

The Greening of Radiology: Simple Changes Reduce Energy Use, Carbon Footprint

ALSO INSIDE:

MR Imaging Provides New Keys to Psychiatric Disease

MR Microscopy Holds Promise for Brain Tumor Research

Real-time Dose Technology Measures Staff Exposure, Minimizes Risk

Timeliness of Follow up After Abnormal Mammography Results Varies Widely

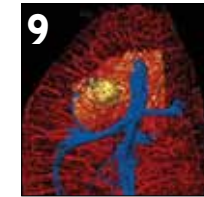
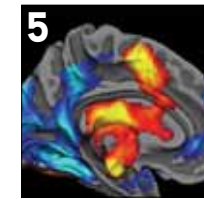
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Front, from left: National Institute of Biomedical Imaging and Bioengineering (NIBIB) Director Roderic Pettigrew, M.D., Ph.D., and NIBIB Deputy Director Belinda Seto, Ph.D., with (back row, from left) new National Advisory Council for Biomedical Imaging and Bioengineering (NACBIB) members Cato Laurencin, M.D., Ph.D., John Gore, Ph.D., and Mark Musen, M.D., Ph.D.

NIBIB Appoints New Advisory Council Members

Three new members have been appointed to the National Advisory Council for Biomedical Imaging and Bioengineering (NACBIB) of the National Institute of Biomedical Imaging and Bioengineering (NIBIB):

John C. Gore, Ph.D., is the Hertha Ramsey Cress chair in medicine, university professor and director of the Institute of Imaging Science at Vanderbilt University Medical Center in Nashville. Dr. Gore is a member of RSNA's Molecular Imaging Committee.

Cato T. Laurencin, M.D., Ph.D., is director of the Institute for Regenerative Engineering and the chief executive officer of the Connecticut Institute for Clinical and Translational Science, Farmington. He is also the Albert and Wilda Van Dusen Distinguished Professor of Orthopaedic Surgery and a professor of chemical, materials and biomolecular engineering at the University of Connecticut, Storrs.

Mark A. Musen, M.D., Ph.D., is head of the Stanford Center for Biomedical Informatics Research and professor of medicine and computer science at Stanford University.

NIBIB, a component of the National Institutes of Health, implements a wide variety of biomedical imaging and bioengineering programs to foster the development of innovative medical technologies to improve healthcare.

Brant-Zawadzki Named to R&E Board of Trustees

A renowned MR imaging expert, **Michael Brant-Zawadzki, M.D.**, has been named the newest member of the RSNA Research & Education (R&E) Foundation Board of Trustees. Dr. Brant-Zawadzki, succeeds Vijay M. Rao, M.D., who has served on the R&E Board of Trustees since 2008.

Dr. Brant-Zawadzki is the executive medical director of the Neuroscience Center of Excellence, Hoag Memorial Hospital, Newport Beach, Calif., and an adjunct clinical professor of diagnostic radiology at Stanford University.

Along with serving as the current vice-chair of the R&E Public Relations Committee, Dr. Brant-Zawadzki has served on the R&E Fund Development Committee and R&E Visionaries in Practice Subcommittee. He is a Gold Visionary donor to the Foundation.

Dr. Brant-Zawadzki is a member of the RSNA Public Information Advisors Network (PIAN), past chair of the Public Information Committee and has served as an associate editor and reviewer for *Radiology*.



Numbers in the News

16

Number of days by which institutions should follow up after abnormal results on screening mammography, according to a study published in the November 2011 issue of *Radiology*. Timeliness of follow up varies widely across institutions, suggesting the potential for improvement and underscoring the need for published guidelines for the U.S. [Read more on Page 13.](#)

44

Number, in millions, of adults who have a diagnosable mental disorder each year, according to the Centers for Disease Control and Prevention. Additionally 13.7 million children are affected. [Turn to Page 5 to learn how MR imaging is helping researchers correlate psychiatric disorders with structural and chemical abnormalities in the brain.](#)

198

Number of RSNA Research & Education (R&E) Foundation grant applications received for the January/February deadlines. Applications are currently under review and funding decisions will be made by the R&E Foundation Board of Trustees later this month. [For a listing of recent donors that help make R&E Foundation grants possible, turn to Page 15.](#)

72,000

Estimated kilowatt hours (kwh) wasted annually in one radiology department by leaving desktop computers and PACS on unnecessarily, according to research presented at RSNA 2011. This equates to almost \$5,000 in electrical running costs, equivalent to the carbon emissions of six passenger vehicles each year. [Learn more about the movement to "green" radiology on Page 7.](#)

TELL A COLLEAGUE—RENEW NOW

RSNA members who did not renew their membership by Dec. 31, 2011, ceased receiving their RSNA publications, including *RSNA News*. Know someone who hasn't renewed? Encourage them to retain all the benefits of their RSNA membership by renewing today at RSNA.org/renew.

In addition to subscriptions to *RSNA News*, *RadioGraphics* and *Radiology*, RSNA benefits include:

- Free advance registration to the annual meeting
- Free education tools to maximize learning and earn CME
- Networking opportunities with radiology professionals from across the globe
- myRSNA®, which lets you build your own personal online workspace

Members who are transitioning into practice from training pay reduced rates their first and second years. For more information on RSNA membership, contact membership@rsna.org, 1-877-RSNA-MEM (776-2636) or 1-630-571-7873 (outside the U.S. or Canada).

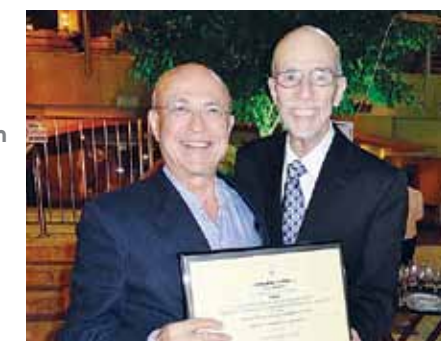


Not too Early to Set Up Group Billing for 2012

Practices and academic institutions with large numbers of RSNA members can take advantage of group billing to receive just one invoice during the next membership renewal cycle. To set up this option, contact the RSNA Membership Department at membership@rsna.org or 1-877-776-2636 (630-571-7873 outside the U.S. and Canada).

Berlin Receives ISRA Honorary Membership

Leonard Berlin, M.D., was named an honorary member of the Israeli Radiology Association (ISRA) during the recent ISRA Annual Meeting in Eilat, Israel. Dr. Berlin, who presented the lecture, "Medical Malpractice Litigation: America's Infamous Export to the World, Status 2011," at the annual meeting, is a member of the RSNA/American College of Radiology (ACR) Task Force on a Core Curriculum for Professionalism and RSNA's Public Information Advisors Network (PIAN).



Moshe Graif, M.D., (left) chair of the Israeli Radiology Association, presents the certificate of honorary membership to Leonard Berlin, M.D., during the recent ISRA annual meeting.

Only Qualified RTs Should Perform Coal Miner Scans, Agency Says

THE U.S. DEPARTMENT of Health and Human Services (HHS) has proposed a new rule allowing only qualified radiologic technologists to produce radiographs of lungs of coal miners under the Coal Workers' Health Surveillance Program.

The "Specifications for Medical Examinations of Underground Coal Miners" outlines the specifications for providing, interpreting, classifying and submitting

chest X-rays of underground coal miners for the surveillance of coal workers' pneumoconiosis. The program is administered by the National Institute for Occupational Safety and Health.

Current standards do not require that qualified RTs perform the radiography. The American Society of Radiologic Technologists supports the proposal and recommends that HHS use the same defi-

inition of radiologic technologists used in the Consistency, Accuracy, Responsibility in Excellence (CARE) in Medical Imaging and Radiation Therapy bill.

The proposed amendments would also add a set of standards permitting the use of digital radiography systems, as the current standards pertain to film-based radiography systems only.

Sunshine Act Postponed to Later This Year

Originally scheduled to begin in January 2012, the federal Physician Payment Sunshine Act designed to promote transparency between healthcare drug and device manufacturers and physicians and big teaching hospitals will now take effect later this year.

Part of the 2010 healthcare reform package, the Sunshine Act requires applicable drug, medical device and other manufacturers to collect data on payments to physicians and teaching hospitals and annually report those numbers to the U.S. Department of Health and Human Services Centers for Medicare and Medicaid Services (CMS). It also requires these manufacturers, as well as drug and device supplier group purchasing organizations, to annually report physician ownership and investment interests.

By shedding light on such information, the law is intended to discourage inappropriate conflicts of interest from developing. "... while some collaboration is benefi-

cial to the continued innovation and improvement of our health care system, payments from manufacturers to physicians and teaching hospitals can also introduce conflicts of interests that may influence research, education, and clinical decision-making in ways that compromise clinical integrity and patient care, and may lead to increased health care costs," according to the CMS proposed rules.

CMS will not require applicable manufacturers and group purchasing organizations to begin data collection until the proposed rule is finalized "as soon as possible during calendar year 2012," according to the agency.



The first reporting deadline for data collected in 2012 will be March 31, 2013, according to CMS. Under the proposal, applicable manufacturers and group purchasing organizations are subject to civil monetary penalties for failing to comply with the reporting requirements of the statute.

The Medical Imaging & Technology Alliance (MITA) offers a list of resources on the Sunshine Act on its website, www.medicalimaging.org, under Policies and Positions.

To access the U.S. Department of Health and Human Services Centers for Medicare and Medicaid Services proposed rules, go to www.cms.gov.

ABR Update

ABMS to Publicly Report MOC Status of All Board-certified Physicians ABR to Provide Online Clarification

Beginning August 1, 2012, the American Board of Medical Specialties (ABMS) will begin reporting on its public website, www.certificationmatters.org, whether or not physicians certified by any of the 24 ABMS Member Boards are meeting Maintenance of Certification (MOC) requirements. This includes ABR board-certified diagnostic radiologists, radiation oncologists and medical physicists.

While complying with the new ABMS standard, the ABR is determined to make it perfectly clear to anyone researching the certification status of its diplomates online that physicians certified before the

MOC program started are NOT required to participate in MOC.

The ABMS has agreed to ABR's request to insert a link on the ABMS public reporting website to the ABR's website. This will enable the ABR to clearly explain that physicians with lifetime certification status need not "meet the requirements" of MOC to retain their valid ABR certification. This information cannot be displayed on the ABMS website because of limitations placed by ABMS.

The ABR has accelerated the development of its own online verification data-

base, which will be available by August 1, 2012. Users will be instructed to access the ABR's new database or contact the ABR directly to obtain information regarding whether a specific physician is required to participate in MOC.

The ABR hopes this initiative will reflect its vigorous efforts on behalf of its diplomates to render the mandated ABMS reporting process clear, fair and consistent with its commitment to those with ABR lifetime certifications.

African Society of Radiology Holds Second Congress

After holding its first meeting in 2011, the African Society of Radiology (ASR) will hold its 2nd ASR Congress in Bibliotheca Alexandrina, Egypt, from April 3-6. The Congress was organized by ASR and the Egyptian Society of Radiology and Nuclear Medicine. The 2011 Congress was attended by more than 120 radiologists from 19 countries in Africa, Europe, Australia and North America. Pictured at the 2011 Congress, from left: Congress President Professor Mohamed DeFortia, ASR Honorary President Professor Guy Frija and first ASR President Professor Jan Labuscagne. The Current ASR President is Professor Hassen Gharbi of Tunisia. For more information on ASR, go to www.asr2012.com.



