

May 2019

IMAGING 3.0 IN PRACTICE

Stewards of High-Value Imaging



Be PAMA AUC Prepared!

2020 Deadline: Prepare Now

Starting Jan. 1, 2020, the Centers for Medicare & Medicaid Services (CMS) will require providers to consult appropriate use criteria (AUC) prior to ordering advanced medical imaging for Medicare patients.

This consult must be completed via a CMS-qualified clinical decision support mechanism (qCDSM), and documented on a claim, or rendering providers will not receive Medicare reimbursement for the exam.

What You Need to Do:

- Make sure your IT, medical and professional staff know that a mandatory one-year “Educational and Operations” testing period starts Jan. 1, 2020
- Encourage your IT, medical and professional staff to start incorporating AUC into your electronic health record (EHR) and image ordering/fulfillment systems
- Work with your referring providers so they know how to use AUC/Clinical decision support (CDS) systems — your qCDSM vendor can help
- Earn credit within the MIPS Improvement Activity Category by taking part *in the current voluntary reporting period*

ACR Resources Can Help



Use CareSelect Imaging™ — ACR Select®, a digital representation of ACR Appropriateness Criteria® for diagnostic imaging — a module contained within CareSelect Imaging.



Take part in (with your referring providers) the Radiology Support, Communication and Alignment Network (R-SCAN™). Earn CME Credit and ABR maintenance of certification Part 4 Credit.



Review Imaging 3.0 CDS case studies to gain insights from other practices and departments that have implemented CDS systems.

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IMAGING 3.0 IN PRACTICE

Stewards of High-Value Imaging



The medical reimbursement landscape is shifting, substantially affecting how we, as radiologists, practice.

The Medicare Access and CHIP Reauthorization Act of 2015 establishes a new framework, rewarding providers for value over volume and requiring radiologists to present concrete data to illustrate how we are delivering better care to patients at lower cost. In parallel, the Protecting Access to Medicare Act of 2014 requires clinicians to consult appropriate use criteria via a qualified clinical decision support (CDS) mechanism when ordering advanced imaging.

With this transition to value-based care upon us, we, as medical imaging experts, must actively engage our referring colleagues to ensure that each patient receives the right imaging test at the right time for the right reason. The ACR's Radiology Support, Communication, and Alignment Network (R-SCAN®) is helping us make this transition.

A quality improvement initiative funded by CMS' Transforming Clinical Practice Initiative (TCPI), R-SCAN empowers radiologists and referring clinicians – in practices large and small – to achieve quantitative improvements in imaging utilization nationwide. A collaborative plan, R-SCAN fosters familiarization with and adherence to the ACR's Appropriateness Criteria®, CDS technology, and Choosing Wisely® recommendations from various medical societies, including the American College of Physicians, the American College of Emergency Physicians, and the American Medical Association, for a multispecialty approach to improved imaging utilization.

And now, R-SCAN participants can review imaging utilization results across a growing list of imaging areas, indications, and exams through the ACR's recently launched CDS R-SCAN Registry. Part of the National Radiology Data Registries, this registry will provide national benchmarking data to clinicians, practices, and healthcare systems for imaging utilization comparison with peers. This information can inform the R-SCAN process, which now offers PI CME as one of its many benefits.

To learn more about R-SCAN, I invite you to read the Imaging 3.0® case studies in this issue. As you will see, the momentum for delivering value-based care is strong. Each case study illustrates how radiologists and clinicians are leveraging R-SCAN to achieve significant, quantifiable imaging utilization improvements. And, if you haven't already, I encourage you participate in R-SCAN as one way to increase your stewardship of appropriate imaging.

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Case Studies

4. In Sync

Radiologists and ED physicians use R-SCAN to bolster their relationship and improve imaging appropriateness for pediatric patients.

7. Backed by Guidance

Hershey Medical Center's R-SCAN project decreases inappropriate low back pain imaging and utilization in the emergency department.

10. Partners in Quality

With R-SCAN, radiologists and ED physicians achieve a 45 percent improvement in appropriate CT ordering for PE.

