RSNA News™

September 2018 Volume 28, Issue 9

RSNA 2018 Spotlights Artificial Intelligence, Machine Learning

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MRI-Based Technology Promising in Alzheimer's
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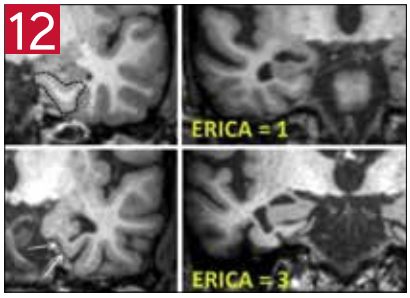

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RSNA MISSION
The RSNA promotes excellence in patient care and health care delivery through education, research and technologic innovation.

RSNA Announces 2018 Honorary Members

The RSNA Board of Directors has announced the Honorary Members who will be honored at the 104th Scientific Assembly and Annual Meeting.

Sneh Bhargava, MD
New Delhi, India

Paul M. Parizel, MD, PhD
Antwerp, Belgium

Jacob Sosna, MD
Jerusalem, Israel

RSNA 2018
TOMORROW'S RADIOLOGY TODAY
NOVEMBER 25-30

2018 RSNA Editorial Fellows Announced

Fowler

George

Kathryn J. Fowler, MD, has been named the 2018 RSNA William R. Eyler Editorial Fellow, and **Elizabeth George, MD**, is the 2018 RSNA William W. Olmsted Trainee Editorial Fellow.

Dr. Fowler recently moved from Mallinckrodt Institute of Radiology, St. Louis, to the University of California San Diego (UCSD), where she serves as an associate professor of diagnostic radiology in the abdominal imaging section. She earned her medical degree from the University of Wisconsin Medical School, Madison, and completed her residency and fellowship in body MRI and abdominal imaging at Mallinckrodt Institute of Radiology.

Dr. Fowler currently serves as an associate editor of body CT on the *Radiology* Editorial Board and earned the *Radiology* Editor's Recognition Award in 2014, 2015 and 2016. She is a member of the abdominal imaging and gastrointestinal imaging panels for *Radiographics* and is a reviewer for journals including *RadioGraphics, Abdominal Radiology* and the *American Journal of Roentgenology*. Dr Fowler has published more than 100 peer-reviewed manuscripts and chapters.

Dr. George is a fourth-year resident and the chief resident in radiology at Brigham and Women's Hospital, Boston. She earned her medical degree from the All India Institute of Medical Sciences, New Delhi, and completed a research fellowship at Brigham and Women's Hospital prior to her residency. She will complete a neuroradiology fellowship at the University of California, San Francisco, from 2019-2021.

Dr. George received the Society of Cardiovascular CT Young Investigator Award in 2014 and the RSNA Trainee Research Prize in 2016. She serves as a research author on the American College of Radiology (ACR) Appropriateness Criteria Women's Imaging Panel. Dr. George is a reviewer for journals including *International Journal of Cardiovascular Imaging, Journal of Computer Assisted Tomography* and *Academic Radiology*.

Both fellows will work with *Radiology* Editor David A. Bluemke, MD, PhD, in Madison, WI, and *RadioGraphics* Editor Jeffrey S. Klein, MD, in Burlington, VT. The Eyler Editorial Fellowship lasts one month and the Olmsted Trainee Editorial Fellowship lasts one week. Each fellow will visit the RSNA Publications Department at RSNA Headquarters in Oak Brook, IL. Dr. Fowler will also work with the *Radiology* editorial team at RSNA 2018.

RSNA Spotlight Course in Buenos Aires Draws Worldwide Audience

The RSNA Spotlight Course, "Últimas Tendencias en Imágenes Abdominales," was held in Buenos Aires, Argentina, in June. Close to 300 attendees from 15 countries learned about the latest trends in abdominal imaging.

The Spotlight Course included didactic lectures and interactive, web-based RSNA Diagnosis Live™ sessions, which gave attendees the opportunity to test their knowledge and engage with renowned global leaders in abdominal imaging. This was the third RSNA Spotlight Course held completely in Spanish.

Course directors Jorge Soto, MD, chief of radiology at Boston Medical Center and chair of the department of radiology at Boston University School of Medicine, and Mariano Volpacchio, MD, a radiologist in the department of diagnostic imaging, Centro Rossi, Buenos Aires, led the 2–day program.

"These types of courses, so close to home for many of the participants, provide invaluable education and networking opportunities that benefit the practice of radiology throughout our region," Dr. Soto said.

Dr. Volpacchio echoed those sentiments. "The response following the course has been overwhelmingly positive and we hope to continue collaborating with RSNA to bring important education options to radiologists in Latin America," he said.

The next RSNA Spotlight Course, "Practical Applications of Artificial Intelligence," will be held Sept. 23–24 in Paris, France. For more information and to register, visit *RSNA.org/Spotlight2018*.

RSNA SPOTLIGHT COURSE

Soto

Volpacchio

William R. Eyler, MD, Celebrates 100th Birthday

Esteemed radiologist and longtime *Radiology* editor, William R. Eyler, MD, celebrated his 100th birthday on April 13. Dr. Eyler was recognized with a birthday celebration at Henry Ford Hospital, Detroit, where he spent the duration of his career. The hospital will honor Dr. Eyler in the fall for 65 years of achievement.

Dr. Eyler joined Henry Ford Hospital in 1953 and served as chairman of the Department of Radiology from 1955 to 1983. Dr. Eyler is retired from Henry Ford but continues to serve as an attending staff radiologist.

Dr. Eyler provided RSNA with 45 years of dedicated service — as assistant editor of *Radiology* (1962–1966), as editor of *Radiology* (1966–1985) and as editor of the RSNA Index to Imaging Literature, which included nearly 40 journals. Dr. Eyler also served as the RSNA Historian for many years.

In recognition of Dr. Eyler's editorial accomplishments, RSNA introduced the William R. Eyler Editorial Fellowship in 1998. Awarded each year, the fellowship offers recipients the opportunity to gain experience in radiologic journalism by working with the *Radiology* and *RadioGraphics* editors and staff. Dr. Eyler received the RSNA Gold Medal in 1976.

SNMMI Names New Officers

Minoshima

Dilsizian

Packard

Satoshi Minoshima, MD, PhD, has been named the 2018–19 president of the Society of Nuclear Medicine and Molecular Imaging (SNMMI). SNMMI introduced a new slate of officers during its recent annual meeting in Philadelphia.

Dr. Minoshima is a professor and chair of the Department of Radiology and Imaging Sciences at the University of Utah, Salt Lake City. He serves on the RSNA Committee on Scientific Affairs.

President-elect is **Vasken Dilsizian, MD,** professor of radiology and medicine at the University of Maryland School of Medicine and chief of the Division of Nuclear Medicine at the University of Maryland Medical Center in Baltimore.

Vice president-elect is **Alan Packard, PhD**, associate professor of radiology at Harvard Medical School, director of radiopharmaceutical research and a senior research associate in nuclear medicine at Boston Children's Hospital.

In Memoriam

Luther W. Brady, Jr., MD

Former RSNA president and international leader in radiation oncology, Luther W. Brady, MD, died on July 13, in Philadelphia. He was 92.

Dr. Brady was an affiliate faculty member in the Department of Radiation Oncology at Drexel University College of Medicine, and served as chair of the Department of Radiation Oncology and Nuclear Medicine at Hahnemann University, both in Philadelphia. After earning his his medical degree at George Washington University, Washington, DC, Dr. Brady completed his residencies in radiology and radiation oncology at the U.S. Naval Hospital, Bethesda, MD, and Thomas Jefferson University and the Hospital of the University of Pennsylvania, both in Philadelphia.

Dr. Brady served as RSNA president in 1985 and as co-chair of the RSNA Research & Education (R&E) Foundation's Silver Anniversary Campaign from 2005 to 2009. He was also a chair of the RSNA Education Council and Nominations Committee. He was a Foundation Visionary and Legacy donor.

A foremost investigator in the history of radiation oncology, Dr. Brady was the co-editor of the landmark textbook, *Principles and Practice of Radiation Oncology*. An expert on tumors of the eye and orbit, Dr. Brady published many of his more than 600 published studies and research papers on this topic. He served as editor of the *American Journal of Clinical Oncology*.

Dr. Brady served as founding president of the American College of Radiation Oncology (ACRO) and as a president of the American Radium Society (ARS), the American Society for Therapeutic Radiology and Oncology (ASTRO) and the American Board of Radiology (ABR).

Dr. Brady was honored with the RSNA Gold Medal in 1989. He received gold medals and lifetime achievement awards from ASTRO, ARS, ACRO, the American College of Radiology and the American Medical Association.

Numbers in the News

30,000

Number of images that have been annotated for the RSNA 2018 Machine Learning (ML) Challenge focusing on pneumonia. Read more about this and other other RSNA ML initiatives on Page 8.

8

The number of past RSNA Research & Education (R&E) grant recipients who received the 2018 Distinguished Investigator Award from the Academy for Radiology & Biomedical Imaging Research — a record number for R&E researchers. Read more on Page 17.

RSNA R&E Foundation Grant Applications Open Soon

If you have considered applying for an RSNA Research & Education (R&E) Foundation grant, now is the time to get organized. The online application process for certain grants will open in October and deadlines for application begin in January.

RSNA's R&E Foundation awards millions of dollars each year to promising researchers and educators in radiology.

Visit *RSNA.org/Foundation* to learn about available grants, access the grant application and read about current and previously funded projects.

September 2018 • Volume 28, Issue 9
Published monthly by the Radiological Society of North America, Inc.
820 Jorie Blvd., Oak Brook, IL 60523-2251. Printed in the USA.