My Turn

Technology is Best Way to Address Self-referral Abuses

Self-referral is rampant in the healthcare system in the U.S. and is one of the factors most responsible for avoidable costs and unnecessary patient risk through unnecessary exposure to ionizing radiation. Financially motivated self-referral siphons money from the health system to no benefit of patients and must be much more effectively addressed by CMS and the private insurance industry.

How we got to where we are today is a painful and sobering story of unintended consequences in healthcare legislation. The so-called Stark Laws provide legal safe harbors with loopholes large enough to drive an MRI device or CT scanner through, let alone radiation therapy devices. What is more disheartening than the failure of CMS and Congress to take action is the rapacious behavior of so many physicians across our country.

Ironically, the financial pressures facing the U.S. may provide the best opportunity to address self-referral. Policymakers are beginning to better understand the erosive and destructive financial aspects of self-referral. At the same

time, government initiatives such as the Health Information Technology (Health IT) Act are creating incentives for physicians to adopt information systems in their practices and CMS is sponsoring a demonstration project to test the utility of computer-based decision support systems to help guide utilization of imaging procedures.

Optimistically, these initiatives will provide the vehicles to deliver real-time point-of-care feedback to referring physicians about appropriateness and help weed out unnecessary studies - whatever their origin. Yes, ethics will still be important but experience with such IT systems indicates that monitoring of physician performance to look for

abusers of utilization is feasible. This approach offers several wins at the same time—better selection of patients, better selection of modalities and protocols, and education of referring physicians through case-by-case feedback while saving money for the health system.

James H. Thrall, M.D., is radiologist-in-chief at Massachusetts General Hospital and the Juan M. Taveras Professor of Radiology at Harvard Medical School in Boston. Dr. Thrall has served as a Perspectives Editor for *Radiology* and received the RSNA Gold Medal in 2007. He served on the RSNA Research & Education Foundation Board of Trustees from 2002 to 2008.



Technology Forum

New Agreement Reached on FDA Medical Device User Fees

While the final details must be ironed out, the Medical Imaging & Technology Alliance (MITA) and U.S. Food and Drug Administration (FDA) have agreed in principle on the FDA's medical device user fee program. This agreement proposes to reauthorize the medical device user fee program and includes commitments from the FDA to improve the device review program, including additional transparency and predictability.

The agreement also includes, for the first time, new goals for total review time for premarket reviews. MITA said

the agreement also enhances premarket review by putting in place mechanisms for earlier, more effective communications between manufacturers and

FDA and improvements to both the pre-submission interaction and guidance development processes. The agreement also includes an independent, third-party audit of the premarket review program. The user fees associated with the agreement total \$595 million over five years to hire more than 200 full-time employees including 140 new device reviewers. MITA was one of

three industry associations that negotiated the agreement.

"In a time of tremendous advances in imaging and radiation therapy technologies, the agreement enables the industry to bring innovative, life-saving technologies to market faster, so that patients receive the care they need," said Lindsay Morris, MITA acting executive director. "The increase in resources to the agency under this agreement corresponds to a more timely approval process, which will benefit patients and the manufacturers who develop these innovative technologies."



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MR Imaging Provides New Keys to Psychiatric Disease

MR imaging is helping researchers correlate psychiatric disorders with structural and chemical abnormalities in the brain and could one day provide a valuable diagnostic and treatment-monitoring tool for patients, according to some experts.

PSYCHIATRIC DISORDERS like schizophrenia, bipolar disorder and attention deficit/hyperactivity disorder (ADHD) exact an enormous toll on society. One in two Americans has a diagnosable mental disorder each year, according to the Centers for Disease Control and Prevention, including 44 million adults and 13.7 million children. The Institute of Medicine recently named depression and schizophrenia as two of the “big nine” chronic conditions that dominate the U.S. medical landscape.

The complexity of human behavior and lack of quantitative objective measures for psychiatric diseases make accurate diagnosis challenging. For instance, bipolar disorder is often misdiagnosed as clinical depression, resulting in misguided treatment approaches. MR-based tools such as MR morphometry, diffusion-tensor imaging (DTI), functional MR (fMRI) imaging and MR spectroscopy have shown promise as diagnostic tests for psychiatric conditions.

In research presented at RSNA 2011, Xiaobo Li, Ph.D., an assistant professor of radiology at Albert Einstein College of Medicine in New York, and colleagues used fMRI to compare the brains of 20 children with ADHD and 15 healthy children as they performed a visual attention working memory task. The fMRI scans showed disturbances in functional connectivity between the visual sensory cortex and the prefrontal cortex in the ADHD group, suggesting that fMRI could be useful for the initial evaluation of patients.

Dr. Li, who has researched psychiatric disorders with MR since 2004, is working on new research using DTI to show white matter impairment in the attention processing pathways in children with ADHD. Advances in MR technology helped fuel her findings, she said.

“Researchers have been working actively on developing new MR and data processing techniques,” she noted. “For example, in our research, parallel MR imaging data acquisition techniques significantly shortened the scan time and high resolution DTI techniques made it possible to assess the very small white matter branches in the human brain.

“In the coming decade or so, we should be able to know better about the neuronal substrates associated with ADHD and find better diagnostic and treatment strategies,” Dr. Li added.



Li



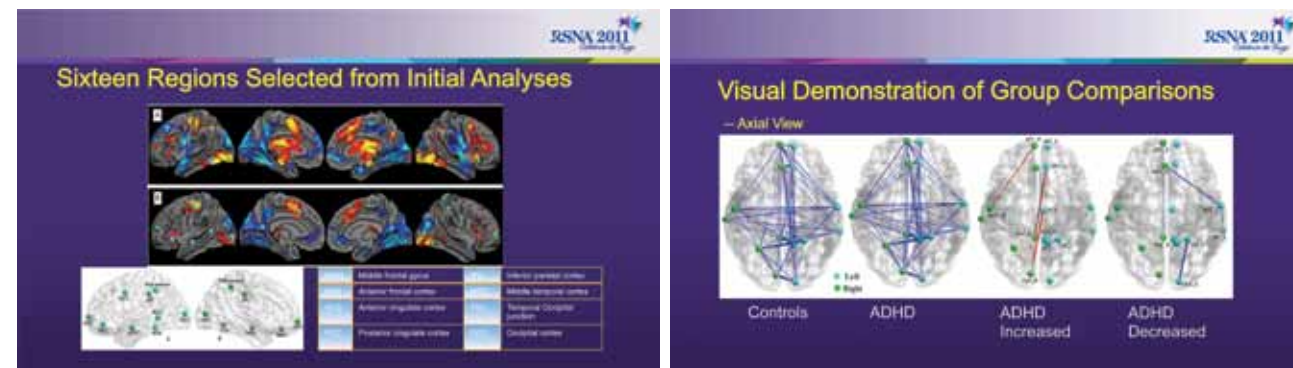
Renshaw

Port

Dr. Li's research represents just part of the spectrum of recent MR-based research on psychiatric disorders. At RSNA 2011, researchers from the Capital Medical University in Beijing presented research that used evidence from voxel-based morphometry to determine that detection in changes of gray and white concentrations may be helpful for the early diagnosis and evaluation

“There is an imaging test for most disease processes, but in the psychiatric field we don't have that yet.”

John Port, M.D., Ph.D.



Xiaobo Li, Ph.D., and colleagues used functional MR imaging (fMRI) to identify abnormalities in the brains of children with attention deficit/hyperactivity disorder (ADHD) that may serve as a biomarker for the disorder. Above, Dr. Li's research presented at RSNA 2011: **Left:** Locations of the 16 brain regions for functional connectivity analysis that were determined based on the activation maps of both groups. **Right:** Within-group averages and between-group comparisons of the pair-wise functional correlation coefficients. The two images at left show the within-group averages; the two images at right show the pairs that had significantly increased and decreased functional connectivities in ADHD, compared to controls.

ation of patients with Tourette Syndrome. In the last year alone, researchers using MR imaging have discovered:

- Low iron levels in the thalamus may contribute to ADHD pathophysiology.
- DTI images and measurements of white matter nerve fibers in regions of the brain critical to language, emotion, and social cognition provide a promising diagnostic test for autism.
- Quantifying the loss of gray matter in the brain can help diagnose serious cases of childhood-onset schizophrenia, bipolar disorder and other psychoses.
- The gray matter in a network of brain regions known to affect social communication and self-related thoughts has a distinct organization in people with autism.
- MR can help predict future bipolar disorder in young people who haven't shown any symptoms.

Technology Detects Neurobiology Differences

Despite the wealth of recent findings, a wider role for the MR imaging in diagnosing psychiatric disease is still years away, according to Perry F. Renshaw, M.D., Ph.D., M.B.A., a professor of psychiatry at the Neuroscience Program at the University of Utah in Salt Lake City.

“The good news is that the new technologies are showing differences in the neurobiology among patients with psychiatric diseases,” he said. “The bad news is that, at a clinical level, we haven't learned much that helps them.”

“We've developed good techniques to tell the difference between groups of people with bipolar diseases and those without,” added John Port, M.D., Ph.D., a radiologist with the Mayo Clinic in Rochester, Minn. “But the tests aren't strong enough to find the condition in an individual.”

The recent development of 7.0 T MR—currently approved for research purposes only—could hasten progress in the field, especially for researchers like Drs. Renshaw and Port who specialize in MR spectroscopy. Dr. Port received a 2001 Research & Education (R&E) Foundation seed grant for his study,

“Imaging Markers of Bipolar Disease: Evaluation of Proton Magnetic Resonance Spectroscopic Imaging.”

“I can use MR spectroscopy to look for abnormal biochemistry,” Dr. Renshaw said. “However, it has a low signal-to-noise ratio. The higher field strength of 7.0 T is an exciting development for MR spectroscopy because it boosts the signal-to-noise ratio.”

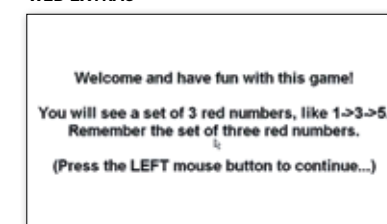
Nevertheless, the economics of psychiatric medicine is a factor. Treatment non-adherence is a major problem and the nature of some psychiatric diseases makes patients unreliable—a problem for busy practices that rely on the MR suite to generate income, Dr. Renshaw said.

“With trends like cuts in reimbursement, operations have to be very efficient,” Dr. Renshaw said. “Someone with a knee injury is likely to show up for an MR, but someone who's methamphetamine-dependent may make an appointment and you never hear from them again.”

Regardless of how MR imaging evolves in psychiatry, ongoing and future research—including studies of biomarkers and the link between imaging findings and genetic profiles—will continue to improve our understanding of the structure and chemistry behind these conditions.

“There is an imaging test for most disease processes, but in the psychiatric field we don't have that yet,” Dr. Port said. “I thought I had one in 2005—I made a presentation at RSNA about it—but it turned out it wasn't strong enough. I hope in my career we will develop something. It won't be tomorrow and it won't be next year, but hopefully we'll have something in the next decade.” □

WEB EXTRAS



To watch an RSNA 2011 press conference presented by Xiaobo Li, Ph.D., about her work using fMRI to study children with ADHD, and to see the test administered to the children as part of the study, (at left) go to rsnanews.RSNA.org.