12. Homing in on Quality

Radiologists in rural western North Carolina are strengthening their relationships with local physicians and reducing inappropriate imaging via R-SCAN.

15. The Benefits of Collaboration

Radiologists and ED physicians partner on an R-SCAN project – successfully reducing unnecessary imaging by 52 percent.

18. Engaging the Physician

Using R-SCAN, radiologists collaborate with family medicine clinics to enhance imaging appropriateness of lumbar spine orders.

20. Teaching Imaging Appropriateness

A simulation-based educational program increases medical students' abilities to identify appropriate imaging.

QUESTIONS? COMMENTS?

Contact us at imaging3@ACR.org

View the full case study library at acr.org/Case-Studies

SHARE YOUR STORY

Have a case study idea you'd like to share with the radiology community? To submit your idea, please visit acr.org/Suggest-a-Case-Study.

In Sync

Radiologists and ED physicians use R-SCAN® to bolster their relationship and improve imaging appropriateness for pediatric patients.

KEY TAKEAWAYS

- Radiologists and ED physicians at Northwest Medical Center teamed up on an R-SCAN project to reduce inappropriate CT ordering for minor pediatric head injury.
- The radiologists and ED leaders initiated an educational intervention that led to a 16 percent reduction in inappropriate CT ordering for minor pediatric head injury in the ED.
- The project helped strengthen the relationship between the radiologists and ED physicians and set the stage for increased collaboration over time.

The radiologists with Envision Physician Services are always looking for ways to strengthen their relationships with referring providers at Northwest Medical Center in Ft. Lauderdale, Fla. So when they heard about the ACR's Radiology Support, Communication, and Alignment Network (R-SCAN®), which brings radiologists and ordering providers together to improve imaging appropriateness, they eagerly enrolled to collaborate with their clinical partners on a project that would meaningfully impact patient care. ([Learn more about R-SCAN at rscan.org](http://rscan.org))

The result was not only a 16 percent reduction in inappropriate image ordering for minor pediatric head injury in the ED, but also an enduring dedication to coordinated care delivery.

Adam M. Gittleman, MD, chief of radiology at Northwest Medical Center, and Bao T. Doan, MD, national medical director of radiology services with Envision Physician Services, led the project. After reviewing the dozen-plus Choosing Wisely® topics that support R-SCAN, the pair decided to pursue the CT for Minor Pediatric Head Injury topic, which recommends forgoing CT for the immediate evaluation of minor pediatric head trauma and instead using the Pediatric Emergency Care Applied Research Network (PECARN) criteria to determine imaging appropriateness.

"We selected this topic because we were receiving a lot of CT orders for minor pediatric head trauma," Gittleman says. "We wanted to collaborate with ED physicians to improve appropriate image ordering and reduce unnecessary radiation exposure for pediatric patients."

With this in mind, Gittleman and Doan approached Northwest's ED and pediatric medicine leaders about the number of CTs the ED physicians were ordering for minor



Radiologists and ED physicians at Northwest Medical Center collaborated on an R-SCAN project to reduce inappropriate head CTs for pediatric patients with minor head trauma.

pediatric head trauma and suggested that R-SCAN could help improve ordering practices. Bruce S. Whitman, DO, who was the site medical director in Northwest's ED at the time, and Ann Marie Font, MD, associate medical director of pediatrics at Northwest, both immediately agreed to participate in the project. "Our group supported the project because CT scans deliver a lot of ionizing radiation, and we're all committed to reducing radiation exposure in pediatric patients," Font says.

In addition to reducing unnecessary imaging, Whitman recognized that R-SCAN would help the ED team meet the care improvement requirements outlined in the Merit-based Incentive Payment System (MIPS). "We knew MIPS was coming and that R-SCAN would help us document our progress to meet the performance criteria," Whitman says. "It was a good way for us

to work with our radiology colleagues to educate our providers and, in turn, educate our patients and families about imaging appropriateness and radiation safety.”