POSTMASTER: Send address corrections or changes to: *RSNA News*, 820 Jorie Blvd., Oak Brook, IL 60523-2251

Non-member subscription rate is $20 per year; $10 of active members' dues is allocated to a subscription of *RSNA News.*

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My Turn:

Radiologists Will Flourish During the Fourth Generation of Artificial Intelligence

In 1956, John McCarthy, an applied mathematician at Dartmouth College, convened a "Summer Research Project on Artificial Intelligence," now widely considered as the birthplace of artificial intelligence (AI). He later wrote that his goal was "to make programs that learn from their experience as effectively as humans do." Sixty years later, his vision has a profound impact on the practice of radiology.

I first encountered Dr. McCarthy when I entered the Stanford AI graduate program in 1981. The members of our class were dubbed "knowledge engineers," training to build rule-based expert systems. Unfortunately, true/false rules couldn't handle the uncertainties inherent in medical decision making. This led to a new generation of AI algorithms that incorporated uncertainty. A knowledge engineer would collaborate with a mammography expert to learn the features that distinguish benign from malignant breast masses. Painstaking work to detect and process these features ultimately led to the computer-aided detection algorithms used in mammography today.

Just a few years ago, a third generation of AI algorithms emerged from rapid advances in applying neural networks to computer vision. These networks, called "deep" because of their many layers, are enormous mathematical equations tuned on high-performance computers through repeated exposure to massive sets of positive and negative training examples. This deep learning process often yields excellent performance in a matter of hours, rather than years.

The resulting computer vision systems have spurred a massive investment in the radiology AI industry, leading to claims radiologists will be replaced. Despite the irresponsible hype, AI innovations will soon transform radiology practice. To help radiologists flourish during this technology revolution, RSNA is devoting its considerable resources and energies toward AI education, research and innovation to usher in a fourth generation of AI technology, working in harmony with radiologists.

RSNA is vastly expanding its AI educational offerings at RSNA 2018, which will feature a variety of targeted educational experiences. In addition to refresher courses and scientific sessions devoted to AI, radiologists can visit the "Crowds Cure Cancer" exhibit to participate in the labeling of clinical images for AI research. The RSNA-NVIDIA Deep Learning Classroom offers an opportunity for anyone with a laptop to construct and train an AI algorithm in just 90 minutes. The RSNA Machine Learning Showcase brings together AI vendors in the exhibit hall, making it easy for attendees to see AI tools nearing clinical application. This year the showcase will more than double in size, with over 70 companies participating.

The Society will cover several new AI educational programs outside the annual meeting, including AI-focused Spotlight Courses and a series of AI webinars for radiologists. And RSNA will continue to co-sponsor the National Imaging Informatics Course for radiology residents, a rich source of knowledge about AI and related informatics topics.

Because AI systems have a voracious need for labeled training images, RSNA will continue to assemble and release well-curated data sets to spur progress. Last year RSNA released data for the RSNA Pediatric Bone Age Challenge, which enabled scientists from around the world to exceed the performance of earlier bone age algorithms. This year, RSNA plans an even more ambitious challenge, the RSNA Pneumonia Detection Challenge, based on thousands of chest radiographs labeled in partnership with the Society of Thoracic Radiology. The winners of this challenge will be honored this year with a $30,000 prize.

RSNA continues to intensify its strong support for AI research and innovation. This year RSNA will begin publishing a new journal, *Radiology: Artificial Intelligence*. The RSNA Research & Eduation (R&E) Foundation again will provide millions of dollars toward investigator-initiated radiology research, enabling AI algorithms for image reconstruction, quality control, triage, CAD and automated diagnosis.

Innovative informatics standards developed by RSNA such as RadLex, structured reporting and common data elements, will help radiologists produce AI training data as part of routine clinical image interpretation.

Previous collapses of over-hyped AI technology have been called "AI winter." While today's enthusiasm for AI can be excessive, these new algorithms have indisputable value to radiology practices, making a severe AI winter unlikely. Regardless of how the AI climate changes, RSNA's sustained support for education, research and innovation will enable radiology practices to thrive as they embrace these new AI tools.

Curtis P. Langlotz, MD, PhD, is professor of radiology and biomedical informatics and director of the Center for Artificial Intelligence in Medicine and Imaging in the Department of Radiology at Stanford University. He serves as the RSNA Board Liaison for Information Technology and Annual Meeting and has led the development of numerous RSNA informatics initiatives, including the RadLex terminology standard, the LOINC-RadLex Playbook of standard exam codes, and the RSNA report template library.

Read more about RSNA Machine Learning, Artificial Intelligence initiatives on Page 8.

Machine Learning Tool Detects Biomarker in Brains of Stroke Patients

BY CINDY KUZMA

When an ischemic stroke patient arrives in the emergency room (ER), assessment of hemorrhage risk helps determine the best candidates for thrombolysis, potentially saving a life.

Bentley

While leukoaraiosis — a small vessel disease marked by white matter (WM) lesions and lacunar infarcts — provides a valuable predictor of bleeding and other outcomes related to stroke, radiologists face challenges in identifying the disease. Although MRI is well recognized as a superior modality in WM lesions, CT — a less effective method — is often the first-line imaging modality of choice, mainly due to its price and availability.

But a new, fully automated machine learning (ML) tool has proven effective in quickly and accurately quantifying cerebral WM lesions, according to new *Radiology* research. The tool may eventually aid clinicians making emergency decisions regarding thrombolysis in stroke patients and may also aid in diagnosing patients with traumatic brain injury and dementia, according to researchers.

"Although identifying on CT which brains are affected by extensive white matter lesions is fairly obvious, knowing exactly where to draw the boundaries and whether someone should be graded moderate or severe is highly variable," said senior author Paul Bentley, PhD, clinical senior lecturer and honorary consultant neurologist at the Centre for Restorative Neurosciences at Imperial College London.

When humans use visual ordinal scales, inter-rater agreements tend to be 0.5–0.65, he noted.

Seeking to create a tool that could improve quantification or at least speed up the process, Dr. Bentley and colleagues — including first author Liang Chen, MSc, a research assistant and PhD candidate at Imperial College London — used a random forest method for segmenting cerebral WM lesions on CT images in a multicenter cohort of patients with acute ischemic stroke.

From a pool of 1,000 CT images of acute ischemic stroke, the researchers selected 90 representative sections from 50 participants. All of these sections showed moderate or severe WM lesions as manually traced by neuroradiologists or stroke physicians with more than five years of experience in stroke.

Next, researchers randomly sampled these images, extracting smaller patches that contained part of the labeled areas and classifying them based on whether or not the central pixel was labeled as WM. Researchers repeated this process millions of times to craft a general classifier.

Finally, the team modified the classifier with a probabilistic atlas of WM lesions based on a set of 227 fluid-attenuated inversion recovery (FLAIR) MR images.

Validating the ML Tool

Once the ML tool was developed, the researchers used several steps to validate the method.

"We compared both the overall volume and spatial overlap of white matter lesion areas segmented by our method with those of three experts who had meticulously drawn over the same set of images," Dr. Bentley said. "They had been asked to draw their perceived boundaries of all cerebral white matter lesions."

These images included both CT and FLAIR MRI for individuals who underwent both types of imaging in the same week — a different set of images than those used in developing the tool.

The goal was to provide robust evidence of the accuracy of the ML method since FLAIR MRI is considered the gold standard for location and volume of the burden of WM lesions. "We also compared our algorithm's output with the ordinal ratings of experts in many hundreds of images from multiple stroke centers," Dr. Bentley said.

Improving Speed Without Sacrificing Accuracy

Results showed that using the automated ML tool for quantification of CT cerebral WM lesions performed similarly to detailed, expert delineation on CT when compared to the standard of expert evaluations of FLAIR MRI.

The tool proved robust even in the presence of other brain lesions — such as atrophy, acute ischemia, or old infarcts — which can sometimes be difficult to distinguish from leukoaraiosis on CT.

Additionally, the automated method worked incredibly quickly. While expert tracings took a median of 7.9 minutes to perform, the total automated processing time — including pre-processing — averaged just 109 seconds (with a range of 79 to 140 seconds).

While additional testing will be required to assess the algorithm's reliability in other clinical scenarios, such as traumatic brain injury and dementia, the algorithm is already being put to use in clinical practice.

"We have already added this algorithm as a tool in our hospital's CT PACS," Dr. Bentley said. "The importance of being able to segment lesions on CT means that parametric outputs can be provided, reliably and rapidly, for images generated in everyday hospital practice."

Low-Dose CT Imaging Focus of RSNA/AAPM Symposium at RSNA 2018

BY JENNIFER ALLYN

Advances in low-dose CT, including early detection and characterization of lung cancer, are having a substantial impact on routine clinical practice and remain an important topic of research.

The applications, benefits and risks related to the use of reduced radiation doses in CT will be discussed at the RSNA/American Association of Physicists in Medicine (AAPM) Symposium, "Low-Dose CT: When Does it Matter, What are the Risks and How do we Make it Effective?" at RSNA 2018.

"The value and low or no-risk of appropriate low-dose CT imaging has been well-established," said Paul E. Kinahan, PhD, moderator of this year's symposium, to be held Tuesday, Nov. 27.

Dr. Kinahan, vice chair for radiology research and head of the imaging research laboratory at the University of Washington, Seattle, is excited to introduce RSNA and AAPM members to new developments in low-dose CT while also tempering expectations due to the risk of compromising clinical performance.

"There are exciting new physics and clinical developments determining the relationships between lesion detection and dose, new classes of iterative CT image reconstruction algorithms and new lung nodule classification rules," Dr. Kinahan said, "However, care must be taken to ensure that doses are not lowered to the level that clinical tasks are compromised."

Cynthia H. McCollough, PhD, will discuss important considerations regarding the use of low-dose CT, including diagnostic performance of the radiologist, during her symposium presentation, "CT Technology and Dose in the 21st Century."

"With all the advances in CT over the last decade, including changes in scanner design, dual-energy CT and widespread adoption of iterative reconstruction and noise reduction techniques, body CT doses have fallen by over a factor of three since the early 80s," said Dr. McCollough, president-elect of AAPM and a professor of biomedical engineering and medical physics at Mayo Clinic College of Medicine and Science in Rochester, MN.