To read the abstracts for the RSNA 2011 presentations referenced in this story, go to RSNA2011.RSNA.org/search and search under the presenter's name.

The Greening of Radiology: Simple Changes Reduce Energy Use, Carbon Footprint

While CT scanners, MR imaging machines, interventional suites and PACS reporting stations make radiology one of the most power-hungry departments in a hospital, facilities can significantly reduce energy consumption by implementing some fairly simple measures.

“As a group, I feel radiologists often overlook our impact on the environment,” said Colin McCarthy, M.D., who presented a quality storyboard, “EcoRadiology: Pulling the Plug on Wasted Energy in the Radiology Department,” at RSNA 2011. “Implementing changes such as turning off computers and air conditioning when not in use represent very simple but effective ways to play our part in reducing the carbon footprint of the department,” Dr. McCarthy said.

Because radiology has long been at the forefront of adopting technology to aid in patient care, radiologists should strive to be role models of energy efficiency in their own institutions, said Eliot Siegel, M.D., a professor and vice-chair of imaging informatics at the University of Maryland School of Medicine in Baltimore and presenter of the scientific paper “Greening Radiology” at RSNA 2011.

“As more facilities turn to electronic medical records for their clinical workflow, energy needs mount,” Dr. Siegel said. “As radiologists, we should help our fellow doctors roll out their own electronic medical records.”

Both physicians worked with colleagues to implement energy-saving models in their own facilities.

Computers, Air Conditioning Needlessly Devour Energy

Dr. McCarthy, a third-year radiology resident at St. Vincent's University Hospital, Dublin, Ireland, and colleagues used readily available and inexpensive energy monitors to analyze usage of various appliances during normal use and in standby mode. After auditing the number of PACS reporting stations, desktop computers, air conditioners, lights, printers and general office equipment left on after hours, the team measured energy consumption for the entire year.

Researchers found that 29 of 43 desktop computers were left on unnecessarily overnight and weekends in the radiology department, wasting 25,000 kilowatt hours (kwh) annually. In addition, 25 of 27 PACS reporting stations were routinely left on overnight and on weekends, wasting 47,000 kwh



McCarthy

Siegel

annually. “This equates to almost \$5,000 in electrical running costs, equivalent to the carbon emissions of six passenger vehicles each year,” Dr. McCarthy said.

Air conditioning is another needless energy drain. In just two reporting rooms, air conditioning wasted 37,000 kwh annually, totaling \$4,000 in electrical running costs, researchers found.

Targeting the department's continued reliance on paper, researchers began offering recycling points for the packaging associated with many radiology catheters. Dr. McCarthy also hopes to implement fully electronic ordering and reporting to reduce the vast amounts of paper used each year.

“Implementing changes such as turning off computers and air conditioning when not in use, represent very simple but effective ways to play our part in reducing the carbon footprint of the department.”

Colin McCarthy, M.D.



Experts say the “greening of radiology” is more critical than ever as radiology departments transition to electronic health records and rely more heavily on power-hungry technology like CT scanners and PACS. Above: Energy-saving measures ranging from turning off computers to purchasing energy-saving light bulbs were discussed by RSNA 2011 presenter Colin McCarthy, M.D. (right) who presented “EcoRadiology: Pulling the Plug on Wasted Energy in the Radiology Department” at RSNA 2011

Dr. McCarthy is also pushing for energy-saving light bulbs. Acknowledging that the bulbs do cost more at the outset, Dr. McCarthy estimated that changing 300 bulbs to energy-saving models could save \$12,000 in electrical costs and at least 80 metric tons of carbon dioxide (the equivalent of 16 passenger cars) annually. “Even we were surprised by the actual amount of energy that was being wasted,” he said.

Daily Bulletin coverage of RSNA 2011 is available at RSNA.org/bulletin.

Shutting Off Computers Saves \$3,300 a Year

Simply shutting down workstations and monitors at the end of the day leads to institution-wide cost savings, according to Dr. Siegel and colleagues, whose findings were published in the November 2011 issue of the *Journal of the American College of Radiology*.

At the University of Maryland, Dr. Siegel and Amy Kuncz, A.R.R.T., plugged their department's computer workstations into a Kill-a-Watt electricity meter to monitor energy usage during active and standby states.

Results showed that computers and monitors left on 24-7 department-wide would use at least 40,189.97 kwh and cost \$4,420. If computers were shut down at the end of the day, the department would use at least 10,261.68 kwh, costing only \$1,128, thereby saving the 29,928.29 kwh and \$3,292, researchers concluded.

“In an age where cost reduction and energy savings are necessary, reducing power consumption in radiology with the simple step of turning machines off at the end of the day, if implemented hospital wide, will lead to cost savings institution wide,” Dr. Siegel said.

Although it's not possible to turn off all computers or PACS workstations in a hospital, shutting down machines that are not in critical areas or in use for overnight call can still make a large difference, he said.

Another strategy for energy reduction is equipment upgrades. Cathode ray tubes generally use more energy than the new liquid crystal display monitors. Although expensive, solid state hard drives—which consume less energy—may be a viable replacement for traditional hard drives, Dr. Siegel said.

Some facilities are even adopting creative energy-saving measures such as implementing rooftop gardens or switching to compact fluorescent light bulbs. Radiologists, according to Dr. Siegel, should be at the forefront of the ecoradiology movement.

“Radiologists have a unique opportunity, as technological leaders, to direct energy efficiency measures as a means of cost savings and reducing airborne by-products from energy production to improve patients' lives,” Dr. Siegel said. “As physicians, we must not only treat disease but promote good health.” □

WEB EXTRAS

□ To watch a video of Colin McCarthy, M.D., discussing his RSNA 2011 research and to access his PowerPoint presentation, go to rsnanews.RSNA.org.

□ To access the study, “Greening Radiology” by Eliot Siegel, M.D., and colleagues, go to www.JACR.org.

MR Microscopy Holds Promise for Brain Tumor Research

A novel technique using 3D MR microscopy, allowing researchers to image vessel architecture in exquisite detail, has the potential to characterize the vascular phenotype of preclinical brain tumor models and holds promise for other areas of research.



RESULTS of research published in the August 2011 issue of the *Journal of Cerebral Blood Flow and Metabolism* move scientists closer to developing accurate clinical in vivo biomarkers of brain tumor angiogenesis and anti-angiogenic therapy, said study author Arvind P. Pathak, Ph.D., an assistant professor in the radiology and oncology departments at Johns Hopkins University School of Medicine.

"The initial success of anti-angiogenic agents in clinical trials has created a crucial need for developing radiologic techniques and imaging markers for assessing their efficacy in patients," Dr. Pathak said. "Due to its sensitivity to various aspects of the vasculature, MR with conventional FDA-approved contrast agents has the potential to be a noninvasive, in vivo marker of angiogenesis with widespread clinical availability."

Researchers focused on the vasculature—a critical determinant in the pathophysiology of brain tumors—and its interactions with neighboring tissues. "While researchers have long examined mouse brains with MR microscopy, studies on the tumor vasculature have been limited because of the difficulty involved," Dr. Pathak said.

With funding from a 2007 Toshiba Medical Systems Research Seed Grant from the RSNA Research & Education Foundation, Dr. Pathak and colleagues developed a novel method for "whole brain" 3D mapping of murine neurovasculature using MR microscopy to characterize the angiogenic phenotype of a mouse brain tumor model.

"Regions of interest analysis showed significant differences in the vascular phenotype between the tumor and the contralateral brain," Dr. Pathak said. "These results unequivocally show the feasibility of using MR microscopy to characterize the vascular phenotype of brain tumors."

This approach also differentiates the tumor vascular architecture from that of the contralateral brain and characterizes global and zonal changes in brain tumor vascular morphology with tumor progression, according to results.

Novel Technique has Vast Potential

The novel imaging method developed by Dr. Pathak and colleagues holds considerable promise for many areas of research, said Jiayang Zhang,

Ph.D., an assistant professor in the Department of Biology at Johns Hopkins, who oversaw Dr. Pathak's research.

"The high-resolution 3D images of the murine brain tumor model have a wide array of applications ranging from bioengineering to tumor biology," Dr. Zhang said. "That is why this exciting research was featured on the cover of one of the premier brain journals."

This RSNA-funded research has also led to a subsequent study by Dr. Pathak and colleagues, published in the July 2011 issue of *PLoS ONE*, which simultaneously examined brain tumor invasion and angiogenesis. (See Web Extras)

"While scientists have developed many different animal models of brain tumor invasion to better understand how tumors grow and spread, high-resolution studies that simultaneously visualize brain tumor invasion and vascularization are rare," Dr. Pathak said. "That was our goal with this research."

The study has also led to new research projects for Dr. Pathak and his team. First, they plan to take information gleaned from the high-resolution MR images to develop in vivo analogues of these biomarkers.

"There are protocols in place that provide a readout on the angiogenic status of an MR scan but the relationship between the readout and underlying biology is not clear," he said. "These preclinical studies help inform that."

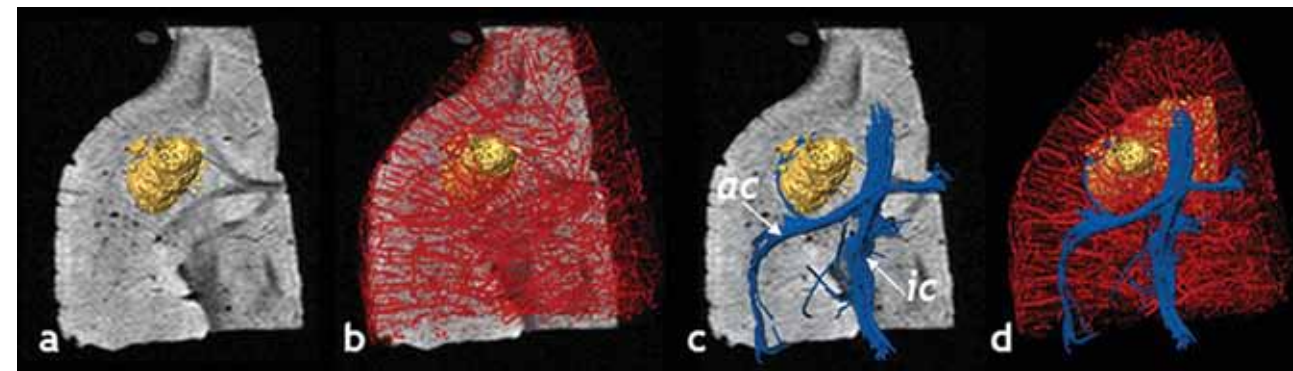
The team also plans to conduct more computational studies and work toward better understanding of the basic biology of brain tumors.

"The RSNA grant was indispensable in moving forward with what has been a truly groundbreaking project."

Arvind P. Pathak, Ph.D.



Pathak



Ultra-high resolution MR microscopy (μ MRI) of a tumor bearing mouse brain: (a) T_2 -weighted μ MRI slice through a 9L brain tumor (gold rendering) bearing brain. (b) 3D overlay of the neurovasculature acquired using ultra-high resolution μ MRI. (c) 3D DTI image showing reorganization of the fibers of the anterior commissure (ac) and internal capsule (ic) around the tumor. (d) Overlay of (b) and (c) illustrating simultaneous changes in vascular and white matter structures.

