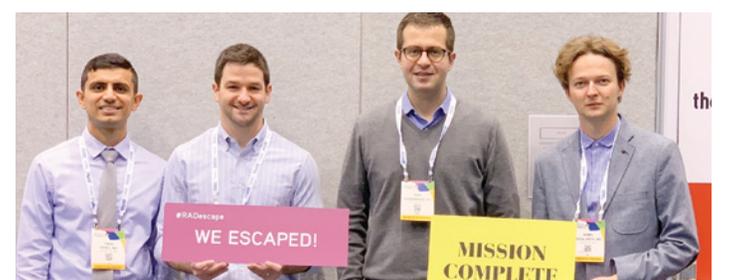
***Mona Abo El-Ela, MSC**, a fourth-year radiology resident from Dermadash Hospital, Cairo, is a first-time attendee and is enjoying, "the diversity of the topics and the challenge of the Case of the Day."*



***Wendy Tu, MD**, a third-year resident at Ottawa Hospital, Canada, is interested in, "experiencing the diversity of the scientific sessions and absorbing all the exciting research."*



*"Meeting up with great colleagues," is one of the best parts about the RSNA annual meeting according to **Nazmus Sakib, MD**, a third-year resident from Beth Israel, Newark, NJ.*



# 3D Printed Prostate Cancer Models Aid Pre-Surgical Planning, Patient Care

By Nick Klenske

*With 3D printing becoming readily available throughout health care, radiologists are using the technology to guide more surgical procedures than ever before – including prostate cancer treatment and care.*

“Graspable, 3D printed models provide radiologists with an accurate level of depth perception that is difficult to achieve when viewing 3D-rendered images on a flat screen,” said presenter Nicole Wake, PhD, of New York University (NYU) School of Medicine, during a Monday session. “3D printing of anatomical data allows radiologists, surgeons, and other physicians to physically hold patient-specific models and use visuo-haptic inputs to better understand both complex anatomy and the condition being treated.”



Wake

To produce anatomically accurate 3D printed models, radiologists must separate regions of interest (ROIs) from DICOM (digital imaging and communications in medicine) images, which can be acquired from any imaging technique offering volumetric imaging capability (i.e., MRI, CT).

The segmented ROIs are then converted into a 3D format that can be recognized by the 3D printing software.

According to Dr. Wake, 3D printed models offer several advantages over other types of models, such as traditional imaging, augmented reality and 3D computer models. Referencing a large cohort study in the *Journal of Urology*, she noted that prostate cancer volume estimates made

using MRI tend to substantially underestimate pathological volumes. “3D printed prostate molds created from a patient’s pre-operative MRI can be used to correlate MRI and pathology,” said Dr. Wake.

Based on an ongoing prospective study underway at NYU, Dr. Wake shared how 3D printed prostate cancer models can be

used for both pre-surgical planning and to help patients better understand their anatomy and disease.

“While they can’t interpret images, patients may be better able to understand the anatomy, disease and surgical plan by handling 3D models and discussing the models with their doctors,” she said.

## Enhanced Insight Into Underlying Anatomy

3D printed models can also influence surgical decisions regarding nerve-sparing, continence, and potency. “These models improve a surgeon’s confidence in the surgical procedure,” Dr. Wake said. “Most importantly, 3D printed models

can decrease operating times and improve outcomes for those patients undergoing robotic-assisted radical prostatectomy.”

By providing both spatial comprehension and tactile feedback, 3D printed prostate cancer models provide enhanced insight into the underlying anatomy.

“With a better understanding of lesion size, shape, and position within the prostate provided by 3D printing, surgeons are better able to prepare and execute these mini-

mally invasive procedures,” concluded Dr. Wake. “Patients can also better understand their disease and surgical procedure, allowing them to feel more comfortable with the surgical plan – ultimately leading to improved patient satisfaction.”

*While they can’t interpret images, patients may be better able to understand the anatomy, disease and surgical plan by handling 3D models and discussing the models with their doctors.*

Nicole Wake, PhD

## Margulis Award Presented Today

The RSNA Alexander R. Margulis Award for Scientific Excellence recognizes the best original scientific article published in *Radiology* for a given year. The Margulis Award Nominating Committee and the Margulis Award Selection Committee review published manuscripts based on their novel, quality, importance and potential scientific and clinical impacts. The 2018 Margulis Award will be presented during today’s Plenary Session at 1:30 p.m. in the Arie Crown Theater. Copies of the study are available in the Membership & Resources area of the Connections Center.