Reducing Unnecessary Radiation

While all patients should be aware of the possible effects of radiation exposure, it is especially important for pediatric patients whose particular sensitivity to ionizing radiation may increase their cancer risk. A single CT scan delivers 1-2 millisieverts of radiation or the equivalent of about 100 chest X-rays — which may significantly impact children. “Part of the problem is that radiation is cumulative, meaning it stays with children throughout their lifetimes,” Doan explains. Still, *Choosing Wisely* reports that EDs nationwide order CTs for 50 percent of children with head injuries, and many of these scans may be unnecessary. “With R-SCAN, we thought we could make a big difference in reducing radiation exposure by preventing many unnecessary CT scans among our pediatric patients,” she adds.

In partnership with ED and pediatric leaders, Gittleman and Doan began following R-SCAN’s three-phase quality improvement approach: pre-interventional analysis, educational intervention, and post-interventional analysis. For the pre-interventional analysis, Gittleman and Whitman went back six months and randomly pulled 50 cases in which ED physicians ordered CTs for children with minor head trauma. “We spent a couple hours manually searching our radiologist information system and reviewing cases to see whether the ordering physicians followed the PECARN criteria,” Gittleman says. “If they followed PECARN, the CT was considered appropriate, and if they didn’t follow the criteria, the CT was considered inappropriate.”

The analysis revealed that about 45 percent of the cases were appropriate, while about 55 percent of the cases were inappropriate. “This was a retrospective review, so we didn’t have all of the information that the ordering physician would have had at the time,” Gittleman notes. “But we were concerned that more than half of the CTs for pediatric patients didn’t meet the PECARN criteria and were therefore deemed inappropriate. We thought we could do better.”



Adam M. Gittleman, MD, chief of radiology at Northwest Medical Center, led an R-SCAN project to reduce inappropriate CT scans for minor pediatric head trauma.

Educating Ordering Providers

Northwest’s ED physicians didn’t regularly follow the PECARN criteria before starting the project because the guidelines weren’t readily available in the hospital’s EHR, Whitman says. Unable to quickly consult the criteria in the fast-paced department, the ED physicians often ordered CT scans for patients with minor head injury — mainly because parents and families insisted. “Many times, physicians order studies because parents are worried about their children and want imaging to confirm they are okay,” Whitman explains. “In the past, our ED physicians didn’t have evidence at their fingertips to show parents that the studies were not clinically necessary.”

To change that, the radiologists partnered with ED and pediatric leaders for the project’s educational intervention phase. Gittleman and Doan shared R-SCAN’s educational resources with the leaders and attended departmental meetings to discuss the PECARN criteria. To ensure everyone was on the same page, Font talked to her team of pediatricians about the importance of reducing unnecessary radiation and informed them that the ED physicians would be using the PECARN criteria to determine imaging appropriateness.

On his end, Whitman used email to distribute the resources to his team members, including ED physicians, physician assistants,

and nurse practitioners. He also met with his team to develop a plan for deploying the PECARN criteria in the ED. “We discussed how to let families know that we were using a clinical decision rule based on nationally recognized scientific data to determine whether CT scans were necessary,” Whitman says.

“Everyone in the department was onboard and appreciated the opportunity to improve image ordering for our pediatric patients.”

From there, the radiologists and ED leaders worked with the hospital’s EHR vendor to integrate the PECARN criteria into the system. Now, when an ED physician orders a CT for pediatric head trauma, the system automatically provides a checklist to determine whether a CT is appropriate based on the PECARN criteria. “Time is the biggest factor in a busy emergency room,” Whitman says. “Having PECARN embedded within our EHR improves image ordering without impeding our workflow.”

If a CT scan is deemed inappropriate, the ED physician discusses it with the family. “The ED doc reviews the criteria with the family and explains that a CT scan is not necessary based on national data,” Whitman says. “These conversations take some time, but the families seem to appreciate the information. They ultimately decide whether to proceed with the scan.”

Measuring the Impact

Six months after completing the educational intervention and implementing the PECARN criteria, the radiologists and ED physicians moved to the next phase of the R-SCAN project — post-interventional analysis. For this phase, the hospital’s IT department created a pediatric head trauma worklist within the hospital’s PACS and collected 50 cases for pediatric patients who suffered minor head trauma.