Image adapted from Pathak et al., *PLoS One* 2011;6(7):e22643. Epub 2011 Jul 27.

RSNA-funded Research has Wide Reach

Along with helping to establish Dr. Pathak's national and international reputation for his work on imaging the tumor microenvironment, the initial RSNA-funded research has led to advancements for other members of his team.

Graduate student Eugene Kim served as the lead author on the *Journal of Cerebral Blood Flow & Metabolism* article and—based on that research—received the Young Investigator Award from the International Bill Nengendank Society for Magnetic Resonance in Medicine.

And the research has had an even wider ripple effect, Dr. Pathak said.

"People are being trained on these new methods that were not available before and we are being

approached for a variety of disease models—not just brain tumors, but Alzheimer's disease and other neurodegenerative disorders," Dr. Pathak said.

Although he suspected its potential, Dr. Pathak said he had no idea the research would have such an immediate impact.

"The RSNA grant was indispensable in moving forward with what has been a truly groundbreaking project," Dr. Pathak said. "Nothing but good has come from the grant in terms of recognition for the project." □

WEB EXTRAS

□ To access an abstract of the study, "Vascular Phenotyping of Brain Tumors Using Magnetic Resonance Microscopy (μ MRI)," in the *Journal of Cerebral Blood Flow & Metabolism*, go to www.nature.com/jcbfm/index.html.

□ To access a free copy of the full study, "Three-Dimensional Imaging of the Mouse Neurovasculature with Magnetic Resonance Microscopy," go to www.plosone.org/article/info.

GRANTS IN ACTION

NAME:

Arvind P. Pathak, Ph.D.

GRANT RECEIVED:

Toshiba Medical Systems/RSNA Research Seed Grant

STUDY:

"Vascular Phenotyping of Brain Tumors Using Magnetic Resonance Microscopy"

CAREER IMPACT:

Due to the current challenge obtaining research funding in an economically difficult period, the RSNA Seed Grant provided Dr. Pathak with the resources to generate high-quality preliminary data for larger extramural grants from the National Institutes of Health. "It also enabled me to complete the first study of the brain tumor vasculature in a pre-clinical model using MR microscopy published in the *Journal of Cerebral Blood Flow & Metabolism*," Dr. Pathak added.

CLINICAL IMPLICATIONS:

From biology and imaging perspectives, knowledge of the 3D architecture of tumor blood vessels is crucial. The use of MR microscopy to generate 3D "digital casts" of the tumor vessel architecture represents a truly innovative approach for investigating tumor angiogenesis at spatial resolutions intermediate to those of in vivo MR imaging and optical microscopy techniques.

For more information on all R&E Foundation grant programs, go to RSNA.org/Foundation or contact Scott Walter, M.S., Assistant Director, Grant Administration at 1-630-571-7816 or swalter@rsna.org.

Real-time Dose Technology Measures Staff Exposure, Minimizes Risk

Technology will soon hit the market that provides real-time feedback about radiation exposure to interventional radiologists during fluoroscopy procedures and offers the promises of helping reduce radiation risks for both patients and staff.

TWO STUDIES—one in North America, the other in Europe—demonstrated the groundbreaking potential of technology featuring a real-time radiation dose display screen and individual wireless dosimeters worn by healthcare staff. Current technologies measure the radiation exposure for an entire month, which makes it difficult to pinpoint the precise time of a high-dose exposure.

“All of us work in radiation all day, so we’re always looking to reduce our risk of exposure,” said James Benenati, M.D., an interventional radiologist at Baptist Cardiac & Vascular Institute in Miami, Fla., and co-author of, “New Device for Interventional Radiology Team Dose Reduction Using Real-time Feedback,” presented at RSNA 2011. “This technology allows us to see how much radiation we’re getting every time we step on the fluoroscopy pedal.”

During the 22-week study at Baptist Cardiac & Vascular Institute, researchers using the technology discovered a downward trend in total accumulated weekly team dose per fluoroscopic minute (PFM). The attending, fellow, nurse, technician and anesthesiologist wore a dosimeter for every procedure. The mean team dose PFM during the final 10 weeks—the open period of the study—was statistically less than the team dose during the closed phase (42.79 microSieverts (µSv) per minute vs. 19.81 µSv per minute).

Seeing the real-time radiation exposure allows team members to adjust their behavior during procedures, Dr. Benenati said. “With this technology, you’re watching every time you touch the pedal,” he said. “We’re able to act on it immediately. Everybody in the room is involved, so we can see who is getting the most or least exposure. You can look and say, ‘OK, I’m getting too much here. I’m going to move the shield or step back.’ It changes the behavior of the whole group.”

Researchers used the Philips DoseAware System (DAS), which resulted from a collaboration between Philips Healthcare and Unfors Instruments.

Real-Time Dose Display Measures Scatter Rates

A European study focusing on scatter dose also demonstrated the potential of real-time dosimeters in improving personal safety for healthcare staff.



(left to right) Jose Miguel Fernandez, M.Sc., Roberto Sanchez, M.D., and Eliseo Vaño, Ph.D.

Researchers in Spain evaluated the Philips DAS showing staff radiation doses in real time in several angiography rooms at Hospital Clínico San Carlos in Madrid.

“When specialists know the dose rate received at any time during their work, they can adopt protection strategies easily without compromising the success of the procedure,” said Roberto M. Sanchez, M.D., a medical physicist at Hospital Clínico San Carlos and lead author of the study, “Staff Radiation Doses in a Real-Time Display Inside the Angiography Room,” published in December 2010 issue of *Cardiovascular and Interventional Radiology*.

“This technology allows us to see how much radiation we’re getting every time we step on the fluoroscopy pedal.”

James Benenati, M.D.



Physicians exposed to radiation on a daily basis have long been concerned about minimizing the risk. Researchers in Spain evaluated the new Philips Healthcare occupational Dose Aware System (DAS) showing staff radiation doses in real time. Dosimeters (bottom) worn by healthcare staff members (left, right), wirelessly track radiation levels every second and relay them to a base-station screen mounted close to the diagnostic monitors, providing an opportunity to improve personal protection

Images courtesy of Philips Healthcare

Researchers used a DAS prototype that utilized dosimeters placed at shoulder level over the protective lead apron of the radiologist. Dosimeters wirelessly track radiation levels every second and relay them to a base-station screen mounted close to the diagnostic monitors. Another dosimeter was placed on the C-arm to measure scatter radiation.

An easy transfer of the values to a data sheet permitted further analysis of the scatter dose profile measured during the procedure.

The cumulative occupational doses measured per procedure ranged from 0.6 to 350 µSv, Dr. Sanchez said. The dose rates recorded ranged from 1 to 5 milliSieverts (mSv)/h during fluoroscopy and from 12 to 235 mSv/h during digital subtraction acquisitions (DSA).

The mean cumulative dose measured at the C-arm during the trial was 1.04 mSv—10 times higher than the dose received by the radiologist (0.11 mSv per procedure). This difference was attributed in large part to radiologists stepping back or leaving the angiography room during DSA.

Researchers concluded that real-time dose display to staff members warns interventionalists whenever the scatter dose rates are too high or the radiation protection tools are not being properly used, providing an opportunity to improve personal protection accordingly.

“Patients and physicians both benefit from this new tool,” Dr. Sanchez said. “For the radiation protection specialist, you can now record every second that a dose is received, which can also be valuable for researching dose reduction strategies.”

Although the mainstream media is currently focused on patient exposure to radiation, physicians have been concerned about their own exposure for decades, Dr. Benenati said.

“We’ve been looking for something like this for a long time,” he said. “Patients are the top priority, but the reality is that the vast majority of them will receive only minimal exposure to radiation throughout their lifetime. The physicians who are in the room every day are at a much greater risk from exposure to radiation.” □

WEB EXTRAS

☑ To access an abstract of the RSNA 2011 presentation, “New Device for Interventional Radiology Team Dose Reduction Using Real-time Feedback,” go to RSNA2011.RSNA.org/search and search under author name “Benenati.”

☑ To access an abstract of the study, “Staff Radiation Doses in a Real-Time Display Inside the Angiography Room,” in the December 2010 issue of *Cardiovascular and Interventional Radiology*, go to www.springerlink.com/content/0174-1551.

Timeliness of Follow up After Abnormal Results on Mammography Varies Widely

New research showing that timeliness of follow up after abnormal mammograms is highly variable among U.S. facilities suggests that there is potential for improvement and underscores the need for published guidelines.

INSTITUTIONS should set a goal of achieving follow up within 16 days after an abnormal screening mammogram, according to Robert D. Rosenberg, M.D., lead author of the research published in the November 2011 issue of *Radiology*. During the research, Dr. Rosenberg served as a professor of radiology and chief of mammography at the University of New Mexico Health Sciences Center in Albuquerque, N.M., and continues his affiliation with the university.

Abnormal mammograms occur in approximately 10 percent of screening and 8 percent of diagnostic examinations, said Dr. Rosenberg, also a radiologist with Radiology Associates of Albuquerque. However, he said, there are currently no U.S.-published guidelines for the appropriate timing for follow-up evaluation after an abnormal mammogram.

Dr. Rosenberg and colleagues turned to the minimum standard recommendations of the fourth edition of the European Guidelines for Quality Assurance in Breast Cancer Screening and Diagnosis. "Most patients undergo follow up within the minimum standard recommendations of the European guidelines, so those guidelines may be a reasonable target within the United States," Dr. Rosenberg said.

Because investigators examined a large number of diverse facilities, "this research can be used as a benchmark for facilities that want to know how well they are performing," Dr. Rosenberg added.

"Timely follow up of abnormal mammography improves the experience for patients, as this is an anxious time for them," he said. "This research shows most patients receive timely follow up from most facilities, but there are many where women wait a considerable time for resolutions of abnormalities, including waiting for biopsies."

Variation in Facility Follow-up Times is "Unexplained"

The current study builds upon a pilot study co-authored by Dr. Rosenberg from the New Mexico Mammography Project, which examined data collected between 1995 and 2002. That study was published in 2007 in the *American Journal of Roentgenology*.