#GIVINGTUESDAY

## Giving Tuesday

*The RSNA Research & Education (R&E) Foundation is participating in #GivingTuesday, a global day dedicated to giving.*

Last year, organizations in more than 150 countries came together to celebrate #GivingTuesday — a movement to celebrate and provide incentives to give. Since its found-

ing in 2012, #GivingTuesday has inspired giving around the world, resulting in greater donations, volunteer hours and activities that bring about real change in communities.

For three consecutive years the RSNA Research & Education (R&E) Foundation has funded \$4 million in grants to researchers and educators in the radiology community with the help of donations from individuals, industry partners and private practice groups.

Celebrate #GivingTuesday and seed the future of radiology by making a donation to the Foundation today at [RSNA.org/Donate](http://RSNA.org/Donate) or by visiting the R&E Foundation booth in the Connections Center.



## Tuesday's Physics Quiz

**Q** A pelvic x-ray will typically give how much effective dose to a fetus – 0.01mSv, 0.1mSv, 1mSv, 10mSv, or 100mSv?

[Answer on page 12A.]

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Presentation  
AI 215-SD-TUB1/ Station #1  
11/27/Tue 12:45 - 13:15

# Lifestyle, Medication Affect Bone Health of HIV-Infected Adults

By Jennifer Allyn

*In adults with long-term HIV infection, low bone mineral density and increased fracture risk have emerged as significant comorbidities.*

As therapies improve, so does life expectancy and a new study presented on Monday assessed the influence of exercise, nutrition and medication on bone microarchitecture to ultimately improve the quality of life for these patients.

“In adults with long-term HIV infection, bone mineral density has been shown to decrease by two to six percent within the first two years of antiretroviral therapy, regardless of the choice of therapy,” said Sarah Foreman, MD, postdoctoral research scholar at University of California, San Francisco (UCSF). “To help decrease the rate of fracture and increase fracture healing, it’s essential to address this multifactorial challenge.”

Researchers studied 29 HIV-infected subjects — three women and 26 men — who had been diagnosed with HIV more than 20 years prior. To assess physical activity levels over the past month, subjects answered questions from the Community Healthy Activities Model Program for Seniors (CHAMPS) questionnaire. To determine their changes in food intake and weight over the previous three months, subjects took the Mini Nutritional Assessment (MNA). They also provided medication assessments.

Participants underwent radius and tibia high-resolution peripheral quantitative CT (HR-pQCT) and laboratory evaluation. Multivariable linear regression models were used to evaluate the effects of exercise, nutritional status, tenofovir disoproxil fumarate (TDF) and protease inhibitor (PI) use on bone microarchitecture, adjusting for all demographic risk factors.

HR-pQCT results showed that cortical bone was detrimentally affected by malnutrition, while trabecular bone was detrimentally affected by previous use of TDF in combination with a PI.

“Not much is known about the determinants of bone microarchitecture in people living with HIV, so the findings were novel to our team,” Dr. Foreman said. “It was interesting that the bone microarchitecture seemed to be correlated to not only medication protocols but also to nutrition and exercise regimens.”

Exercise could help diminish decreases in trabecular bone structure while nutritional support is specifically relevant for maintaining cortical bone structure.

“Our team noticed that light and moderate, but not vigorous, physical activity also favorably influenced bone composition, which can help patients who may not be

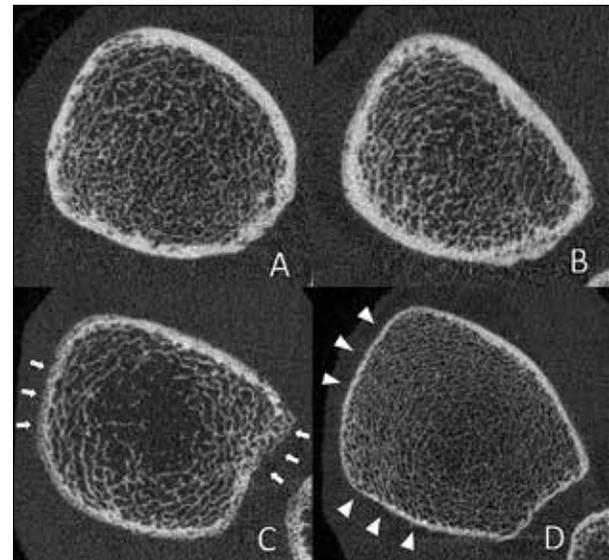


Foreman

interested in maintaining high levels of physical activity,” Dr. Foreman said.