"These advances increase the medical benefit and decrease the potential radiation risk associated with CT. Nevertheless, if the diagnostic quality is not adequate and the radiologist does not make the correct diagnosis, this can greatly jeopardize patient outcomes."

Kinahan

McCollough

Aberle

Low-Dose CT in Lung Cancer

Denise R. Aberle, MD, 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.

Given the prominent role of semantic features in current diagnostic classification models of lung cancer, she will describe approaches to standardizing semantic characterization of lung nodules based on an illustrated lexicon in her presentation, "Contemporary CT of the Indeterminate Lung Nodule: Where We Are and Why it Matters."

Dr. Aberle is professor of radiology and bioengineering at the University of California Los Angeles (UCLA), and vice chair for research in the Department of Radiological Sciences in the David Geffen School of Medicine at UCLA.

"My research has centered on oncologic imaging, particularly on the early detection of lung cancer and the use of qualitative and quantitative image features for lung cancer diagnosis and characterization," Dr. Aberle said. "I am particularly interested in the use of low-dose CT to assist with the classification of indeterminate lung nodules, understanding the evolution from preneoplasia to early malignancy to advanced disease and the mechanisms for arresting disease with immunotherapies and chemo-immunotherapies."

Dr. Aberle was the principal investigator of the ACRIN-NLST (American College of Radiology Imaging Network component of the National Lung Screening Trial), the NCI-sponsored randomized controlled trial that showed a reduction in lung cancer mortality with low-dose CT screening relative to chest radiography screening for lung cancer and which formed the basis for the adoption of low-dose CT screening in the U.S. She also plans to take her research in new directions.

"The validation of low-dose helical CT for lung cancer screening of high-risk individuals in the NLST led to a sea change in health policy on the early detection of lung cancer," Dr. Aberle said. "Now the focus will be on how it will perform in nodule classification, particularly when integrated with clinical and molecular biomarkers of lung cancer in the setting of indeterminate lung nodules, and how it may enable the differentiation between indolent and aggressive lung cancers after initial diagnosis."

Dr. McCollough agrees that CT colonography and CT screening for lung nodules are indications where low-dose CT has been the most successful. However, she cautions that for many other indications, low-dose CT may not be helpful.

"You usually have to trade off something when you lower the dose and you don't want that to be diagnostic performance," Dr. McCollough said. "Dose customization that is specific to the patient and to the reason for the exam, as well as technical advances such as tube current modulation and tube potential optimization, have the potential to help patients get a quality exam at lower doses."

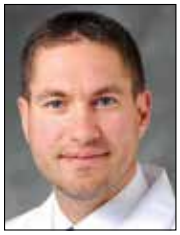
Artificial Intelligence, Machine Learning

BY RICHARD DARGAN

RSNA continues to lead the field in artificial intelligence (AI) and machine learning (ML) with expanded learning and research opportunities planned for RSNA 2018.

Langlotz

Prevedello



Halabi

Erickson

From leading-edge presentations to the return of the RSNA ML Challenge and the Machine Learning Showcase, RSNA 2018 will offer a growing roster of programming focusing on the power and potential of AI in radiology and issues associated with implementation.

Following the successful debut of the ML Pediatric Bone Age Challenge in 2017, RSNA 2018 will feature the ML Pneumonia Detection Challenge. The most accurate algorithm submissions will be recognized in the Machine Learning Showcase.

In the 2017 challenge, more than 250 participants created algorithms to predict skeletal age using pediatric hand x-rays. The competition had a considerable impact, said RSNA board liaison for information technology and annual meeting Curtis P. Langlotz, MD, PhD.

"Data scientists from around the world used the data set to exceed the performance of previously published AI systems that automatically estimate bone age," said Dr. Langlotz, a professor of radiology and biomedical informatics and director of the Center for Artificial Intelligence in Medicine and Imaging in the Department of Radiology at Stanford University.

The process was overseen by members of the RSNA Radiology Informatics Committee (RIC) Machine Learning Steering Committee, chaired by Luciano M. Prevedello, MD, MPH, of Ohio State University in Columbus, and the Machine Learning Data Standards Subcommittee, chaired by Safwan Halabi, MD, clinical professor of pediatric radiology at Stanford.

The 2018 ML Challenge invites participants to develop tools that identify and localize pneumonia on chest x-rays using images from a publicly available National Institutes of Health (NIH) data set.

The success of ML research in radiology depends on the availability of datasets with high-quality annotations. For this year's challenge, a set of 30,000 images has been carefully annotated by a team of volunteer radiologists, including chest specialists from the Society of Thoracic Radiology. Teams of contestants will use the annotations, which identify abnormal areas in the lung images and assess the probability of pneumonia, to develop their algorithms.

"This year's competition is a lot more image-heavy than in 2017," Dr. Halabi said. "It represents one of the largest uses of patient imaging to date for this type of competition."

The 2018 challenge will be conducted using a software platform from Kaggle, a leader in data science competitions.

Returning for RSNA 2018, the RSNA Machine Learning (ML) Showcase (*above*, at RSNA 2017) will educate attendees about the latest ML technology and offer networking opportunities with leading companies.

Editor's Note: This is the last in a series of articles on Machine Learning (ML).

Play an Expanding Role at RSNA 2018

Kaggle will also donate $30,000 to be shared among the top entries.

"Our goal is to increase participation in the Machine Learning Challenge and grow outreach to other specialties," Dr. Halabi said. (See Web Extras below.)

The challenge launched in August with the release of the "training" dataset; the evaluation phase will be held in October.

Deep Learning Classroom Takes a Deeper Dive

Also returning this year is the RSNA Deep Learning Classroom presented by NVIDIA Deep Learning Institute (DLI), a leader in visual computing technologies. Certified instructors from NVIDIA's DLI will be on hand to help attendees learn to write algorithms and improve their understanding of AI technology.

"The RSNA Deep Learning Classroom offers an opportunity for anyone with a laptop to construct and train an actual computer-vision system based on a neural network in just 90 minutes," Dr. Langlotz said.

More than 1,000 people attended the 2017 classroom. The 2018 classroom will increase the focus on radiology imaging with advanced topics like data augmentation, segmentation and multiparametric classification.

The coursework offers different levels of exposure for attendees based on their depth of knowledge, said Bradley J. Erickson, MD, PhD, a radiology professor and director of the Radiology Informatics Laboratory at the Mayo Clinic in Rochester, MN.

For instance, some programs will include intentional gaps so that participants can figure out what is needed to make the algorithm work. Optional pieces will be available at the end of the programs so that advanced users can jump ahead and work on more complex algorithms.

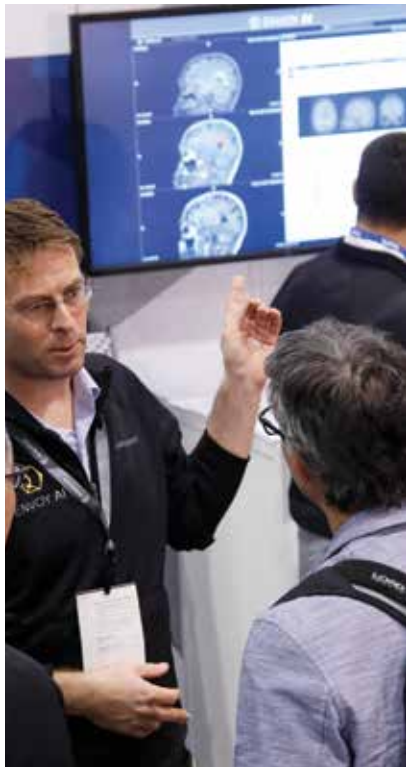
"There has been a lot of hype around AI," said Dr. Erickson, a member of the RSNA RIC. "It's critical that our membership understands how it can work and how it can fail, and the classroom provides an excellent way for us to demonstrate both."

Along with AI-focused refresher courses and scientific sessions, the meeting offers a variety of other educational experiences focusing on AI research. Radiologists can visit the National Cancer Institute's Crowds Cure Cancer exhibit returning for its second year. Presented in the Learning Center, the project invites radiologists to annotate clinical images for ML research.

Also at RSNA 2018, the Machine Learning Showcase gives attendees an opportunity to learn about the latest ML technology and network with companies on the forefront of ML advancements. The showcase will feature a Machine Learning Theater, offering presentations daily between 11 a.m. and 2 p.m.

"In the years to come, RSNA's support for education, research and innovation in this field will grow as AI becomes an integral part of radiology practice," Dr. Langlotz said. "RSNA will continue to educate not only radiologists but also researchers and industry scientists about AI and ML."

For more information on the 2018 Machine Learning Challenge, go to *RSNA.org/Informatics.*



The 2018 Machine Learning Showcase is sponsored by Arterys and Google Cloud.

RSNA Leads the Way in Artificial Intelligence, Machine Learning

RSNA initiatives are at the forefront of artificial intelligence (AI) and machine learning (ML) innovations.

In August, RSNA launched the first in a series of live 60-minute webinars on AI and its applications for radiology featuring internationally renowned experts. RSNA will also offer AI webinars on Oct. 25, Dec. 11, and on Feb. 21, 2019.
Read more on Page 22.

Also in August, RSNA co-sponsored the National Institutes of Health (NIH) National Institute of Biomedical Imaging and Bioengineering workshop, "Artificial Intelligence in Medical Imaging" to foster collaboration in applications for diagnostic medical imaging. The workshop was also sponsored by the American College of Radiology and the Academy for Radiology & Biomedical Imaging Research.

The RSNA Spotlight Course, "Practical Applications in Artificial Intelligence," being held Sept. 23–24 in Paris, France, will focus on integrating AI with current medical imaging and examine how AI will impact the future of radiology. Additional AI Spotlight courses will be held in 2019 in San Francisco, CA, and Paris, France, with more courses being developed in other regions of the world.