For the *Radiology* study, Dr. Rosenberg and colleagues examined pooled data sent to the Breast Cancer Surveillance Consortium (BCSC) Statistical



Rosenberg



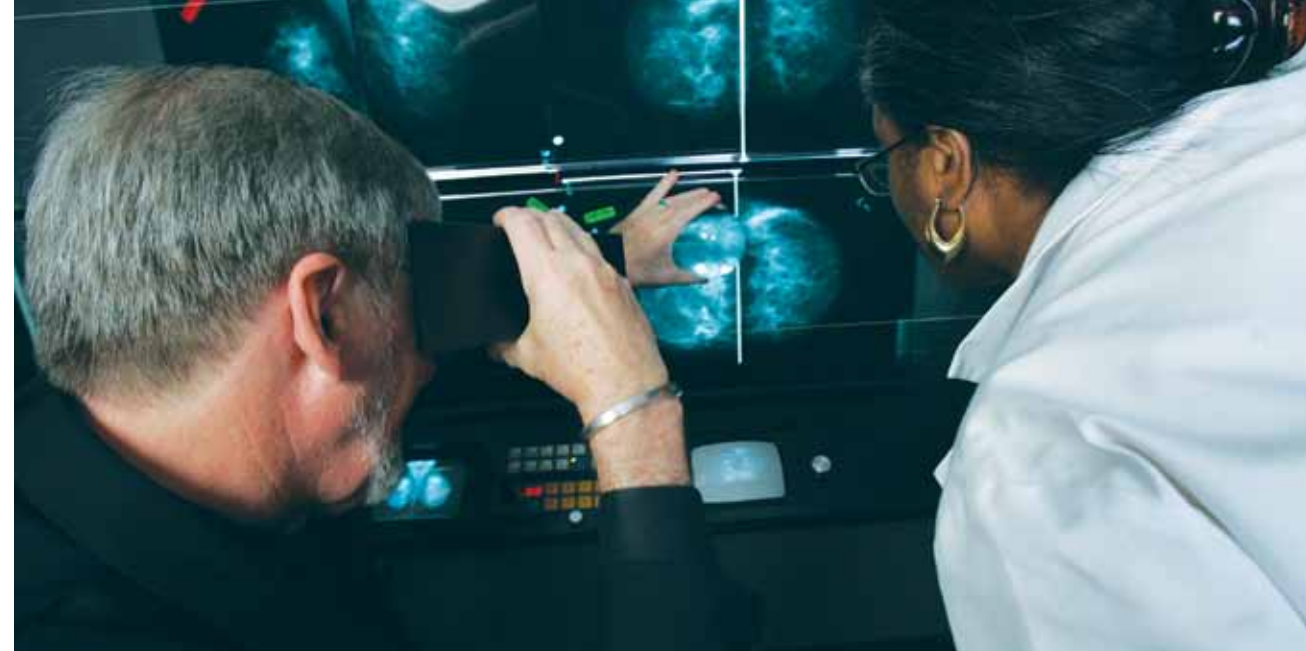
Taplin

Coordinating Center in Seattle, Washington, from mammography registries in New Hampshire, New Mexico, North Carolina, San Francisco, Vermont and western Washington State.

Researchers analyzed computer data on screening mammograms performed in women ages 40 to 80 years between January 1996 and December 2007. Inclusion criteria were a recommendation for immediate follow up at screening or subsequent imaging and observed follow up within 180 days of the recommendation. They reviewed 214,897 recommendations for

“The most important take-home point from our research is that a high percentage of women can be seen within 16 days following an abnormal mammogram screening. This benchmark is achievable.”

Stephen H. Taplin, M.D., M.P.H.



Although abnormal mammograms occur in approximately 10 percent of screening and 8 percent of diagnostic exams, timeliness of follow up varies widely among facilities, according to new research. Although no U.S. guidelines exist, researcher Robert D. Rosenberg, M.D., encourages institutions to set a goal of achieving follow up within 16 days after an abnormal mammogram.

additional imaging from 118 facilities and 35,622 biopsy recommendations from 101 facilities.

Results showed that the median time before follow-up care was 14 days after an additional imaging recommendation and 16 days after a biopsy recommendation. Approximately 90 percent of recommendations for additional imaging and 81 percent of biopsy recommendations were followed up within 30 days. Facilities with higher recall rates tended to have longer follow-up times for additional imaging, according to results.

During the study period, rates of biopsy recommendation follow-up rates improved at 15 and 30 days although follow-up times varied substantially across facilities. "Overall, despite rapid initial follow up of additional imaging, variation between facilities is considerable and unexplained," Dr. Rosenberg said.

Unexpected Results Suggest Potential Benchmarks

One unexpected result of the study is the high proportion of facilities reporting follow up within 16 days, said co-author Stephen H. Taplin, M.D., M.P.H., chief, Process of Care Research Branch, Division of Cancer Control and Population Science, National Cancer Institute, Bethesda, Md.

There was still significant room for improvement, however. For biopsy recommendation, half the facilities reported between 30 and 45 percent follow up at 15 days. However, at 15 days, some facilities were able to follow up on almost 65 percent of cases and others were able to follow up on only 10 percent of cases, according to the study.

"The most important take-home point from our research is that a high percentage of women can be seen within 16 days following an abnormal mammogram screening," Dr. Taplin said. "This benchmark is achievable."

Authors suggest that U.S. institutions monitor their own times with the goal of achieving follow up within 16 days after an abnormal mammogram screening.

Patient Characteristics Linked to Timeliness of Follow-Up

Although a delay in follow up after an abnormal mammogram can be attributed to the provider or healthcare system, timeliness can also depend on characteristics of the patient.

In research conducted at Group Health, a Seattle-based BCSC site registry, Karen J. Wernli, Ph.D., and colleagues evaluated women aged 40 to 84 years who received a mammogram between 1996 and 2003, with follow up within 180 days. The study included 20,060 screening mammograms and 3,184 diagnostic mammograms. The research was published in the February 2011 edition of the *American Journal of Managed Care*.

"For women who had an abnormal screening mammogram, the median time from the exam to follow up was 13 days," Dr. Wernli said. "For women who had an abnormal diagnostic mammogram, the median time to follow-up was five days."

Characteristics associated with earlier follow up of abnormal screening mammograms included family history of breast cancer, symptoms at time of mammogram or extremely dense breasts. In contrast, women who were older than 70 years, Asian, or college graduates were less likely to return within seven days after an abnormal screening mammogram. "Efforts to understand and reduce barriers to timely follow up might be important for those groups of women," Dr. Wernli said.

"Identifying specific patient-level characteristics early can decrease anxiety, speed up ruling out a cancer diagnosis and help to prevent women from falling through the cracks with a late diagnosis," said Dr. Wernli, who also stressed the need to establish clinical guidelines for obtaining an evaluation after an abnormal mammogram. □

WEB EXTRAS

☑ To read the *Radiology* study, "Timeliness of Follow-up after Abnormal Screening Mammogram: Variability of Facilities," go to RSNA.org/Radiology.

☑ To hear a podcast discussion of the *Radiology* study with lead researcher Robert D. Rosenberg, M.D., go to RSNA.org/Radiology.

☑ To access an abstract of the study, "Timing of Follow-up After Abnormal Screening and Diagnostic Mammograms," in the *American Journal of Managed Care*, go to www.ajmc.com.

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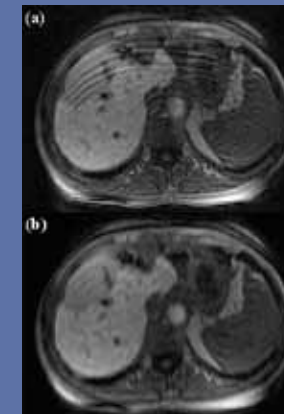
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Harriet W. & James C. Hewitt, M.D.
Jennifer A. Hill, M.D.
William R. Hodge, M.D.
Sachiko & Zenichiro Hombu, M.D.
Yun-Soo Kim & Hyun-Sook Hong, M.D., Ph.D.
Kathleen T. Hudson, M.D.
Aurora & Isidro L. Huete, M.D.
Andrea Diaz De Vivar & Juan J. Ibarra-Rovira, M.D.
Joseph H. Jackson Jr., M.D.
Marcia C. Javitt, M.D. & Jonathan C. Javitt, M.D., M.P.H.
Sharada Jayagopal, M.D. & Salem G. Jayagopal, M.D.
Donald L. Jeck, M.D.
Dragan V. Jezic, M.D.
Vera B. John-Mikolajewski, M.D.
Carl E. Johnson, M.D.
Marvin W. Johnson, M.D.
Derrick A. Jones, M.D.
Howard Kahen, M.D.
Lester Kalisher, M.D.

YOUR DONATIONS IN ACTION

With an RSNA R&E Foundation Research Resident Grant, **Candice A. Bookwalter, M.D., Ph.D.**, is developing a new method to detect failed breath holds during abdominal MR imaging examinations. This method will allow automatic and retrospective correction of motion artifact from breathing and potentially turn nondiagnostic exams into diagnostic exams.



Motion corrupted (a) and corrected images (b) for approximately a 50 percent breath hold.



Peter H. Kalkman, M.D.
Kristine M. Mosier, D.M.D., Ph.D. & Andrew J. Kalnin, M.D.
Alan M. Kantor, M.D.
Daniel R. Karolyi, M.D., Ph.D.
Russell Karp, M.D.
Vasavi Rajagopal & Saravanan Kasthuri, M.D.
Gregory A. Kaufmann, M.D.
Melanie & Mark W. Keenan, M.D.
Leslie Keighan, M.D.
Elizabeth A. Kelley, M.D.
Susan S. Kemp, M.D.
Troy W. Kerby, M.D.
John A. Khademi, D.D.S., M.S.
Kari & George M. Khoury, M.D.
Gabriela Hernandez & Eric T. Kimura-Hayama, M.D.
Kenneth Kist, M.D.
Cassandra & Gerald M. Klein, M.D.
Nadine Koff, M.D. & David A. Koff, M.D.
Elizabeth & Jay L. Korach, M.D.
Joseph G. Koza, M.D.
Beth D. Kruse, M.D. & Thomas Moore
Cheryl & Jeffrey A. Kugel, M.D.
Raymond H. Kuo, M.D.
Shawn L. Laferriere, D.O.
Kent T. Lancaster, M.D.
Luis A. Landeras, M.D.
Patricia E. Lane, M.D.
Paul A. Langis, M.D.
Tal Laor, M.D.
Andrew L. Laurel, M.D.
Betty Lee, M.D.
Joe C. Leonard, M.D.
In honor of Bobby G. Eaton, M.D.
Robert F. Leonardo, M.D.
Claude Levy, M.D.
Errol Lewis, M.D.
Jie Li, M.D.
Jean & Joel E. Lichtenstein, M.D.
Melissa S. Liebling, M.D.
Gregory M. Lim, M.D.
In honor of Anne C. Roberts, M.D.
Jeffrey Lin, M.D., Ph.D.
Mina Jo & Michael N. Linver, M.D.
In honor of Lawrence W. Bassett, M.D.
Chi Fai Lo, M.B.Ch.B.
Margaret A. Lynch-Nyhan, M.D.
Danny Z. Ma, M.D.
James D. MacGibbon, M.D.
Theresa & Daniel E. Magill, M.D.
William H. Magnuson, M.D.
Saturunathan Maheshwaran, M.D.
W. Jamie Malone, D.O.
Joan Cho & David A. Mankoff, M.D., Ph.D.
Marcos R. Manzini, M.D.
Andrea R. Manzo, M.D.
Kenneth R. Maravilla, M.D.