The goal of the study is to assist physicians in balancing medications with physical activity and nutritional guidance to prevent bone loss in adults with HIV, particularly since the study demonstrated the use of TDF with PIs can compromise bone health.

In addition, researchers also noted that dual energy X-ray absorptiometry may no



Ultradistal tibia HR-pQCT images of two adults with HIV-infection with high nutritional scores (A, B) and two adults with HIV-infection with low nutritional scores (C, D). Those with low nutritional scores show reduced cortical BMD with visibly increased porosity (C, white arrows) and reduced cortical thickness (D, white arrowheads).

longer be sensitive enough to assess osseous changes in long-term HIV-infected individuals and that HR-pQCT may be better suited to evaluate these changes.

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# Radiology Adds Value to Anatomy Courses in Medical School

By Melissa Silverberg

*Radiologists are anatomists of the future. That is the premise of researcher Kathryn Darras, MD, who is working to assess the effectiveness of integrating 3D imaging into the anatomy curriculum of medical students.*

In research presented Monday, Dr. Darras, a radiologist at the University of British Columbia who is pursuing a PhD with the School of Health Professions Education at Maastricht University in the Netherlands, examined the educational value of

*We saw that virtual dissection adds to traditional anatomy teaching and we learned more about what kind of cases we should be sharing with students to get them excited about radiology.*

Kathryn Darras, MD

teaching medical undergraduates anatomy using new 3D imaging technology, such as anatomy visualization tables (AVTs).

"The purpose of our study was to see how we can use novel technology to bring radiology to medical students in a way that is easy to understand, but still connects them to the clinical world," Dr. Darras said.

Typical anatomy education has focused on cadaveric dissection with some integration of ultrasound and 2D images. However, Dr. Darras said that with recent advances in technology, radiologists and medical educators should take advantage of new ways to explore difficult cases with students and expose them to the field.

For example, AVTs can be used to teach anatomy through virtual, or digital, dissection. Real patient CT scans – either normal or abnormal – are loaded onto the AVTs, which function like large touch-screen PACS workstations and allow learners to work together in small groups to manipulate the data and move through the dissection.

#### Virtual Dissection Valuable to Students

All 292 first-year medical students at the University of British Columbia, were included in the study. Basic Virtual Dissection Curriculum, which focused on normal anatomy, was offered to all students concurrently with their cadaveric laboratories.

Additionally, an advanced Virtual Dissection Curriculum that focused on

pathology was offered to students through four extra-curricular sessions. Dr. Darras said 105 students volunteered for the advanced course, although most had no prior exposure to radiology teaching.

A survey following the basic AVT course found that 73.8 percent of students reported that virtual dissection was an effective use of their time and 78.7 percent said that the virtual dissection portion of class enhanced their understanding of the clinical applications of anatomy.

Among the students in the advanced AVT course, 93.1 percent indicated that virtual dissection was definitely a valuable addition to their learning and 88.5 percent agreed or strongly agreed that virtual dissection improved their understanding of disease and pathology. Most students, 94.2 percent, agreed or strongly agreed that it improved their understanding of the role of the radiologist in patient care.



Darras

"We saw that virtual dissection adds to traditional anatomy teaching and we learned more about what kind of cases we should be sharing with students to get them excited about radiology," Dr. Darras said.

Dr. Darras said the advanced AVT course gave first-year medical students an opportunity to explore complex cases they typically would not see so early in their studies. Students commented

that the imaging made it easier to understand the pathogenesis of disease.

"Students found the cases interesting and engaging and were inspired to learn more medicine," Dr. Darras said. "There's something about learning in 3D that makes the content more accessible to students. It has given us insight into how we can teach radiology effectively to this population of students."

The research project was supported by an RSNA Research and Education (R&E) Foundation grant. Dr. Darras received the RSNA Trainee Research Prize for her study.