Using those cases, Gittleman and Whitman conducted another retrospective review to determine whether appropriate image ordering for pediatric head trauma had improved as a result of their combined efforts. This analysis showed that the data had in fact flipped — with about 54 percent of cases deemed appropriate and about 46 percent of cases deemed inappropriate based on the PECARN criteria.



Bao T. Doan, MD, national medical director of radiology services with Envision Physician Services, says R-SCAN helped the team at Northwest reduce radiation exposure in some of its most vulnerable patients — children.

Additionally, the team looked at the total number of head CTs that the ED physicians had ordered between December of 2016 and February of 2017 (pre-interventional) and the number of CTs they had ordered between December of 2017 and February of 2018 (post-interventional). This analysis showed that of the 68 total head CTs ordered for pediatric patients during the pre-interventional phase, about 44 percent were for minor head trauma, and of the 84 total head CTs ordered for pediatric patients during the post-interventional phase, about 37 percent were for minor head trauma.

“So we not only saw a 16 percent reduction in inappropriate image ordering as a result of our work, but we also saw a 20 percent reduction in the total number of head CTs ordered for minor head injury,” Gittleman says.

The project’s quantifiable results have helped Gittleman and Doan convince their radiology colleagues to make quality improvement a priority. The pair shared the project with their team, using a PowerPoint presentation. “Sometimes we do things over and over without really pausing to contemplate whether we’re doing them in the best

way possible,” Doan says. “A project like this allows us to look back at our processes and see that when we tweak them a little, we can make things better for us, our care partners, and, ultimately, our patients without even disrupting our workflow. It’s very rewarding when you see the positive impact of your efforts — especially when caring for our youngest and most vulnerable patients.”

Strengthening Care Partnerships

In addition to achieving quantifiable results, the project has helped strengthen the relationship between the radiologists, ED physicians, and pediatricians at Northwest. “Our groups have always had a collaborative relationship, but R-SCAN has encouraged us to interact even more,” Gittleman says. “We’re friendlier with one another, and we engage in conversations more often than we did before. That kind of collegiality leads to more coordinated patient care.”

Whitman agrees and says that the project has empowered the ED physicians to consult with the radiologists more frequently. “During this project, we communicated more directly with the radiologists, particularly with Dr. Gittleman, and now, our providers know that they can call the radiologists with questions about which tests are appropriate based on the clinical condition,” he says. “The radiologists are always willing to talk with us so we can treat our patients better. We look forward to continuing our collaboration to improve ordering of CTs and other imaging studies.”

Everything went so well, in fact, that the radiologists and ED physicians are preparing to partner on another R-SCAN project — this one aimed at reducing inappropriate CTAs for patients with suspected pulmonary embolism. “Reducing unnecessary CTAs is also part of the MIPS criteria and also involves radiation reduction,” Whitman says. “It will help us treat our patients more appropriately. It’s a good project all around.”

The radiology and ED teams hope to launch the PE project at Northwest Medical Center before eventually taking it across

Envision Physician Services, which employs thousands of radiologists and other specialty providers nationwide. “We couldn’t expand our pediatric head trauma project across the network because only some of our facilities offer pediatric care, but all of our facilities see patients with suspected PE,” Doan explains. “The ultimate goal is to get every hospital that we service involved in this project. If we do this on a national basis, we think we’ll get even more significant results and improve patient care on an even larger scale.”

By Jenny Jones

Next Steps

- Enroll in R-SCAN and partner with referring providers to improve imaging appropriateness for enhanced patient care.
- Follow R-SCAN’s three-step quality improvement process and measure results, incorporating the PECARN criteria where appropriate.
- Educate patients and families about appropriate imaging and radiation safety and use evidence-based guidelines to educate them about the most clinically appropriate care pathway.

FOR DISCUSSION

How are you educating referring physicians about appropriate image ordering and the risks of unnecessary radiation exposure, especially for pediatric patients?

How can you strengthen your relationships with referring physicians and staff and empower them to consult with radiologists more frequently?

How can you educate patients and families about appropriate imaging and radiation safety and use evidence-based guidelines to encourage shared decision making about their care?