In early 2019, RSNA will debut its new online journal, *Radiology: Artificial Intelligence*, highlighting the emerging applications of AI and ML in the field of imaging across multiple disciplines. The journal's editor, Charles E. Kahn, Jr., MD, MS, invites submissions to the bi-monthly journal available exclusively online. For more information on *Radiology: Artificial Intelligence*, go to *pubs.RSNA.org*.

WEB EXTRAS

For more information on the 2018 Machine Learning Challenge, go to *RSNA.org/Informatics*.

Study Shows Human Factors Discourage Radiology Staff from Reporting Safety Events

About half of employees do not report errors, according to a new *Radiology* study.

BY CINDY KUZMA

Errors are human. So too are the reasons staff members of one academic radiology department often do not report them, according to a recent *Radiology* study.

In fact, only about half of the employees in one large academic radiology department attained 100 percent reporting of safety events, the study showed. The reasons that employees stay silent include what the researchers call human factors, such as uncertainty about what constitutes a reportable event, reluctance to challenge authority, and the sense that no one would listen.

The study was led by radiologist Bettina Siewert, MD, vice chair for quality and safety in the Department of Radiology at Beth Israel Deaconess Medical Center in Brookline, MA. Dr. Siewert is responsible for analyzing all serious reportable events in the radiology department and instituting measures to prevent future events.

While the Joint Commission requires accredited institutions to participate in a biannual safety attitude questionnaire, the survey does not inquire about other human factors that may adversely affect a culture of safety.

When two potentially serious, reportable events occurred in the radiology department at Beth Israel,

human factor

Dr. Siewert and her team set out to identify the root causes and were surprised by some of their findings.

"What piqued our interest was that during the debriefings of these two events, people talked about how they had noticed that something was off, but they were not in a position to say something about it," said Dr. Siewert, who is also an associate professor of radiology at Harvard University in Boston.

The institution's quality and safety work group, which meets monthly, discussed these issues, reviewed the relevant literature and developed a questionnaire focusing on safety events, which were defined as "any situation with the potential to cause harm to a patient, staff or family."

Of the 648 radiology department staff members, 363 completed the online survey, which aimed to determine how often employees speak up about safety incidents; how often they were unable to do in the last 12 months; and what "human factor barriers" prevented them from speaking up.

One to three questions on the survey addressed each of these human factors, many of which were related to the authority gradient — a real or perceived difference in status between team members, such as a resident or fellow and an attending radiologist. "In an academic center that is very difficult to address," Dr. Siewert said. "Understandably, trainees feel very vulnerable."

Of the 363 survey respondents, 182 (50 percent) said they always spoke up about safety concerns; 134 (37 percent) did so most of the time; 36 (10 percent) sometimes; and seven (2 percent) rarely and 4 never (1 percent). When asked why they did not report such incidents 69 percent cited a high reporting threshold (being uncertain that their observations qualified as a safety event); 67 percent had qualms about challenging authority; 53 percent cited fear of disrespect; and 52 percent mentioned lack of being listened to.

The team concluded that eliminating barriers to speaking up requires major changes in departmental processes, in skill training of both frontline and leadership staff, and in culture.

Practical solutions include recognizing people who report adverse events and developing a language script for reporting such events in a non-threatening manner.

Cultural changes should include setting new behavioral norms, eliminating disrespect and fear of retaliation from the work environment, and having leaders invite feedback regarding safety concerns, the researchers concluded.

Creating a Culture of Safety

The findings have led to positive changes at Beth Israel. After reviewing the results, Dr. Siewert and her team formed a safety work group, where representatives from different work areas meet twice a week to discuss the barriers and how to address them.

Since then, Dr. Siewert has noticed a new openness. For instance, earlier this year, a technologist noticed another staff member inadvertantly breaking sterility during a procedure and voiced the concern. "That was a huge save," she said.

Whether results would translate to other academic radiology departments may depend on the size, Dr. Siewert said. Fewer barriers exist between people who know each other better. Indeed, the study showed people who had been working at the institution longer were more likely to report safety events.

Regardless, changing expectations to make safety everyone's responsibility can likely benefit institutions of any size, she said. Encouraging staff to speak up is also critical.

"Physicians and other team leaders need as much information as possible to make the right decisions. By speaking up and providing additional information, staff members can make valuable contributions to patient safety and to the success of their team," Dr. Siewert said.

Barriers to Reporting Safety Incidents

In the *Radiology* study, Dr. Siewert and colleagues identified these barriers to speaking up about safety incidents.

- High reporting threshold (uncertainty about one's observation)
- Challenging authority
- Lack of listening
- Fear of disrespect
- Fear of retribution
- Toxic team leader
- Role on the team
- Uncertainty about responsibility on the team
- Lack of language training for addressing safety issues

Siewert

WEB EXTRAS

Access the study, "Barriers to Safety Event Reporting in an Academic Radiology Department: Authority Gradients and Other Human Factors," at *RSNA.org/Radiology*.

New MRI-Based Technology Shows Promise in Identifying Brain Atrophy Associated with Alzheimer's Disease

BY LYNN ANTONOPOULOS

A promising new visual scoring system using MRI technology has proven to be a relatively quick and inexpensive means of identifying patients with structural brain changes associated with Alzheimer's disease (AD).

Results of the study published in *Radiology* suggest that the MRI-based visual scoring system focused on entorhinal cortex atrophy (ERICA) — one of the first brain structures affected in AD — has the potential to reliably distinguish AD patients from those experiencing subjective cognitive decline (SCD) at an earlier stage in the diagnostic process.

"Aside from neuropsychological testing and cerebrospinal fluid (CSF) biomarkers, structural MRI plays a pivotal role both in evaluating atrophy patterns and excluding other possible causes of given symptoms," said Jonas Enkirch, MD, of the Department of Radiology, University Hospital (UH) in Bonn, lead author of the study.

Although prior studies have shown that the entorhinal cortex and transentorhinal region are affected in early AD, taking quantitative volume measurements for the structures is time-consuming and impractical in the clinical setting Dr. Enkirch said.

"It was our goal to create a simple, yet reliable tool to assess entorhinal cortex atrophy," Dr. Enkirch said. "Its practicable application in daily routine was a matter of prime importance."

Developing the ERICA Score

The researchers conducted a retrospective study in which they first developed the ERICA score using data from a cohort of 48 subjects (20 with AD and 28 control subjects) who underwent 3-Tesla MRI between 2009 and 2016.

Their initial approach was problematic. "Before we devised our visual score, we tried to assess ERICA with simple length-width measurements and ratios thereof," Dr. Enkirch said. "But we left that approach due to low inter-observer reliability."

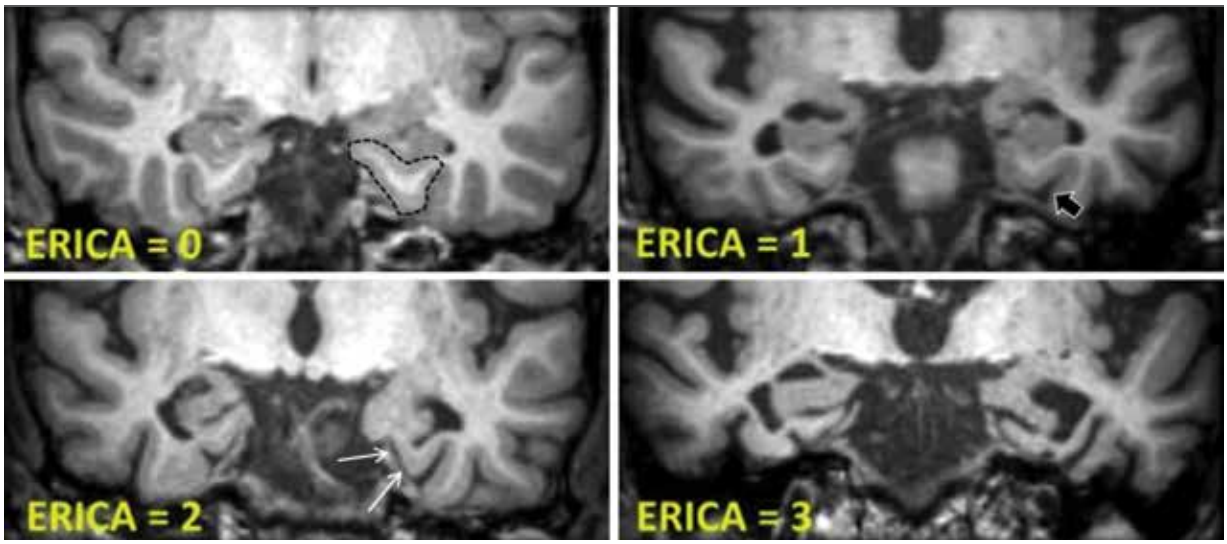
In a modified tactic, researchers categorized ERICA in four stages based on the structural health of the entorhinal cortex. The scores were defined on a scale of zero to two with observed conditions ranging from normal volume of the entorhinal cortex and the parahippocampal gyrus to pronounced atrophy of the parahippocampal gyrus and a wide cleft between the entorhinal cortex and the cerebellar tentorium.

"During the initial development of the score, we were surprised to see recurring patterns of ERICA in patients with AD, especially a detachment of the entorhinal cortex from the cerebellar tentorium, which we later termed the 'tentorial cleft sign'," Dr. Enkirch said.

Using the scoring system, researchers then evaluated an independent cohort of 60 patients suspected of having AD and 60 age-matched patients with SCD. All subjects were patients from an affiliated memory clinic and/or those who were undergoing diagnostic testing for neurodegenerative biomarkers at UH Bonn.

According to the study, all eligible patients were required to have a documented diagnosis of probable AD including abnormal CSF or amyloid PET biomarkers, among other criteria.