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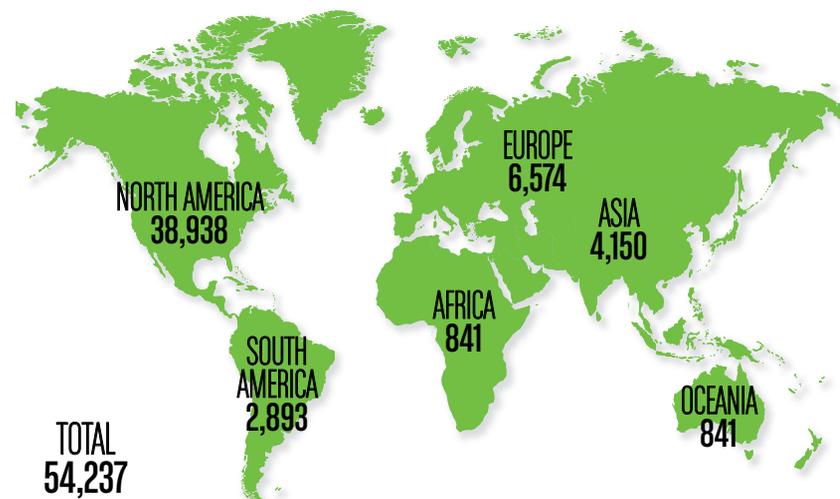
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## RSNA Membership



## ABR OLA Preview at RSNA 2018

The American Board of Radiology's (ABR) Online Longitudinal Assessment (OLA) for Part 3 of the Maintenance of Certification (MOC) program is available for preview at RSNA 2018.

Diagnostic radiology and diagnostic radiology subspecialty diplomates will be able to access OLA in early 2019, with subsequent roll-out to the other ABR specialties of interventional radiology, medical physics and radiation oncology in 2020.

OLA is a progressive online assessment that will replace the previous proctored MOC exam required every 10 years. OLA enables diplomates to demonstrate what they know through a convenient and flexible online format, eliminating the need for travel.

Stop by the ABR booth 1013 in the South Hall at RSNA 2018 for a personal OLA demonstration.



Tuesday's  
**Answer**

[Question on page 10A.]

**A** 1 mSv.

# CT Radiomics Shows Promise Predicting Survival in Early Lung Cancer

By Richard Dargan

*A CT radiomics model is more effective in predicting disease-free survival in patients with early-stage lung cancer than traditional clinical staging, according to research presented Monday.*

Lung cancer is traditionally staged through the Tumor-Nodes-Metastasis (TNM) method, in which three variables are used to assign a stage to the cancer, ranging in increasing order of severity from 0 to IV. But this approach has limitations.

“The TNM method predicts the prognosis according to the size and extent of tumor invasion, lymph node metastasis and distant metastasis,” said study co-author Xueguo Liu, MD, PhD, from Sun Yat-sen University in Zhuhai, China. “Even the same-staged solid lung cancers with the same treatments show different curative effects and metastatic behavior. TNM stage is not able to fully reflect the intratumor heterogeneity, which may result in therapeutic failures.”

Heterogeneity is one of the many features of a tumor that can be assessed through radiomics or the conversion of images into data that can be mined and analyzed with the help of computers.

Dr. Liu and colleagues recently developed a CT radiomics model in collaboration with research scientists from GE Healthcare China led by Xin Li, PhD, for patients with stage I lung cancer. They used CT scans to train and test the algorithm, maximizing

the effectiveness of the training set through the use of a random forest model, a powerful machine learning algorithm that helped select radiomics features significantly related to prognosis.

They then retrospectively evaluated the performance of the radiomics model in predicting disease-free survival and compared it with traditional clinical staging through the TNM method in 109 cases of stage I solid lung cancer.

**Radiomics can be used to identify potential biomarkers to predict prognosis of early stage solid lung adenocarcinoma patients after surgery.**

Xueguo Liu, MD, PhD

## Radiomics Can Guide Treatment Decisions

The researchers followed the patients for up to six years and found that 10 of the 385 radiomics features were significantly associated with disease-free survival. The model



Liu

was able to distinguish between patients at high and low risk of cancer recurrence, which is important in determining the appropriate course of treatment.

“This radiomics model can predict disease-free survival of stage I solid lung adenocarcinoma better than traditional clinical staging,” said Dr. Liu. “Radiomics can be used to identify potential biomarkers to predict prognosis of early stage solid lung adenocarcinoma patients after surgery.”