Backed by Guidance

Hershey Medical Center's R-SCAN® project decreases inappropriate low back pain imaging and utilization in the emergency department.

KEY TAKEAWAYS

- A radiologist at Penn State Hershey Medical Center worked with emergency department (ED) providers, including physicians, nurse practitioners, and physician assistants, to reduce inappropriate low back pain radiographs in the ED.
- The team conducted the project with ACR's R-SCAN™, a CMS-sponsored initiative that brings radiologists and referring physicians together to improve imaging appropriateness.
- Following an educational intervention, inappropriate plain-film imaging for low back pain in the ED decreased more than 40 percent, and utilization decreased more than 35 percent.

Suspecting that many emergency department (ED) patients were undergoing unnecessary plain-film imaging for low back pain, a radiologist at Penn State Milton S. Hershey Medical Center led a quality improvement project (QIP) to address the issue with ED providers. The result was a 43 percent reduction in inappropriate radiographic imaging for low back pain in the ED and a more than 35 percent reduction in utilization. Here's how it unfolded.

Hershey's radiologists and ED physicians heard about possible inappropriate imaging for low back pain in the ED in 2015, while working together on a separate QIP focused on lumbar spine MRIs. Following the success of that project, Timothy J. Mosher, MD, the medical center's chair of radiology, suggested that the two departments collaborate on another QIP, this time using ACR's Radiology Support, Communications, and Alignment Network (R-SCAN®). ([Learn more about R-SCAN at *rscan.org*](#))

Funded through the Centers for Medicaid and Medicare Service's Transforming Clinical Practice Initiative ([Learn more at *bit.ly/RSCAN_TCPI*](#)), R-SCAN brings radiologists and referrers together to improve imaging appropriateness around Choosing Wisely® topics. The program gives participants access to a free version of the CareSelect Imaging™ clinical decision support tool, educational resources, and CME and MOC credits. ([Learn more about CareSelect Imaging at *bit.ly/CareSelect*](#))

As the Hershey team considered whether to enroll in R-SCAN, members noticed that low back pain was one of the available topics. Reminded of what they had learned about low back pain imaging during their last QIP, members agreed that R-SCAN afforded an opportunity to improve their ordering practices around low back pain in a structured way.

"We had an anecdotal sense that a large number of ED patients who didn't meet



Timothy J. Mosher, MD, chair of radiology at Hershey Medical Center and distinguished professor of radiology at Penn State University, led an R-SCAN project to improve image ordering for low back pain in the ED.

the appropriateness guidelines were being imaged for low back pain," says Mosher, who is also a distinguished professor of radiology at Penn State University. "R-SCAN provided a framework to verify the problem, measure the problem, intervene to improve imaging appropriateness, and follow-up on the effectiveness of our efforts."

Establishing a Baseline

The team launched the project in the spring of 2016. The first step, as outlined by R-SCAN, involved a pre-intervention phase in which Mosher reviewed all of the cases of ED patients who had undergone imaging for low back pain during a three-month period, from April through June, of that year. Mosher worked with the medical center's IT team to develop a computer script to automatically pull these cases — 202, in all.

While R-SCAN participants typically use CareSelect Imaging to



Radiologists and ordering providers at Hershey Medical Center partnered on an R-SCAN project that led to a reduction in inappropriate image ordering for low back pain.

digitally evaluate their cases based on the ACR Appropriateness Criteria®, Moshier decided to evaluate his cases manually using evidence-based guidelines from the American College of Emergency Physicians (ACEP) and the National Quality Forum (NQF). These guidelines say to refrain from imaging patients for low back pain unless they have a history of conditions, such as cancer, trauma, IV drug abuse, specific neurological impairment, HIV, intraspinal abscess, or immune deficiency. Moshier says he chose to use the ACEP and NQF guidelines because they correspond with standards from multiple specialty organizations, including ACR.

Upon reviewing the cases against the guidelines, Moshier found that 44 percent of the 202 cases did not meet the defined appropriateness criteria. “This verified what we had suspected: that many low back pain radiographs in the ED were inappropriate,” he says.