Matthew A. Marcus, M.D.
Antonella & Angelo Marrone, M.D.
William G. Mason Jr., M.D.
Sandi & Terence A. Matalon, M.D.
Judith & Kenneth W. Matasar, M.D.
Laura & Vincent P. Mathews, M.D.
Veena M. Chandler, M.D.
Robert E. Mazzei, D.O.
Nadine & Alistair St. Aubyn McBean, M.B.B.S.
Jennelle & Alexander M. McKinney IV, M.D.
Brian McNamee, M.D.
Michael J. Meagher, M.D.
Jocelyn H. Medina, M.D.
Gary L. Merhar, M.D.
David Merran, M.D.
Stacey Mackes & Michael M. Moore, M.D.
Kambiz Motamedi, M.D.
Gaspar A. Motta-Ramirez, M.D.
Jeanette M. Moulthrop, M.D. & Mark Moulthrop
Narry Muhn, M.D. & Daniel Muhn
Steven J. Munzer, M.D.
Marcia E. Murakami, M.D.
Amy M. Neville, M.D. & Peter Chiu, M.D.
Shelly I. Shiran, M.D.
Leigh S. Shuman, M.D.
Judy S. & Michael S. Sidell, M.D.
In memory of Steven M. Pinsky, M.D.
Harleen Khanijoun & Navneet Singh, M.D.
Sudha P. Singh, M.D. & Pradumna P. Singh
Kathleen & Gerald C. Smidebush, M.D.
Bruce A. Smith, M.B.Ch.B.
Darrin S. Smith, M.D.
Michael D. Orsi, M.D.
Jennifer D. Smith, M.D.
Rahul A. Somvanshi, M.D.
Norman S. Sorkin, M.D.
Julie G. Sossaman, M.D.
Andrew P. Spillet, M.D.
Eric M. Spitzer, M.D.
Prachi P. Agarwal, M.D. & Ashok Srinivasan, M.D.
Shodhan L. Patel, M.D.
Lloyd E. Stambaugh III, M.D.
Robin & Roderic I. Pettigrew, Ph.D., M.D.
Maria T. Pettinger, M.D.
Roger T. Pezzuti, M.D.
Nuala & Douglas E. Pfeiffer, M.S.
Katja Pinker, M.D.
Paul F. Pizzella, M.D.
Mary E. & Donald A. Podoloff, M.D.
Mary & Richard J. Price, M.D.
Hector Ramirez Jr., M.D.
John W. Rampton, M.D.
Janak K. Raval, M.D.
Jeanne & James V. Rawson, M.D.
Sarah N. Reed-Esper, M.D. & Daniel Esper

John S. Richmond, M.D.
Ronald P. Robinson, M.D.
Pablo Rodriguez Covill, M.D.
Mark A. Rosovsky, M.D.
Sandra A. Ruhs, M.D.
Kenneth A. Rule, M.D.
Frank J. Rybicki III, M.D., Ph.D.
Noah D. Sabin, M.D., J.D.
Rabea Janjua & Nabile M. Safdar, M.D.
Rodrigo Salgado, M.D.
Faisal A. Sami, M.D.
Rola Saouaf, M.D.
Francesco Sardanelli, M.D.
Susann E. Schetter, D.O.
Christian Schneider, M.D.
Amy & Steven M. Schonfeld, M.D.
Ryan B. Schwope, M.D.
Mary & Charles E. Seibert, M.D.
Gustav Seliger, M.D.
Timothy H. Seline, M.D.
Trudy & Kevin L. Shady, M.D.
Rodney G. Shaffer, M.D.
Aaron Sharma, M.D.
Riva & Howard Shein, M.B.B.Ch.
Melinda J. & Edward Q. Shepherd, M.D.
Joshua S. Shimony, M.D., Ph.D.
Shelly I. Shiran, M.D.
Leigh S. Shuman, M.D.
Judy S. & Michael S. Sidell, M.D.
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Continued on page 22

Journal Highlights

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

Osteoporosis Imaging—State of the Art and Advanced Imaging

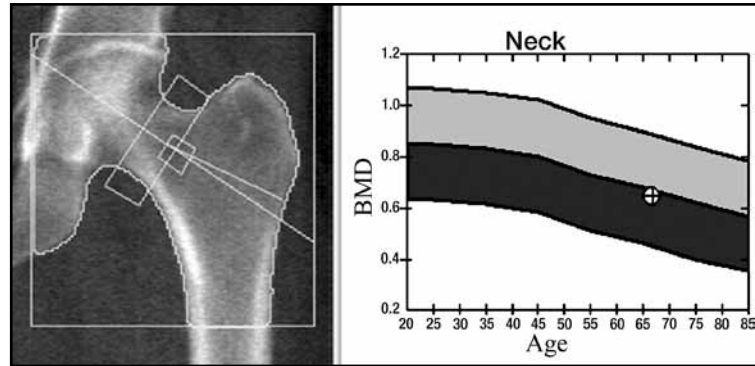
While dual-energy X-ray absorptiometry (DXA) is currently the state-of-the-art technique to measure bone mineral density and help physicians diagnose osteoporosis, new research is focusing on assessing bone quality using other advanced imaging techniques.

In an article in the April issue of *Radiology* (RSNA.org/*Radiology*), Thomas M. Link, M.D., of the University of California at San Francisco, and colleagues assess novel techniques to measure bone mineral density and discuss how imaging techniques should be used to diagnose prevalent osteoporotic fractures. Specifically, the authors discuss:

- High-resolution peripheral CT
- Multidetector CT
- MR imaging
- MR spectroscopy and perfusion
- Quantitative ultrasound

Correctly diagnosing and interpreting fragility fractures with all available imaging modalities is one of the major responsibilities of radiologists, according to the authors. "Radiologists need to be sensitized to the fact that the presence of fragility fractures will alter patient management and these fractures need to be described in the report."

Radiology



DXA studies of the proximal femur of a 66-year-old woman, the lowest T score of total and femoral neck regions of interest is used to classify the bone as normal, osteopenic, or osteoporotic. In this postmenopausal woman the T score was -1.8, which is in the osteopenic range.

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Imaging of Whole-Organ Pancreas Transplants

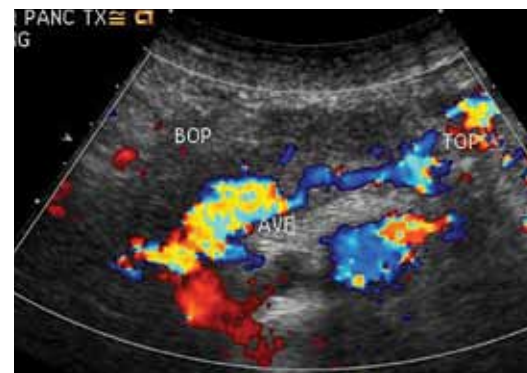
While whole pancreas transplantation is an established treatment for selected patients with diabetic nephropathy or poorly controlled diabetes, surgical techniques vary and have evolved over the past four decades.

Imaging evaluation of the whole pancreas transplant should begin with an understanding of the most commonly used surgical techniques and of the spectrum of postoperative complications, according to an article by Fauzia Q. Vandermeer, M.D., of the University of Maryland School of Medicine, in Baltimore, and colleagues in the March-April issue of *RadioGraphics* (RSNA.org/*RadioGraphics*). Specifically, the authors address:

- Vascular anatomy of a pancreas transplant
- Surgical and postoperative complications of pancreas transplantation
- Strengths and limitations of ultrasound, CT, and MR imaging in evaluating a pancreas transplant

"The radiologist must be familiar with the spectrum of surgical techniques and the normal postoperative imaging appearances of the whole pancreas transplant so as to be able to recognize abnormal postoperative findings," the authors write.

RadioGraphics



Iatrogenic arteriovenous fistula due to biopsy in a 42-year-old woman after PTA. Longitudinal color Doppler US image shows a dilated tubular structure with turbulent flow, a finding that is closely associated with the splenic vein and graft artery of the transplant and compatible with an arteriovenous fistula (AVF) within the proximal body of the pancreas (BOP). TOP = tail of pancreas.

(*RadioGraphics* 2012;32:411-435) ©RSNA, 2012. All rights reserved. Printed with permission.

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

Radiology in Public Focus

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

The National CT Colonography Trial: Assessment of Accuracy in Participants 65 Years of Age and Older

CT colonography can be used as a primary screening tool for colorectal cancer in adults over the age of 65, according to new research.

C. Daniel Johnson, M.D., professor and chair of radiology at Mayo Clinic in Scottsdale, Ariz., and colleagues conducted a follow-up analysis of data from the National CT Colonography Trial, in which 2,600 patients over the age of 50 underwent both virtual and optical colonoscopies at 15 centers around the country.

Researchers analyzed trial data from 477 patients over the age of 65 and 2,054 patients between the ages of 50 and 65 who were screened with the two procedures for polyps. Patients in the study were both men and women at predominantly an average risk for colorectal cancer.

Cancerous lesions 1 centimeter or larger were found in 6.9 percent of patients in the 65 and older group and in 3.7 percent of the younger patients.

Parameter	Size of Adenoma or Cancer (mm)					
	≥5	≥6	≥7	≥8	≥9	≥10
Participant age ≥ 65 y	0.497 (0.368, 0.634) [111]	0.590 (0.443, 0.735) [90]	0.694 (0.526, 0.800) [60]	0.796 (0.548, 0.893) [48]	0.755 (0.588, 0.872) [38]	0.755 (0.578, 0.869) [37]
Participant age < 65 y	0.598 (0.527, 0.680) [263]	0.722 (0.643, 0.802) [190]	0.740 (0.638, 0.798) [180]	0.790 (0.687, 0.860) [138]	0.825 (0.709, 0.902) [100]	0.839 (0.717, 0.924) [91]
Change	-0.101 (-0.216, 0.016)	-0.133 (-0.263, -0.014)*	0.106	0.048	0.091	-0.091 (-0.288, 0.085)

Note.—Data are average sensitivities, with 95% CIs in parentheses and numbers of lesions in brackets.
* The 95% CI does not include 0, indicating an uncorrected significant difference at the α level of .05.

Above: The sensitivity of CT colonography in the two age groups for the detection of adenomas or cancers with varying sizes. In the older group, the average sensitivity estimate for detection of adenomas or cancers 10 mm or larger was 0.75 (95 percent CI: 0.578, 0.869), compared with 0.84 (95 percent CI: 0.717, 0.924) in the younger group. There was no difference in per-polyp sensitivity estimates between the age groups.

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Results showed no significant difference in the accuracy of CT colonography for the detection of large and intermediate-sized cancers in the older participants compared to the younger participants. Sensitivity and specificity among the older and younger groups were 0.82 and 0.83

and 0.92 and 0.86, respectively, according to researchers.

"For most measures of diagnostic performance and in most subsets, the difference between senior-aged participants and those younger than 65 years was not statistically significant," the authors write.

Impact of Mammography Detection on the Course of Breast Cancer in Women Aged 40–49 Years

Increased mammography-detected breast cancer over time coincides with lower-stage disease detection resulting in reduced treatment and lower rates of recurrence, adding factors to consider when evaluating the benefits of mammography screening of women aged 40–49 years, according to new research.

Judith A. Malmgren, Ph.D., president of HealthStat Consulting, Inc., Seattle, Wash., and a team of researchers reviewed breast cancer patient data from a dedicated registry at the Swedish Cancer Institute's community cancer center.

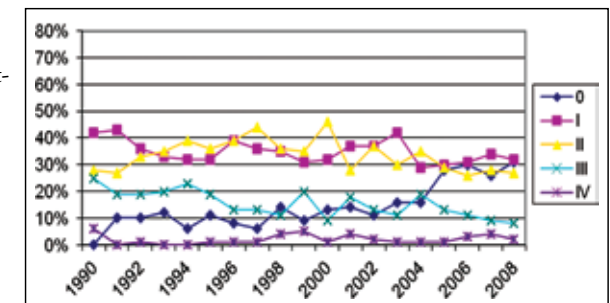
Researchers analyzed data on 1,977 breast cancer patients between ages 40 and 49 who were treated between 1990 and 2008, examining the method of diagnosis (detected by mammography, patient or physician), stage at diagnosis (0-IV, confirmed by biopsy), treatment, and annual follow-up information, including recurrence of disease.