Two blinded, independent raters assessed MRI studies of patients with SCD or probable AD. The raters



The ERICA score. The visual pattern for entorhinal cortex atrophy was defined as follows: A score of 0 indicated normal volume of the entorhinal cortex and parahippocampal gyrus (marked area); a score of 1, mild atrophy with widening of the collateral sulcus (black arrow); a score of 2, moderate atrophy with detachment of the entorhinal cortex from the cerebellar tentorium (the "tentorial cleft sign"; white arrows); and a score of 3, pronounced atrophy of the parahippocampal gyrus and a wide cleft between entorhinal cortex and the cerebellar tentorium.
Enkirch, et al., *Radiology* 2018:288;1 © RSNA 2018.

applied the ERICA index test score and compared it to the medial temporal lobe atrophy (MTA) score, a validated means of assessing atrophy of the hippocampus.

Patients with AD had higher ERICA scores than those with SCD, according to results. An ERICA score of two or greater discriminated between AD and SCD better than the MTA score, researchers said.

In terms of an association between the ERICA score and CSF biomarkers, the research demonstrated a strong, positive association of the ERICA score with CSF amyloid markers.

"Although advanced and expensive imaging procedures such as amyloid PET have been developed to identify patients with AD, structural MRI remains fundamental in the diagnostic work-up of a patient with dementia," said study author Andreas Traschütz, MD, PhD, of University Hospital of Tubingen, Germany. "Entorhinal cortex atrophy could be as effectively assessed in a semi-quantitative manner by our ERICA score."

Further Testing of ERICA Score

Realizing the importance of an early AD diagnosis, researchers say confirming the efficacy of the ERICA score is an important next step in the process.

"The utility of the ERICA score remains to be shown in a more prevalent clinical setting, when the patient presents at early stages with mild cognitive impairment (MCI)," Dr. Traschütz said. "At this stage, however, we already see the potential for the 'tentorial cleft sign,' which defines a pathological ERICA score, to become a visual engram for every clinician, prompting consideration of AD dementia."

Along with finalizing a follow-up study on patients with MCI, Dr. Enkirch and colleagues are planning a prospective study in close cooperation with the local memory clinic and the German Center for Neurodegenerative Diseases in Bonn.


Enkirch


Traschütz

WEB EXTRAS

Access the study, "The ERICA Score: An MR Imaging–based Visual Scoring System for the Assessment of Entorhinal Cortex Atrophy in Alzheimer Disease," at *RSNA.org/Radiology*.

New RSNA Online Series Helps Radiologists Navigate Health Care Economics

BY JENNIFER ALLYN

For many radiology residents, fellows and practicing radiologists, learning about how economics and health policy affect the specialty — things like physician reimbursement and regulatory compliance — is far down on the list of items that need to be successfully understood before moving further into their careers.

To help trainees and radiologists navigate the emerging value-based payment systems in the U.S., the RSNA Online Learning Center offers a series of Economics and Health Policy courses. This online series was developed by Richard Duszak, MD, professor of radiology and vice chair for health policy and practice, Emory University School of Medicine, Atlanta, with the help of a 2017 GE Healthcare/RSNA Education Scholar Grant and the RSNA Education Center.

"The reality is that society is looking for meaningful change in how health care services are delivered and paid. I'm a strong believer that that change best comes from within — from physicians who know how our system works, and have made lifelong commitments to providing the best patient care possible," Dr. Duszak said. "If radiologists — whether in private practice or academics — don't understand the complex ecosystem in which they practice, they will never be successful agents of change."

This online series provides radiologists with the knowledge to demonstrate competency in various program-specific areas of health policy and practice management, such as coding, compliance and productivity assessment. The series meets the requirements of the health care economics milestone project recently initiated by the Accreditation Council for Graduate Medical Education (ACGME) and American Board of Radiology (ABR) for all accredited residency and fellowship programs in radiology. Additionally, RSNA provides self-assessment CME (SA-CME) for practicing radiologists seeking education in health care economics and health policy.

To help learners access the content in the format that best fits their learning style, each of the seven educational courses includes a number of short vodcasts —

GRANTS IN ACTION

NAME: Richard Duszak, MD

GRANT RECEIVED: 2017 GE Healthcare/RSNA Education Scholar Grant

STUDY: Radiology Economics and Policy Learning Electronic Toolkit (REPLeT)

CAREER IMPACT: "The GE Healthcare/RSNA Education Scholar Grant has been instrumental, after two decades in private practice, in jump-starting my career as an academic educator. I believe that this content fills an important void in radiology education, and in that way, I see this as great opportunity for me to pay it forward to the profession."

CLINICAL IMPLICATION: The online educational courses provides trainees and radiologists with the knowledge to demonstrate competency in various program-specific areas of health policy and practice management and also meets the economic milestones requirements for all ACGME residency and fellowship programs in radiology. The program provides self-assessment CME (SA-CME) for practicing radiologists seeking education in health care economics and health policy.

> *"If radiologists — whether in private practice or academics — don't understand the complex ecosystem in which they practice, they will never be successful change agents."*
>
> RICHARD DUSZAK, MD

podcasts with videos — pre-populated content-rich slide decks for teaching faculty to create their own lectures, post-tests and an evaluation.

RSNA Courses Offer Valuable, Enduring Content

While Dr. Duszak has been a regular champion of the need to create and advance education in economics and health policy and often lectures and writes on the topic, it wasn't until he learned about the GE Healthcare/RSNA Education Scholar Grant that he had his "aha" moment. He realized that he could create an online series that would democratize and facilitate access to this content for training programs across the country.

"Without the R&E grant support, a matching commitment from my department at Emory, and the support of the RSNA Education Center, I never would have been able to pull this off," Dr. Duszak said. "My R&E grant provided the academic time necessary to plan the curriculum, bring on board experts in adult education as advisors, develop a digital media dissemination strategy and obtain ACGME continuing medical education approval for the curriculum, in addition to the massive amount of time necessary to create brand new content for the series."

This type of education, while meeting a broad need within the radiology educational community, is particularly valuable and Dr. Duszak realized he had a decision to make about how and where to offer the courses.

"A few for-profit continuing education organizations got wind of my idea, but I ultimately decided that doing this in a not-for-profit manner would best serve the radiology community," Dr. Duszak said. "For over two decades, I had been the beneficiary of so much great work that resulted from RSNA, so I saw this as a great opportunity to pay it forward to the profession and create what I hope to be valuable and enduring content."

Dr. Duszak worked with the RSNA Education Center to design the unique format of the courses that are being offered now on the RSNA Online Learning Center.

The courses are available for free to RSNA members and for $75 to nonmembers. Seven courses include topics on reimbursement basics, service valuation and costs, current and emerging payment models, physician performance assessment, revenue cycle management, advanced economics and health policy for nuclear radiologists, and advanced economics and health policy for vascular and interventional radiologists.

"I hope this will be a resource that will help RSNA demonstrate its ongoing value to the radiology community," Dr. Duszak said. "RSNA's partnership adds a lot of credibility to the curriculum, creates a wider distribution to trainees and practicing radiologists, and, I hope, gives other radiologists who have big ideas the encouragement to apply for grants and consider working with RSNA on unique ways to educate their colleagues about important issues facing the specialty."

WEB EXTRAS

Access the Economics and Health Policy courses at *RSNA.org/learning-center-economics-health-policy.*

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YOUR DONATIONS IN ACTION

Record Number of R&E Grant Recipients Receive Distinguished Investigator Award

Dunnick

RSNA Research & Education (R&E) Foundation Grant recipients have a history of making significant research contributions throughout their careers. This year, eight past R&E grant recipients received the 2018 Distinguished Investigator Award from the Academy for Radiology & Biomedical Imaging Research — a record number for R&E researchers.

This prestigious award recognizes independent investigators who have achieved a minimum of 25 peer-reviewed scientific research publications as first or senior author and at least six years of funding as a principal investigator of a major competitive extramural research grant. Awardees have attained a level of accomplishment that ranks within the top 10 percent of all academic radiology faculty. This year, 42 researchers will receive this award and will be acknowledged during a ceremony at RSNA 2018.

"The RSNA R&E Foundation is proud to see so many of its grant recipients continuing to conduct impactful research," said N. Reed Dunnick, MD, chair of the R&E Foundation Board of Trustees. "The Foundation provides radiology investigators with many of the resources needed to jump start their studies, which often leads to further funded research, and ultimately to improved patient care."

R&E grant recipients who will receive the 2018 Academy for Radiology & Biomedical Imaging Research Distinguished Investigator Award are:

- Christine B. Chung, MD, University of California San Diego
- Gregory Chang, MD, PhD, New York University School of Medicine
- Daniel Kim, PhD, Northwestern University
- Yvonne W. Lui, MD, New York University School of Medicine
- Kathryn A. Morton, MD, University of Utah
- Mizuki Nishino, MD, MPH, Harvard University
- Drew A. Torigian, MD, University of Pennsylvania
- Xiaoming Yang, MD, PhD, University of Washington

Register for RSNA 5k Fun Run Supporting R&E Foundation

Nov. 27 at 6:30 a.m

Registration is now open for the RSNA 5k Fun Run along the Chicago lakefront. If you are a runner, casual jogger or walker, you are invited to take part in this race in support of radiology research and education. Race spots fill up quickly, so register yourself or your team early to receive a limited supply commemorative T-shirt. All proceeds benefit the RSNA Research & Education (R&E) Foundation. Register at *RSNA.org/Fun_Run*.

The Fun Run is sponsored by Konica Minolta Healthcare.

The RSNA R&E Foundation provides the research and development that keeps radiology in the forefront of medicine. Support your future—donate today at *RSNA.org/Donate*.

Radiology in Public Focus

Press releases were sent to the medical news media for the following articles appearing in recent issues of *Radiology*.

Women More Likely to Use Other Preventive Health Services after Mammography

Medicare beneficiaries who undergo breast cancer screening with mammography are more likely than unscreened women to undergo other preventive health services like screening for cervical cancer and osteoporosis, according to a new study in *Radiology*.

Mammography is among the most commonly offered preventive services for women ages 40 years and older, but little is known about the association between screening mammography and use of a variety of preventive services in the Medicare population, along with the impact of false-positive mammographic findings on preventive services use.

Researchers from NYU School of Medicine in New York, Emory University in Atlanta and the Harvey L. Neiman Health Policy Institute in Reston, VA, compared preventive services utilization among 185,625 women who underwent mammography from 2010 to 2014 with that of a control group who did not have screening mammography.