More research is needed, but Dr. Liu and colleagues believe the model can play a role in guiding treatment decisions for patients at a high risk of disease progression.

“I think this radiomics model has good prospects,” Dr. Liu said. “It can optimize the existing pathological staging methods, improving the accuracy of predicting prognosis, and predict tumor heterogeneity, assisting in the stratification of treatment plans.”

# Study Reveals Higher Mammography Rates in Coastal Cities

By Mary Henderson

*The number of women getting screening mammograms has increased significantly over the past 30 years, said Eric Kim, MD, diagnostic radiology resident at NYU Langone Health.*

According to data from the National Center for Health Statistics, the utilization of screening mammography has increased from 28.7 percent of women 40 years and older in 1987 to 65.3 percent in 2015.

However, millions of women in both rural and urban areas are still not receiving mammographic screening. Breast cancer remains the second leading cause of cancer-related deaths among women in the U.S.

“We can still do better,” Dr. Kim said during a Monday presentation.

He said screening mammography rates for women 40 years and older in 2004 varied from 71.1 percent in rural areas to 75.4 percent in metropolitan areas. While

researchers have identified a lack of access to care providers and other physical barriers as factors affecting the lower rate of mammographic screening in rural areas, less is known about urban areas.

“Studies thus far have focused on rural disparities in screening utilization,” he said. “City-level screening mammography disparities have been less evaluated, although more than 30 million adult women live in the 500 largest U.S. cities.”

To evaluate disparities in screening mammography utilization at the city level, Dr. Kim and his colleagues conducted a descriptive study using public data from the 500 Cities Project, which reports city-level data

**We found higher screening mammography utilization on the coasts in areas with higher levels of household income and insurance.**

Eric Kim, MD

on 27 chronic disease measures in more than 103 million people.

The project includes survey data on health risks; the utilization of screening mammography by more than 127,000 women; and data from the U.S. Census Bureau including income, educational attainment, race and employment. The research team matched screening mammography utilization to variables expected to impact screening in the 500 Cities Project data.

According to the statistical analysis, the mean utilization rate for city screening mammography was 77.7 percent, with the highest utilization (82.7 percent) in the New England cities and the lowest (73.6 percent) in cities in the mountain states, a north-south corridor stretching from Montana, Idaho and Wyoming to Arizona and New Mexico.

“We found higher screening mammography utilization on the coasts in areas with higher levels of household income and insurance,” Dr. Kim said.

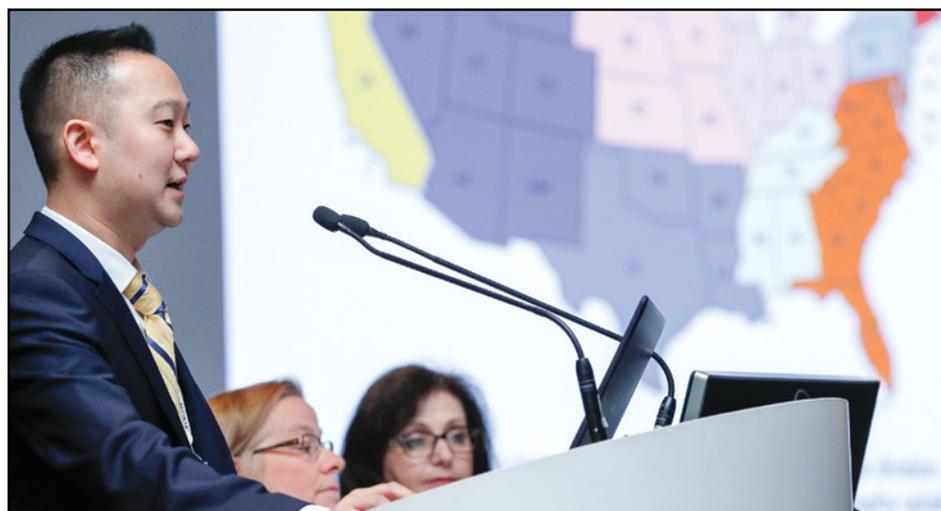
The study demonstrated a positive correlation between screening mammography utilization and use of preventive health

screenings and with household income. Utilization was negatively correlated with obesity, poverty and a lack of insurance.

According to the researchers’ analysis, significant independent predictors of screening mammography utilization included Pap test compliance, being of Asian descent, having private insurance and geographic region of residency.