Researchers discovered a real and significant shift to mammography-detected (MamD) breast cancer from 28 to 50

percent of the annual total during that time period, with fewer patient-detected cases in a large carefully followed up cohort of patients from a community institution. The shift to more mammography-detected breast cancer cases was accompanied by a shift to diagnosis at a lower stage of disease (diagnosis at stage 0 increased 66 percent and diagnosis at stage III decreased 66 percent) and disease that requires less treatment.

The decision to undergo screening mammography by women aged 40–49 years is multifactorial, according to the authors.

"The decision should be made by empowering patients with information and data from knowledgeable providers, counseling patients in regard to the benefits and harms of screening mammography," the



Change in Tumor, Node, and Metastasis (TNM) stage for breast cancers diagnosed with all detection methods according to year of diagnosis over time for years 1990–2008 (n = 1977).

(*Radiology* 2012;262:3:797-806) ©RSNA, 2012. All rights reserved. Printed with permission.

authors write. "Our study results indicate that patients should be informed that screening mammography can help reduce morbidity and mortality associated with a more advanced-stage breast cancer diagnosis and treatment."

Radiology in Public Focus

Media Coverage of RSNA

From mid-December to mid-January, media outlets carried 6,292 RSNA-related news stories reaching an estimated 4.2 billion people.

Print coverage included *Boston Globe*, *The Orlando Sentinel*, *Arizona Daily Star*, *Sarasota Herald-Tribune* and *The Wichita Eagle*.

Broadcast coverage included *The Dr. Oz Show*, CNN, WCBS-AM (New York), KABC-TV (Los Angeles), KTLA-TV (Los Angeles), WLS-AM (Chicago), WGN-TV (Chicago), WFLD-TV (Chicago), WCVB-TV (Boston), WPVI-TV (Philadelphia), KYW-TV (Philadelphia), WBBM-TV (Chicago), KDFW-TV (Dallas), WTVT-TV (Tampa), WFSB-TV (Hartford, Conn.) and WFTV-TV (Orlando).

Online coverage included *Los Angeles Times*, *TIME*, *USA Today*, *Boston Herald*, *Washington Post*, *Miami Herald*, *U.S. News & World Report*, *Forbes*, *The Huffington Post*, Yahoo! News, Fox News, NPR, BBC News, CBS News and ABC News.



RSNA 2011 ANNUAL MEETING COVERAGE

Total media coverage of the RSNA annual meeting from November 2011 through January 2012, has resulted in a record 14,735 tracked media placements, yielding an estimated potential audience/circulation of nearly 8 billion. Both in placements and impressions, media coverage of RSNA 2011 has already exceeded totals for RSNA 2010, which garnered 7,894 placements with 5.3 billion audience impressions for the entire year.

Notable placements for RSNA 2011 include: *The New York Times*, *Washington Post*, *The Sunday Times* (U.K.), *The Daily Telegraph* (U.K.), *Philadelphia Inquirer*, *Toronto Star*, *Boston Globe*, *The Globe and Mail*, *Chicago Sun-Times*, Associated Press, Voice of America, NPR - *Morning Edition*, NPR - *All Things Considered*, *BBC World News*, *Anderson Cooper 360°*, *Morning Express with Robin Meade*, *CNN Presents*, MSNBC, Google News, Yahoo! News, MSN Health, *The Huffington Post*, and online editions of *USA Today*, *TIME* and *The Wall Street Journal*.

April Outreach Activities

In April, RSNA distributed the "60-Second Checkup" audio program to nearly 100 radio stations across the U.S. The segments focused on patient privacy.

Residents & Fellows Corner

Stay Connected with myRSNA®

Residents and fellows who want to share knowledge and engage in conversations with their peers near and far can use the myGroups feature in myRSNA to start and join groups.

myGroups was created with file sharing in mind. A myRSNA user can create a group, select whom they wish to join, and then all members of the group can add files to the group page. Group members are able to view the files within myRSNA, download them and comment on them.

Groups can also be tagged with search terms and made public so that other people can find them and request membership, or they can be private and unlisted.

Seetharam Chadalavada, M.D., a second-year radiology resident at the University of Pennsylvania, said he was thinking long-term when he created the "Penn Radiology 2014" group through myRSNA. "The idea is that as we move forward in our careers, we can use this group to organize meetings and share information about programs and career opportunities," Dr. Cha-



dalavada said. "It can also help us meet after we graduate.

"The idea in creating this group and getting my classmates to sign up is that the group would become the 'Facebook' within the radiology community," Dr. Chadalavada continued. "I created the 'Penn Radiology' group as well and that is meant for all alumni to network."

To search existing groups or create your own, click myGroups in the lefthand sidebar of myRSNA. If you tag your group and make it open to public searching, you will be notified when another myRSNA user requests to join.

The myRSNA customizable web portal is a benefit of RSNA membership. Membership is free for residents and fellows and then discounted the first two years in practice after training.

The Value of Membership

RSNA 2011 Cases of the Day Now Online

A popular attraction at RSNA annual meetings, the 2011 Cases of the Day are now available online.

Cases of the Day—image-based case scenarios spanning 14 radiology subspecialties—are presented each day at the annual meeting. Participants review each case, submit a diagnosis and check the correct answer that is released the following morning. In the online format, participants who view the RSNA 2011 cases and submit diagnoses not only immediately see the correct answer but also receive instant feedback and can discuss the case with others.

Each Case of the Day is worth 1.00 AMA PRA Category 1 Credit™, which will be automatically transferred to the RSNA CME Credit Repository upon completion. Cases of the Day are free to RSNA members. Non-members may access online Cases of the Day for a fee of \$15 per case.



Now available online, 2011 Cases of the Day are free to RSNA members.

Expanding Features Deepen *Radiology's* Reader Impact

Whether you prefer the print, online or tablet edition, free access to the continually evolving scientific journal *Radiology* is a premier benefit of RSNA membership.

Each month, *Radiology* publishes approximately 300 pages of peer-reviewed original research, authoritative reviews, well-balanced commentary on significant articles and expert opinion on new techniques and technologies. *Radiology's* current 6.069 impact factor is the highest of all general diagnostic imaging journals.

The journal continues to expand its online presence with interactive features including podcasts, videos, a monthly reader poll and the popular Diagnosis Please that invites readers to submit the most likely diagnosis for a particular case. Users can also earn online CME credit for an activity associated with selected Review and State of the Art articles.

Readers also are invited to explore full-content *Radiology* apps for the iPhone®, iPod touch® or iPad® and mobile-optimized sites now available for mobile devices.

A new feature, *Radiology Select*, is a continuing series of selected *Radiology* articles that highlight developments in imaging science, techniques and clinical practice. (See sidebar)

For more information on these and other *Radiology* features—and to view a video introduction of *Radiology Select* by *Radiology* Senior Deputy Editor Deborah Levine, M.D.—go to Radiology.RSNA.org.

To read about the newly redesigned RSNA journals page, see RSNA.org on page 24.

Radiology Select Now Available with Free Tablet Download

Members and non-members can now enjoy the first volume of *Radiology Select*—Volume 1: Pulmonary Nodules—with a free download of the tablet edition.

As a special promotion, those who purchase the online edition are automatically qualified to receive the tablet edition for free. Users can access this version of *Radiology Select* on iPad or Android devices.

With the tablet edition, an RSNA username/password allows users to delve even deeper into the carefully selected content with features such as side-by-side figure comparisons, image zoom, note-taking and audio and video podcasts. Note: The self-assessment modules (SAMs) and CME education components are available only through the online SAM edition.

After you purchase the online edition of *Radiology Select*:

- Download the *Radiology Select* app from the iTunes, App Store or Android Market
- Open the app and select "Sign In" in the upper left corner
- Log in with your RSNA username/password
- The "buy" button will change to "download" for the volume purchased
- Tap "download" to install (download times may vary)

To get started, visit RSNA.org/RadiologySelect.



Education and Funding Opportunities



RSNA Introduction to Research for International Young Academics

Deadline for nominations—April 15

The RSNA Committee on International Relations and Education (CIRE) seeks nominations for this program

that encourages young radiologists from countries outside North America to pursue careers in academic radiology by:

- Introducing residents and fellows to research early in their training
- Demonstrating the importance of research to the practice and future of radiology
- Sharing the excitement and satisfaction of research careers in radiology
- Introducing residents to successful radiology researchers, future colleagues and potential mentors

The program consists of a special four-day seminar held during the RSNA Scientific Assembly and Annual Meeting. CIRE recommends 15 international young academics for consideration by the RSNA Board of Directors each year. Complimentary registration, shared hotel accommodation for the duration of the program and a stipend to help defray travel expenses are awarded to successful candidates.

Eligible candidates are residents and fellows currently in radiology training programs or radiologists not more than two years out of training who are beginning or considering an academic career. Nominations must be made by the candidate's department chairperson or training director. Fluency in English is required.

Nomination forms are available at RSNA.org/IRIYA.

ICR 2012

May 3-6, 2012
São Paulo Brazil

RSNA will sponsor a session on pediatric cardiovascular imaging and additional speakers at the 27th International Congress of Radiology (ICR), to be held in conjunction with the 42nd São Paulo Radiological Meeting, May 3-6, in São Paulo Brazil.

The International Society of Radiology (ISR) presents ICR every two years in a differ-

ent location around the world. The ICR meeting offers educational activities including oral and digital scientific presentations, discussions on health policies and a technical exhibition. Previous ICR meetings took place in Mexico (2004), South Africa (2006), Morocco (2008) and China (2010).

Enroll online at www.icr2012.org.

Medical Meetings

April-May 2012

APRIL 16-20

Society for Pediatric Radiology (SPR), 55th Annual Meeting, Fairmont Hotel, San Francisco, Calif.
• www.pedrad.org

APRIL 19-21

SNM, with cosponsors including RSNA, 3rd Multimodality Cardiovascular Molecular Imaging Symposium, National Institutes of Health, Bethesda, Md.
• www.snm.org

APRIL 20-22

Australian Institute of Radiography (AIR), 9th Annual Scientific Meeting of Medical Imaging and Radiation Therapy, Sydney Convention and Exhibition Centre
• www.air.asn.au/asmmirt2012

APRIL 21-25

American College of Radiology (ACR), 89th Annual Meeting and Chapter Leadership Conference, Washington Hilton Hotel, Wash., D.C.
• amcl.acr.org

APRIL 21-26

American Society of Neuroradiology (ASNR), 50th Annual Meeting and the Foundation of the ASNR Symposium 2012, Hilton New York, NY
• www.asnr.org/2012/

APRIL 26-29

Canadian Association of Radiologists (CAR), 75th Annual Scientific Meeting, Le Centre Sheraton, Montreal, Quebec
• www.car.ca/en.aspx

APRIL 27-30

Australian and New Zealand Society of Nuclear Medicine (ANZSNM), 42nd Annual Scientific Meeting, Melbourne Convention Centre, Australia
• www.anzsnm2012.com.au

APRIL 28 - MAY 2

American Radium Society (ARS), 94th Annual Meeting, Cosmopolitan, Las Vegas, Nev.
• www.americanradiumsociety.org

APRIL 29-MAY 2

British Nuclear Medicine Society (BNMS), 40th Annual Meeting, Harrogate Conference Centre, United Kingdom
• www.bnms.org.uk

MAY 11-12

Medical Imaging Informatics and Teleradiology, 8th Annual Conference, Novotel Toronto Centre, Toronto, Canada
• www.miiit.ca

RSNA Clinical Trials Methodology Workshop

January 12-18, 2013

Scottsdale, Ariz.