Defining the Audience

Data in hand, Moshier moved to the educational intervention phase of R-SCAN, during which he focused on teaching the ED physicians about appropriate image ordering for low back pain.

“Not only did we cut the percentage of inappropriate exams almost in half, but overall we cut the number of exams by over a third.”

— Timothy J. Moshier, MD

Working with the ED chair, Moshier sent the physicians copies of the ACEP and NQF guidelines and articles from the *Journal of the American College of Radiology*, the *Journal of the American Medical Association*, and *Radiology* (See links under the [Related Resources](#) section.) about appropriate low back pain imaging. He also met with the physicians outside of clinical hours to discuss the imaging guidelines and appropriate imaging.

Following the intervention, Moshier moved on to R-SCAN’s post-intervention phase. Using the same computer script as before, he pulled all of the cases of ED patients who underwent plain-film imaging for low back pain from July through September, expecting far fewer inappropriate exams. But he was disappointed when 42 percent of the cases still did not meet the guidelines.

Suspecting that something was amiss, Moshier looked to see who actually ordered low back pain imaging in the ED. He found that advanced practice clinicians (APCs), including nurse practitioners and physician assistants, in the ED’s quick-care area ordered 85 percent of the exams. His intervention had been directed at the wrong providers.

Correcting Course

With this in mind, Moshier went back to R-SCAN’s interventional phase. He reached out to the APC liaison in the ED and asked about talking with the APCs about imaging appropriateness for low back pain. The liaison was receptive and invited Moshier to the APCs’ journal club the following week.

In preparation for the meeting, Moshier sent the APCs the ACEP and NQF guidelines, the articles about appropriate low back pain imaging, and the data he had collected during the pre-intervention phase. “I broke the ordering data up by faculty, residents,

and APCs, so they could see that they controlled this and could take ownership of it to do better,” Moshier says.

Developing a Solution

During the meeting, Moshier spent nearly two hours reviewing the articles and talking about appropriate imaging with the dozen or so APCs in attendance. The APCs explained that the primary driver for low back pain imaging in the ED was patient satisfaction. They often ordered the imaging simply because patients wanted it.

“Patients come in with low back pain, and they expect something to be done,” says Joseph Laurito, who was the lead APC in the ED during the project. “In talking with Dr. Moshier, I thought about all of the X-rays I’ve ordered for patients just to make them happy and how many times the imaging uncovered something that was unexpected. The answer was: none.”

By the end of the journal club, the APCs resolved to change their approach to low back pain imaging. “We decided to start talking to patients about why we shouldn’t image for low back pain when it’s not indicated — it’s a waste of money and time, and it puts patients at risk for unnecessary radiation exposure,” Laurito says.

Seeing Results

After the meeting, Moshier began analyzing low back pain cases and saw an almost immediate reduction in the number of inappropriate orders. He then passed this information along to the APCs to encourage them to continue their efforts. “Sharing that success was important so they could see that what they were doing was having a direct impact on quality,” Moshier says.

At the end of the year, Mosher again followed R-SCAN's post-intervention phase. Using the same computer script from before, he pulled all of the low back pain radiographs that were conducted in the ED during the last quarter, October through December, and evaluated the cases based on the guidelines.

This time he found that only 25 percent of the studies were inappropriate. He also found that the number of radiographs ordered for low back pain was down to nearly 140 from about 220 the previous quarter — a more than 35 percent reduction in utilization.

"Not only did we cut the percentage of inappropriate exams almost in half, but overall we cut the number of exams by over a third," Mosher says. "This reduction is good for patients because it reduces the risk of over diagnosis and unnecessary exposure to radiation. It's also good for our health system, because it represents a significant cost savings, while demonstrating radiology's contribution to the Triple Aim."

Laurito agrees that the change has been good for patient care, without compromising patient satisfaction. "Just having that discussion with the patients, they quickly understand why imaging isn't appropriate," he says. "There haven't been any arguments from the patients, in my experience."