The results showed that women who underwent mammography screening, with either positive or negative results, were significantly more likely than unscreened women to later utilize Pap smear, bone mass measurement and influenza vaccine services. In women who had not undergone these preventive measures in the two years prior to screening mammography, utilization of all three services after false-positive mammography screening was no different than after a true-negative screening.

"Our theory is that when patients are counseled about mammography screening, this represents an opportunity for the physician to bring up other preventive services and the health benefits of these services for women in their age group," said Stella Kang, MD, assistant professor of radiology and population health at NYU School of Medicine. "So a patient's interest in breast cancer services specifically could raise awareness in preventive services overall."

WEB EXTRAS

Access the study, "Use of Breast Cancer Screening and Its Association with Later Use of Preventive Services among Medicare Beneficiaries," at *RSNA.org/Radiology*.

Smoking and Diabetes Linked to Brain Calcifications

People who smoke or have diabetes may be at increased risk of hippocampal calcifications according to a new study in *Radiology*.

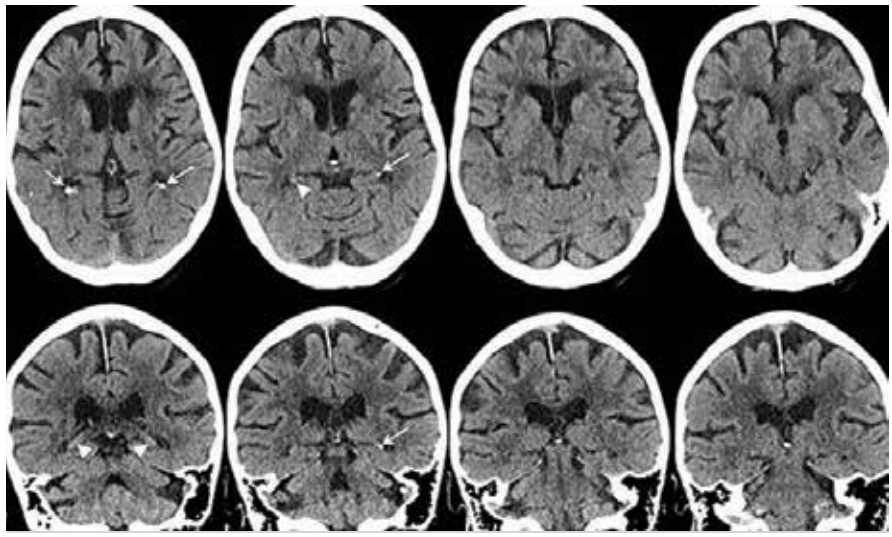
"We know that calcifications in the hippocampus are common, especially with increasing age," said the study's lead author, Esther J.M. de Brouwer, MD, a geriatrician at the University Medical Center in Utrecht, the Netherlands. "However, we did not know if calcifications in the hippocampus related to cognitive function."

The researchers analyzed the CT scans of 1,991 patients, average age 78 years, who had visited a memory clinic at a Dutch hospital between 2009 and 2015.

Results showed that 380, or 19.1 percent, had hippocampal calcifications and older age, diabetes and smoking were risk factors associated with the presence of hippocampal calcifications.

The number of risk factors each patient had was associated with the severity of hippocampal calcifications. In patients with moderate or severe calcifications, 17.0 percent had two risk factors and 3.1 percent had three risk factors, while those without hippocampal calcifications or with mild calcifications, only 11.1 percent had two risk factors and 0.5 percent had three risk factors.

While the study was not designed to conclusively determine if smoking and diabetes increase the risk of hippocampal calcifications, the results strongly suggest a link. However, there was no link between the presence and severity of hippocampal calcifications and cognitive function.



Axial and coronal CT images in an 88-year-old woman show mild hippocampal calcification (*arrowheads*). Arrows indicate calcification of choroid plexus.
de Brouwer, et al., *Radiology* 2018 © RSNA 2018

WEB EXTRAS

Access the study, "Hippocampal Calcifications: Risk Factors and Association with Cognitive Function," at *RSNA.org/Radiology*.

More Breast Cancers Found with Combined Digital Screening

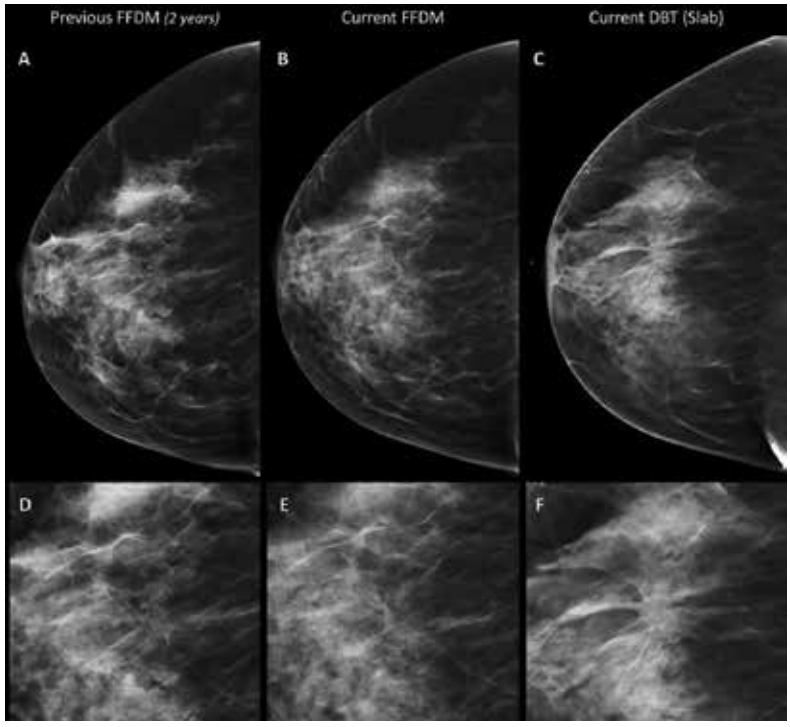
A combination of digital mammography and tomosynthesis detects 90 percent more breast cancers than digital mammography alone, according to a new study in *Radiology*.

To learn more about the impact of digital breast tomosynthesis (DBT) on sensitivity and recall rate, researchers compared results between 9,777 women randomized to undergo digital mammography and DBT and 9,783 randomized to have digital mammography alone.

The combination of digital mammography and DBT detected 8.6 cancers per 1,000 cases, a rate almost twice that of the 4.5 per 1,000 detected by mammography alone. The recall rate was 3.5 percent in both groups. DBT alone detected 72 of 80 cancers found in the DBT and digital mammography group.

"Tomosynthesis and digital mammography is much more sensitive than digital mammography," said the study's principal investigator, Pierpaolo Pattacini, MD, radiologist and director of the radiology department at AUSL Reggio Emilia in Reggio Emilia, Italy. "The vast majority of the advantage is due to tomosynthesis alone."

While DBT's higher sensitivity would seem to make it a logical choice for breast cancer screening programs, more research is needed to weigh the benefits against any undesired effects. The gain in detection for combined digital mammography and DBT was higher for ductal carcinoma in situ than for invasive cancer.



Images in a 70-year-old woman in the digital breast tomosynthesis (DBT) plus digital mammography (DM) study arm. She had a breast density of Breast Imaging Reporting and Data System category C. A spiculated opacity is seen in the parenchyma of the upper-central quadrant of the right breast. A, D, Full-field DM (FFDM) obtained 2 years previously. B, E, Current FFDM images show only very fine converging speculation in the parenchyma. C, F, At DBT, the opacity with its irregular stellate margins is clearly visible. Both readers judged DBT alone and DBT+DM as showing positive results. Histologic examination after US-guided tru-cut biopsy and surgical specimen examination revealed invasive ductal carcinoma grade 2, luminal A, 15 mm.
Pattacini, et al., R*adiology* 2018 © RSNA 2018.

The additional reading time DBT would require is another consideration. According to the researchers, implementing tomosynthesis in public screening programs would require rethinking protocols and reading technologies to reduce or eliminate the extra costs.

WEB EXTRAS

Access the study, "Digital Mammography versus Digital Mammography Plus Tomosynthesis for Breast Cancer Screening: The Reggio Emilia Tomosynthesis Randomized Trial," at *RSNA.org/Radiology*

Media Coverage of RSNA

In May, 803 RSNA-related news stories were tracked in the media. These stories reached an estimated audience of 290 million people.

Coverage included WGN-AM (Chicago), *Philly.com*, *The Arizona Republic, Diagnostic Imaging*, *Pittsburgh Post-Gazette*, *Auntminnie.com*, *DOTmed Business News*, *Radiology Business Journal* and *Health Imaging & IT*.

September Public Information Outreach Activities Focus on Ovarian and Prostate Cancers

In recognition of Ovarian Cancer and Prostate Cancer Awareness Months in September, RSNA is distributing public service announcements (PSAs) to inform patients about the risk factors, available screening methods and treatment options for these diseases.

New on *RadiologyInfo.org*

Visit *RadiologyInfo.org*, the public information website produced by RSNA and ACR, to read new patient information on pancreatic cancer disease and treatment.

RadiologyInfo.org
For patients

Journal Highlights

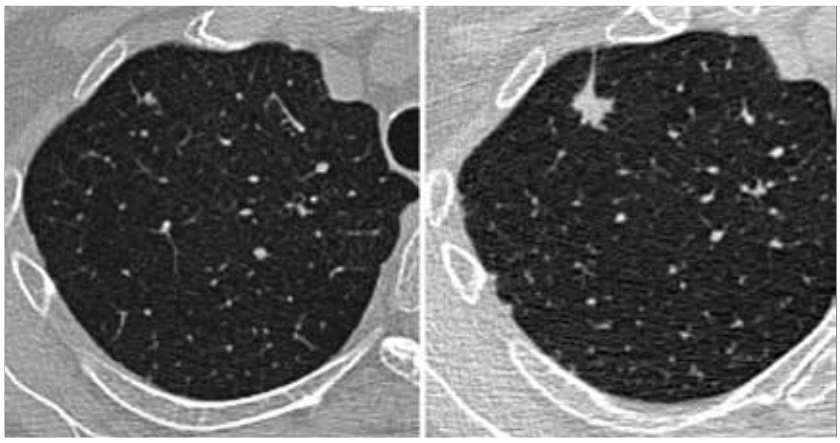
The following are highlights from the current issues of RSNA's two peer-reviewed journals.