Applications due June 4

Over the course of this 6½-day workshop, each trainee will be expected to develop a protocol for a clinical study, ready to include in an application for external funding. Participants will learn how to develop protocols for the clinical evaluation of imaging modalities. A dynamic and experienced faculty will cover topics including:

- Principles of clinical study design
- Statistical methods for imaging studies
- Design and conduct of multi-institutional studies
- Sponsorship and economics of imaging trials
- Regulatory processes

Applicants will undergo a competitive selection process for course entrance. Once admitted, trainees will participate in advance preparation, didactic sessions, one-on-one mentoring, small group discussions, self-study and individual protocol development. Familiarity with basic con-

World Conference on Interventional Oncology

June 14-17, 2012
Chicago

RSNA is a cosponsor of this year's World Conference on Interventional Oncology (WCIO), the largest interventional oncology meeting in the U.S. More than 700 attendees are expected to attend WCIO 2012.

The conference leverages a combination of state-of-the-art lectures, panel discussions, invited papers, and selected abstracts of basic, translational, and clinical research to promote meaningful dialogue on avail-

able and emerging therapies in radiology, medical oncology, surgical oncology, interventional oncology, hepatology and radiation oncology.

Learn more at www.wcio2012.org.

Apply Now for RSNA Editorial Fellowships

Applications due
May 1

THE RSNA Trainee Fellowship and Eyler Editorial Fellowship offer the opportunity to work with *Radiology* Editor Herbert Y. Kressel, M.D., in Boston and *RadioGraphics* Editor Jeffrey

S. Klein, M.D., in Burlington, Vt. The Eyler fellowship lasts one month and trainee fellowship lasts one week. Each fellow will also visit the RSNA Publications and Communications Division at RSNA Headquarters in Oak Brook, Ill. The Eyler

Fellow will work with the RSNA editorial team at RSNA 2012.

Learn more at RSNA.org/Publications/editorial_fellowships.cfm.

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Continued from Page 16

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Annual Meeting Watch

News about RSNA 2012



Advance Registration and Housing Open May 9

RSNA 2012 advance registration and housing open May 9 for RSNA and AAPM members. Non-member registration and housing open June 6. Advance Registration and Housing information is available at RSNA2012.RSNA.org.

RSNA 2012 Registration

How to Register

There are four ways to register for RSNA 2012:

1 INTERNET—Fastest way to register!

Go to RSNA.org/register

2 FAX (24 hours)

1-888-772-1888
1-301-694-5124

3 TELEPHONE

(Mon.-Fri. 8 a.m. – 5 p.m. CT)
1-800-650-7018
1-847-996-5876

4 MAIL

Experient/RSNA 2012
P.O. Box 4088
Frederick, MD 21705 USA

Registration Fees

BY NOV. 2 AFTER NOV. 2

	BY NOV. 2	AFTER NOV. 2	
\$	0	\$100	RSNA/AAPM Member
	0	0	RSNA/AAPM Member Presenter
	0	0	RSNA Member-in-Training, RSNA Student Member and Non-Member Student
	0	0	Non-Member Presenter
	165	265	Non-Member Resident/Trainee
	165	265	Radiology Support Personnel
	750	850	Non-Member Radiologist, Physicist or Physician
	750	850	Hospital or Facility Executive, Commercial Research and Development Personnel, Healthcare Consultant and Industry Personnel
	300	300	One-day registration to view only the Technical Exhibits

Important Dates for RSNA 2012

May 9	Member registration and housing open
June 6	Non-member registration and housing open
July 11	Course enrollment opens
Oct 19	Deadline for international badge mailing
Nov 2	Deadline for housing and discounted registration
Nov 21	Deadline for guaranteed seating to all ticketed courses
Nov. 25 – 30	RSNA 98th Scientific Assembly & Annual Meeting

INTERNATIONAL VISITORS

If you must apply for a temporary non-immigrant visa to attend RSNA, you are advised to apply as soon as travel to the U.S. is decided and no later than three to four months in advance of the travel date. RSNA offers an official letter of invitation for RSNA 2012 attendees.

For more information about registering for RSNA 2012, visit RSNA2012.RSNA.org, e-mail reginfo@rsna.org, or call 1-800-381-6660 x7862.



Annual Meeting Attendees Gravitate To Digital Navigators

Introduced just two years ago, Digital Navigators placed throughout McCormick Place have become an extremely popular way for RSNA annual meeting attendees to find their destinations.

RSNA 2011 offered 14 Digital Navigators featuring 42-inch touchscreens to guide users with visual cues to technical exhibit booths, educational sessions, facility services and more. A total of 764,368 impressions, or screen “touches,” were recorded—a 33 percent increase over 2010.

THE NEW RSNA.org

Optimize Your RSNA Journals Experience

Exploring the finest peer-reviewed journals in radiology is now faster and easier than ever with the newly redesigned journals page on the all-new RSNA.org.

All *Radiology* and *RadioGraphics* related content is consolidated into intuitive categories that quickly direct you to your desired destination. Once you've explored online content and perused the latest online editions or utilized any of the other journal resources, click the new feedback button to offer your thoughts on the site.

Highlights of the redesigned page include:

- ▶ **Feedback:** Click here to leave comments and suggestions for improving your RSNA Web experience.
- ▶ **Things to Know:** Order a non-member subscription or apply for RSNA membership, which includes free journal subscriptions and access to the *Radiology* Legacy collection. Opt for online-only journals, explore exclusive content and earn instant CME.
- ▶ **Explore the Finest Journals in the Field:** Access direct links to *Radiology*, *RadioGraphics* and the *Radiology* Legacy collection.
- ▶ **Mobile Options:** Access full content *Radiology* and *RadioGraphics* apps and mobile-optimized sites for your mobile device.
- ▶ **Resources:** Subscriber help and services are accessible at this central hub.
- ▶ **Extras:** Additional icons at the bottom of the page direct you to essential tools and content relevant to your online experience.
- ▶ **Social Media:** Follow *Radiology* and *RadioGraphics* on Facebook, Twitter and other social media sites.



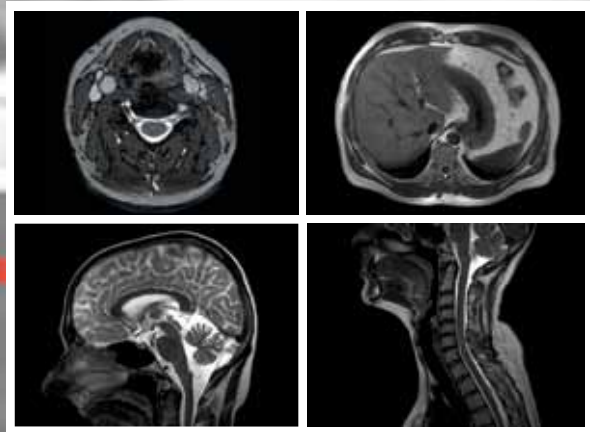
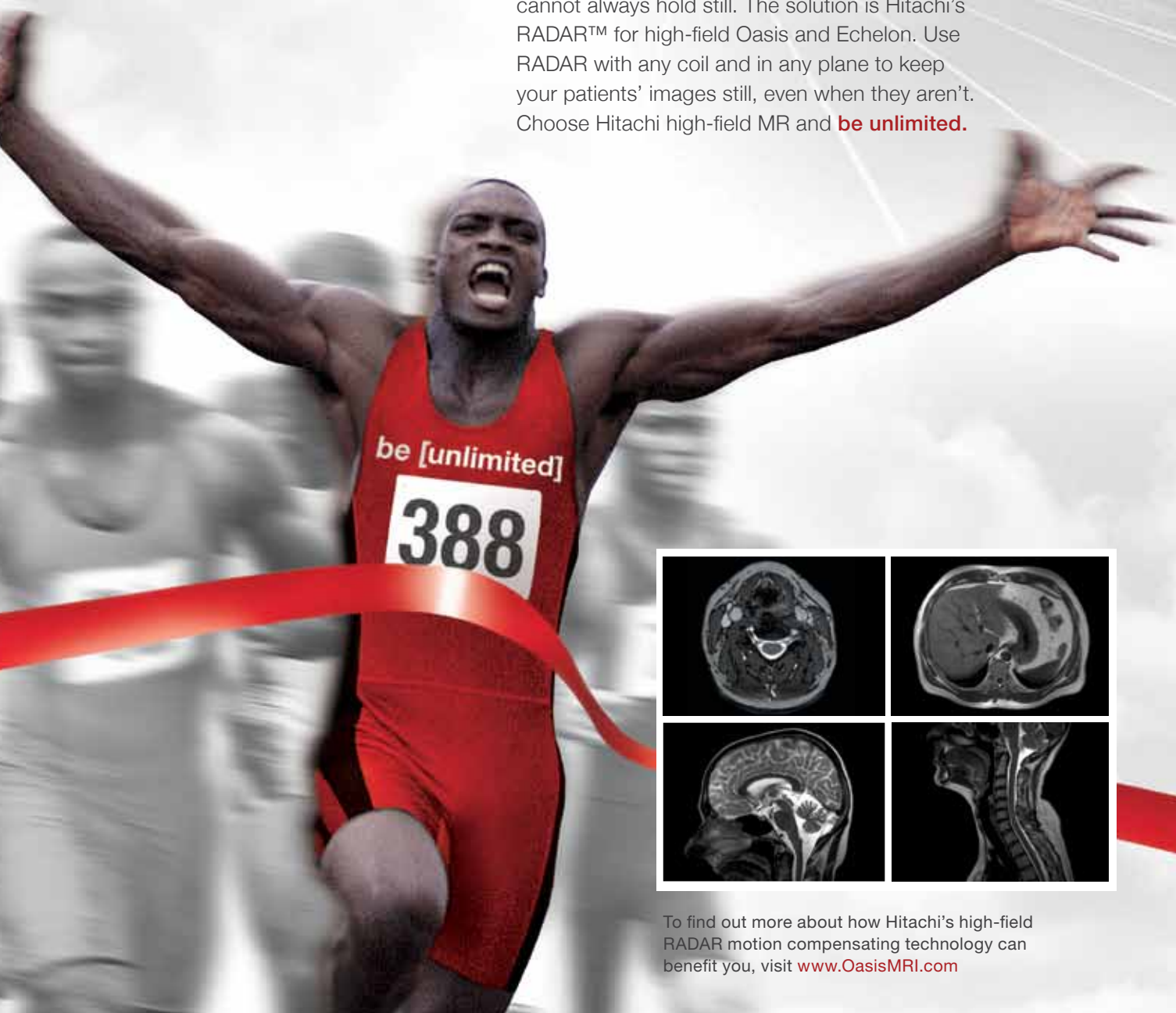
COMING NEXT MONTH

While a radiologist might have an idea in mind, he or she might not be familiar with the process for developing, patenting and licensing inventions that could become critical to daily practice. In next month's *RSNA News*, we explain how physician-entrepreneurs can take the next step with their intellectual property.

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