“Although the literature focuses on rural screening disparities, uptake varies at the city level throughout the country,” Dr. Kim said. “Identifying predictors of uptake may aid in targeting areas and populations for screening education and intervention.”

Next research steps for Dr. Kim include connecting city-level screening utilization with the incidence of breast cancer mortality.



Kim

Tuesday's  American Association of Physicists in Medicine  
**Physics Tip**

**In IR procedures, collimation improves image quality as well as reduces dose. A smaller field of view produces less scatter which will increase contrast in the images.**

# Assessing the Clinical Impact of Second Opinion Radiology Consultation for Breast Cancer Patients

By Nick Klenske

While many patients diagnosed with breast cancer seek an additional review and reinterpretation of their breast imaging studies from a specialized cancer center, second-opinion radiology review can be time-consuming, labor-intensive – and expensive.

However, if a second opinion finding progresses from benign to malignant, it is generally accepted that the increased cost for further evaluation and management is both beneficial and warranted. As a result, most studies on the clinical impact of second opinion radiology consultation for patients with breast cancer continue to support the use of second opinions in clinical management.

That said, there is the lack of a gold standard assessing whether the first or second opinion is correct. During a Monday session, Debra Whorms, MD, a resident physician at Cambridge Health Alliance, Mass., shared results of her research examining the impact of second opinion breast imaging consultation in patients with a new breast cancer diagnosis.

“We looked at the frequency of discrepancy between interpretation from outside radiologists and those from breast imaging specialists providing the second opinion and assessed the impact this had on guiding

management changes and finding new malignancies,” she said.

## Study Highlights Discrepancy Between Radiologists

Dr. Whorms’ research differs from prior studies in that her team assessed discrepancy using the American College for Radiology RADPEER™ scoring system. Discrepancy scores were assigned blindly by two breast imaging radiologists in consensus, with cases showing a moderate to major discrepancy being reviewed by medical and surgical oncologists for management changes.

“We think this approach offers a more accurate and comprehensive assessment of true discrepancy between radiology reads,” she said.

Based on this research, Dr. Whorms found that not infrequently – 16 percent of the time – there is a significant discrepancy between radiologists. Furthermore, this discrepancy resulted in a change in the surgical management plan for 7 percent of patients and the identification of malignancy in 4 percent.

“These findings highlight the variation or discrepancy between radiologists and the impact this can have on patient care,”

*These findings highlight the variation or discrepancy between radiologists and the impact this can have on patient care.*

Debra Whorms, MD

CONTINUED FROM PAGE 1A

## Can Clinicians Lead Radical Redesign?

The principles of the radical redesign outlined by Dr. Berwick are: Change the balance of power, standardize what makes sense, customize to the individual, promote well-being, create joy in work, make it easy, move knowledge — not people, collaborate/cooperate, assume abundance and return the money.

“Clinicians can take the lead in bringing these design concepts to reality by remaining open to new ideas,” he said.

Dr. Berwick shared an example of the principle of changing the balance of power through the story of the remarkable success experienced at an institution in Sweden where, inspired by one of their patients, physicians began allowing patient-administered, self-care dialysis.

The patient later encouraged the practice at another institution in Waco, Texas. Patient involvement created a radical change in their attitudes and outlooks as well as in staff responsibility. Staff become teachers, coaches and trainers who share the power in delivering necessary care.

“Historically we worked our way into a bit of a mess,” Dr. Berwick said. “Trained as proud professionals, if we stay in our channels and we’re taught to be heroes, we begin to lose sight of the system. Likewise, the rewards, punishment and payment incentives do not work because they do not produce change. There is a new set of social needs that can be met. It can be achieved only through buoyancy in the work force, and it’s a job to do together.”



Whorms

Dr. Whorms said. “In general, our study supports a multi-disciplinary breast oncology program, with embedded formal breast imaging subspecialty second opinion consultation, for all patients referred with newly diagnosed breast cancer.”

Nevertheless, Dr. Whorms noted several potential drawbacks, including a higher-than-usual rate of false positive reads as consulting radiologists have a heightened level of scrutiny given a cancer diagnoses. There is also a potential delay in treatment due to the need for additional diagnostic evaluation, which could increase costs.

Further research is needed to help determine the implications of the service on time-to-treatment, long-term patient outcomes and health care costs.



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