Importance of Long-term Low-Dose CT Follow-up after Negative Findings at Previous Lung Cancer Screening

While lung cancer screening has been extensively studied over the last two decades, the long-term duration and time interval of low-dose CT in lung cancer screening remains unclear.

In an article published online in *Radiology* (*RSNA.org/Radiology*), John Kavanagh, FFR, RCSI, University Health Network, Toronto Canada, and colleagues studied the incidence of lung cancer in a cohort of patients with negative findings at previous lung cancer screening.

Of those who were part of the International Early Lung Cancer Action Program screening study between 2003 and 2009, 4,782 were identified with negative screening results, which was defined as no solid nodules greater than 5 mm and no nonsolid nodules greater than 8 mm at the close of the study.



Axial low-dose noncontrast CT images in 77-year-old man (risk score, 18.9%). A CT scan obtained in 2007 (*left*) demonstrates punctate nodule in the right upper lobe. A follow-up CT scan obtained in 2016 (*right*) shows that the nodule has developed into a spiculated nodule.
Kavanagh, et al., *Radiology* 2018;InPress © RSNA 2018.

Starting with those at highest risk, identified by factors including age, smoking history, body mass index, family history of lung cancer, years since smoking cessation and diagnosis of chronic obstructive pulmonary disease, 327 participants were contacted and 200 underwent low-dose CT.

The median time since previous CT was seven years. The incidence rate of developing lung cancer during the next six years was estimated at 5.6 percent. The period prevalence of lung cancer was 20.8 percent (new and preexisting lung cancer, 68 of 327). The detection rate of low-dose CT was 7 percent (14 of 200 subjects). Of the 14 screening-detected cancers, 12 were stage I or II.

Radiology

"Our study shows that high-risk individuals have a high incidence of lung cancer after previous negative low-dose CT examinations and, therefore, that screening should continue beyond three years. The definition of the optimum screening interval may be different for various groups of individuals and will be the subject of future studies," the authors conclude.

Opening in October – *Radiology: Cardiothoracic Imaging* Submissions

Radiology: Cardiothoracic Imaging, one of the three new online-only journals from RSNA, is accepting original research and editorial submissions beginning Oct. 1. The journal will debut in spring 2019.

Suhny Abbara, MD, is editor of the bi-monthly journal that will emphasize research advances and technical developments in medical imaging that drive cardiothoracic medicine.

Submissions are currently open for *Radiology: Artificial Intelligence*, which will publish in early 2019.

For more information on the new journals, go to *RSNA.org/Journals*.

Listen to *Radiology* Editor David A. Bluemke, MD, PhD, discuss this month's research you need to know. Podcasts summarize the importance and context of selected recent articles. Subscribe today at *RSNA.org/Radiology-Podcasts* and never miss a single episode.

Radiology PODCASTS

Highlights include:

- "US Time-Harmonic Elastography: Detection of Liver Fibrosis in Adolescents with Extreme Obesity with Nonalcoholic Fatty Liver Disease," Hudert CA, et al.
- "General Practitioners Referring Adults to MR Imaging for Knee Pain: A Randomized Controlled Trial to Assess Cost-effectiveness," Oudenaarde K, et al.
- "Radiation Dose Reduction by Using CT with Iterative Model Reconstruction in Patients with Pulmonary Invasive Fungal Infection," Yan C, et al.

Successful Integration of Contrast-enhanced US into Routine Abdominal Imaging

Contrast–enhanced ultrasound (US) is recognized increasingly as a useful tool in a wide variety of hepatic and nonhepatic applications and was recently approved for limited use for liver indications in adult and pediatric patients in the U.S.

In an article in the September-October issue of *RadioGraphics* (*RSNA.org/RadioGraphics*), Xiaoyang Liu, MD, PhD, University Health Network, Toronto, Ontario, Canada, and colleagues discuss common abdominal applications of contrast-enhanced US and how to implement it into a clinical practice.

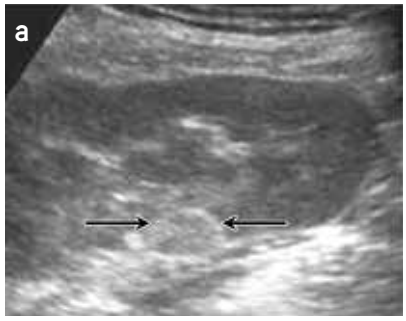
Contrast-enhanced US is useful to characterize indeterminate lesions detected at baseline US and those found with other imaging modalities such as CT or MRI. Contrast-enhanced US can also be used when intravenous contrast material is necessary but iodine and/or gadolinium-based contrast agents are contraindicated, mostly in patients with renal failure.

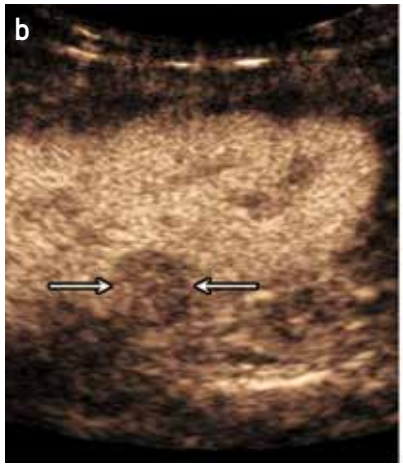
The most common renal indication for contrast-enhanced US is for differentiation of neoplastic from non-neoplastic complex cysts. Owing to its high sensitivity for detection of vascularity, contrast-enhanced US is a simple and useful tool to confirm the vascularity of a neoplastic cyst or exclude malignancy in the absence of vascularity in a complex-appearing cyst with high confidence.

The real-time nature of contrast-enhanced US and its high contrast resolution allow the modality to show arterial enhancement more consistently than does CT or MRI. The purely intravascular nature of contrast-enhanced US also allows for better determination of washout.

RadioGraphics

"Contrast-enhanced US offers advantages that provide added value to imaging practice in various organ systems and has an essential role in multimodality imaging. These advantages include extremely high sensitivity to the microbubble contrast agent, real-time imaging, the purely intravascular property of contrast agents, lack of nephrotoxicity, easy repeatability, portability and relatively low cost," the authors write.





Small solid malignant nodule in a 31-year-old man after a kidney transplant. (a) Surveillance US image of the transplanted kidney shows a hyperechoic nodule (arrows). (b) Contrast-enhanced US image obtained immediately after the baseline US image shows arterial phase hypovascularity of the nodule (arrows) compared with the adjacent renal cortex at 9 seconds. (c) At 60 seconds, relatively early washout (arrows) is seen. The contrast-enhanced US findings were highly suggestive of malignancy. Biopsy results showed papillary renal cell carcinoma, and the patient was treated successfully with radiofrequency ablation.
Liu, et al., *RadioGraphics* 2018;38;5 © RSNA 2018.

This article meets the criteria for *AMA PRA Category 1 Credit*™. SA-CME is available online only.

Listen to *RadioGraphics* Editor Jeffrey S. Klein, MD, and authors discuss the following articles from recent issues of *RadioGraphics* at *RSNA.org/RG-Podcasts.*

RadioGraphics PODCASTS

- "CT for Evaluation of Acute Gastrointestinal Bleeding," Wells, M.L., et al.
- "Incomplete Cord Syndromes: Clinical and Imaging Review," Kunam, V.K., et al.

Audio summary podcasts (also available on iTunes and Google Play) include these studies: "CT and MR Imaging of Cardiothoracic Vasculitis," Broncano, J. et al; "Imaging of Acute Conditions of the Perineum," Choe J., et al; and "Sarcoidosis from Head to Toe," Ganeshan, D., et al.

Education and Funding Opportunities

Writing a Competitive Grant Proposal Workshop

March 8 – 9, 2019
RSNA Headquarters
Oak Brook, IL

Registration is open for the Writing a Competitive Grant Proposal Workshop designed for researchers in radiology, radiation oncology, nuclear medicine and related sciences who are interested in actively pursuing federal funding.

The course fee is $225. Register online at *RSNA.org/CGP*.

NIH Grantsmanship Workshop

The NIH Grantsmanship Workshop, which introduces participants to the process of preparing a competitive research or training grant application, will be held Saturday, Nov. 24, from 1 to 5 p.m. at McCormick Place in Chicago. Workshop attendees must be registered for the RSNA annual meeting and can add the workshop to My Agenda at *RSNA.org/Annual-Meeting*.

For more information, contact the department of research at *DOR@rsna.org* or 630-368-3742.

Online NIIC Course Focuses on Fundamentals of Informatics

Senior radiology residents looking to understand the fundamentals of imaging informatics can participate in the innovative, weeklong online National Imaging Informatics Curriculum and Course (NIIC) to be held Oct. 9-12. RSNA partners with the Society for Imaging Informatics in Medicine (SIIM) to sponsor the course.

Developed with a grant from the Association of University Radiologists R&E Foundation, the course features live and recorded lectures and small group discussion sessions.

To register for the course, go to *RSNA.org/Informatics*.

RSNA Artificial Intelligence (AI) Webinar Set for October

RSNA is offering a series of 60-minute webinars on artificial intelligence (AI) featuring internationally renowned experts.

The second webinar in the series, "Current State and Future Perspectives of AI," will be held Thursday, Oct. 25 at 11 a.m. (CT). It will provide an overview of the current and near future applications of AI in radiology.

Paul Chang, MD, vice chair, radiology informatics at the University of Chicago will serve as moderator. Other speakers include Luciano Prevedello, MD, MPH, chair of the RSNA Machine Learning Steering Committee for the Radiology Informatics Committee and chief, Division of Imaging and Informatics, the Ohio State University Wexner Medical Center, Columbus, and Abdul Halabi, global business development lead, healthcare and life sciences at NVIDIA, Santa Clara, CA.

Additional webinars are:

• "Future Applications of AI," Dec. 11, 2018, 11 a.m. (CT); Moderator: Adam Flanders, MD; additional speakers: Charles E. Kahn, MD, MS, Marc Kohli, MD, and J.R. Geis, MD.

• "AI, an Ally or an Enemy?" Feb. 21, 2019, 11 a.m. (CT); Roundtable speakers will include: Curtis P. Langlotz, MD, PhD, and Drs. Chang and Flanders.

The first webinar, "Intro to AI and Machine Learning: Why All the Buzz," held on Aug. 10, and subsequent ones will be available on-demand beginning on Sept. 26.

Each webinar is $35 for members; $50 for non-members. For more information and to register, go to *RSNA.org/AI-webinars*.

Value of Membership

RSNA R³ Program Keeps Training Members in the Know

The RSNA Resident Representative (R³) program creates awareness of RSNA resources and facilitates communication between RSNA and radiology residents.

Launched three years ago by the RSNA Resident and Fellow Committee, the program includes second-year residents as selected by radiology residency programs around the world to serve as R³ representatives. These residents receive a monthly e-newsletter from RSNA with useful information such as education resources to share with their fellow trainees.

R³ representatives also participate in select RSNA surveys aimed at identifying current interests and needs of residents. At the end of the year, each R³ participant is recognized during the RSNA annual meeting with their name showcased in the Residents Lounge.

Currently, 192 resident representatives from 178 institutions participate in the R³ program. R³ submissions have concluded for the 2019 academic year. For more information about participating in the program starting in 2020, email *customerservice@rsna.org*.

RSNA 2018 Registration Open

RSNA offers several registration options to best meet your needs. Visit *RSNA.org/Registration-Packages* to choose a package that's right for you.

Important Dates for RSNA 2018

Oct. 26	Advance Registration Deadline; after this date rates increase $160 for most categories
Oct. 27	Canceling a hotel reservation as of this date will result in the forfeiture of the hotel deposit equal to one night's room and tax
Nov. 25 – 30	104th Scientific Assembly & Annual Meeting

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Register Now and Plan Your RSNA 2018 Experience

Explore "Tomorrow's Radiology Today" by attending RSNA 2018. Whether your goal is to stay current on new techniques, learn about the latest technology or network with your peers, there is a registration option that will meet your needs. Visit *RSNA.org/Annual-Meeting* for a personalized registration recommendation.

Virtual RSNA 2018 – Register for the Virtual Meeting, offering more than 200 live-streamed and on-demand courses, scientific presentations and education exhibits. The Virtual Meeting also provides access to more than 2,000 education exhibits and scientific posters. CME credit is available for many sessions and registered attendees will have access to all content through April 2019.

Bistro RSNA – The Bistro offers a full menu and ample seating for lunch during the meeting and brunch will be available in the Technical Exhibits Hall on Thursday. Reserve tickets in advance at *bistroticket.com/rsna*.

5K Fun Run – Race your colleagues and fellow attendees to the finish line of the RSNA 5K Fun Run on Tuesday, Nov. 27, at 6:30 a.m. Race spots fill up quickly, so register yourself or your team early to ensure you receive a commemorative T-shirt. All proceeds benefit the RSNA R&E Foundation. Fun run registration is open at *RSNA.org/Fun-Run*.

The 5K Fun Run is sponsored by Konica Minolta Healthcare.

Discovery Theater – Offering a variety of programs from musical acts to educational presentations, the Discovery Theater is a great place to relax and learn. Visit the online meeting program for a schedule of events.

Access the RSNA Meeting Program Online in 2018

In order to reduce our environmental footprint, RSNA will transition from a print to a digital meeting program beginning in 2018, offering the most important meeting information in these formats:

• **Meeting Central** *(Meeting.RSNA.org)* Explore the meeting program, review the roster of technical exhibitors and build your personalized schedule on My Agenda.

• **The RSNA 2018 Meeting App** Browse the meeting program, access maps to navigate McCormick Place and customize your daily meeting schedule with My Agenda. The app will be available in October via the App Store and Google Play.

While the Program in Brief will no longer be available in print, RSNA will continue to publish the onsite Pocket Guide, an easy-to-use reference to course and event information, floor plans at McCormick Place and transportation and dining, plus subpsecialty content brochures in print and online.

The Meeting App is sponsored by Google Cloud.

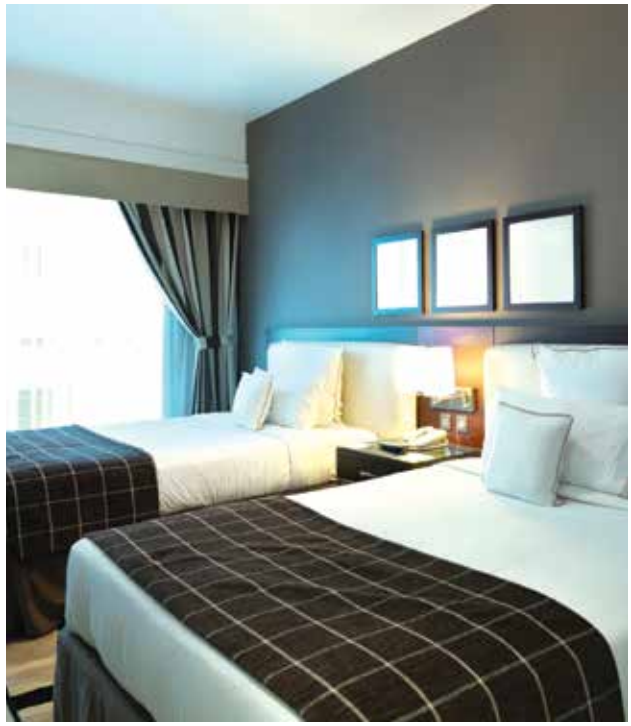
Annual Meeting Watch

Reserve Your Hotel Room by Sept. 12 for Best Savings

Let RSNA help plan your stay in Chicago for RSNA 2018. Reserve by Sept. 12 to take advantage of the best hotel room selection in downtown Chicago.

Advantages to reserving your hotel through RSNA, include:
- Earn hotel loyalty points
- Choose from nearly 100 downtown Chicago hotels
- Secure great hotel rates
- Access the free shuttle service or Metra Electric rail system to/from McCormick Place

Find the hotel that best fits your needs by visiting *RSNA.org/hotel-reservations*. If you are traveling internationally to RSNA 2018, ESA Voyages and ACE Marketing are the official international travel agencies offering travel packages to the annual meeting. Contact RSNA hotel services at *housing@rsna.org* for additional information.



OBSERVE BEFORE YOU RESERVE!

Experient is the only certified partner to reserve your 2018 RSNA hotel rooms!
Be aware of fraudulent and counterfeit websites—only reserve your RSNA hotel reservations through Experient, our trusted partner since 1980.

Experience the TravelStore Difference and Enter to Win Free Airfare

Book your trip with TravelStore and experience the personalized service that has made it one of the best travel management companies in the U.S. TravelStore has a special offer for RSNA attendees. Book air travel through TravelStore by Oct. 26 to be entered in a drawing for a $500 USD travel credit toward future airfare on United Airlines. Call 1-310-752-9106 between 10:30 a.m. and 7 p.m. CT and mention code AM2018.

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Save Up to 10 Percent with Exclusive Airline Discounts

United Airlines offers discounts from 2 to 10 percent off applicable fares to RSNA 2018. Discounts apply on United Airlines and flights operated by United or other airlines branded United Express. International discounts are allowed on flights operated and/or marketed on the following carriers, provided such flights are booked by a travel agency or United Reservations:
- Flights via the Atlantic: Air Canada, Austrian Airlines, Tyrolean Airways, Brussels Airlines, Lufthansa Airlines, Swiss International Airlines.
- Flights via the Pacific: United codeshare flights operated by All Nippon Airways.

Applicable terms and restrictions apply. Book online at *United.com/MeetingTravel* and enter offer code ZECR659898 or call United at 1-800-426-1122 and provide the offer code. A service fee applies for phone reservations.

Delta Airlines offers special discounts on most fares: restrictions may apply.

Discounts are applicable to U.S./Canada origination passengers. Book online at *Delta.com/Meetings* and enter Meeting Event Code NMS2L or call Delta at 1-800-328-1111 and provide the event code. A service fee applies for phone reservations.

International Visitors

RSNA is deeply committed to serving all of our members and supporting the vital work being done in North America and abroad to further advance the science of radiology. The pursuit and exchange of science and education is an important part of our goal to improve patient care.

Over 10,000 international attendees participated in RSNA 2017 and RSNA continues to invite radiologists from around the world to take part in our programs and resources.

RSNA encourages all international travelers to the annual meeting and other educational programs to make travel plans as early as possible. Please visit *RSNA.org/Visas* for updated information on travel to the United States.

Exhibit in the Start-Up Showcase at RSNA 2018

Application Deadline Oct. 31

Are you working for an emerging or start-up company in the health care industry? Engage with radiology professionals, network with industry experts and present your products or services to potential investors as part of the RSNA Start-up Showcase, comprised of 24 kiosks in a specially designated area of the Technical Exhibits Hall at RSNA 2018.

The Start-up Showcase gives emerging companies a turn-key experience to reach important decision makers. Applications are due by Oct. 31 and the showcase is limited to the first 24 participants. Information and eligibility requirements are available at *RSNA.org/start-up-showcase.*

For questions, contact the RSNA Exhibit Sales Team at *sales@rsna.org* or 1-630-481-1046.

COMING NEXT MONTH

Next month, *RSNA News* provides a preview of the 3D printing features and opportunities planned for RSNA 2018.

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