Following the Plan

At the end of the project, Mosher used R-SCAN's Excel templates to upload his case data. The templates allow participants to track data points that aren't part of R-SCAN reporting, while eliminating the need to manually enter cases into the portal. Mosher received a report, including graphs that showed an increase in high-value exams following the educational intervention.

Mosher credits the project's success in part to how easy R-SCAN is to deploy in just about any practice setting. "We made a few modifications to the R-SCAN template to align with our needs, but it was pretty easy to use," he says. "R-SCAN gave us a good roadmap for approaching our appropriateness challenges."

For others who might be considering their own R-SCAN projects, Mosher suggests

starting small. "You don't want to bite off a huge project with a large amount of data and then realize you don't have the resources to do it," he says. "If you start with something manageable, you will have success and build little evangelists along the way. Once you have that buy-in, you can tackle other projects."

By Jenny Jones

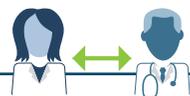
Next Steps

- Identify a topic area where patients may be receiving inappropriate imaging and find out who orders those exams.
- Approach the ordering providers about enrolling in R-SCAN and track your progress through the program.
- Introduce an educational intervention to improve image ordering and compare pre- and post-intervention cases to assess the intervention's impact.

Related Resources

These are the articles Mosher shared with the ED physicians and APCs:

- "Low Back Pain in the Emergency Department — Are the ACR Appropriateness Criteria Being Followed?" (bit.ly/JACRLowBackPain)
- "The Medicare Outpatient Imaging Efficiency Measure for Low Back Pain (OP-8)" (bit.ly/OutpatientImagingRSNA)
- "Clinicians' Perceptions of Barriers to Avoiding Inappropriate Imaging for Low Back Pain—Knowing is Not Enough" (bit.ly/CliniciansPerceptions)
- "ACR Appropriateness Criteria Low Back Pain" (bit.ly/ACRCriteria)



Download a PAMA flier to share with referring physicians at bit.ly/PAMAFlier



Joseph Laurito, lead advanced practice clinician (APC) in the ED at the time, worked with his team to implement a solution to improve appropriate image ordering for low back pain.

FOR DISCUSSION

How can you determine if ED patients in your facility are undergoing unnecessary imaging for low back pain and identify who is ordering these exams?

What is the best approach to teach your ED physicians, nurse practitioners, and physician assistants about evidence-based guidelines regarding appropriate imaging for low back pain?

What opportunities do you have to educate patients at your facility about appropriate imaging guidelines and the risks of unnecessary radiation exposure?

Partners in Quality

With R-SCAN®, radiologists and ED physicians achieve a 45 percent improvement in appropriate CT ordering for PE.

KEY TAKEAWAYS

- Radiologists and ED physicians in suburban Philadelphia collaborate on an R-SCAN® project to reduce low-value CT imaging for pulmonary embolism.
- Reminding referring physicians about the ACR Appropriateness Criteria® for PE diagnoses with CT improves appropriate imaging and enhances quality of care.
- Distributing educational handouts to patients improves physician/patient engagement and increases patient satisfaction.

Pulmonary embolism (PE) is a life-threatening condition, affecting an estimated 300,000–600,000 people in the United States annually.¹ Occurring when a blood clot travels to the lungs, PE can be difficult to diagnose due to its non-specific symptoms: shortness of breath, chest pain, and palpitations.

For this reason, emergency departments (EDs) nationwide have ordered a steadily rising number of chest CTs for suspected PE over the years — with a fivefold increase from 2000 to 2009 alone.² But research shows that these exams are often unwarranted, resulting in unnecessary radiation exposure and escalating healthcare costs.

With this in mind, radiologists and ED physicians at Main Line Health's Riddle Hospital in suburban Philadelphia partnered to reduce inappropriate CT ordering for suspected PE in the hospital's ED.

R-SCAN Project

Ashima Lall, MD, MBA, FACHE, system chief of performance improvement for Radiology Associates of the Main Line, and Rebecca L. Pasdon, DO, emergency physician at Riddle, spearheaded the project using the ACR's Radiology Support, Communication and Alignment Network (R-SCAN®). ([Learn more about R-SCAN at rscan.org](#))

R-SCAN is a collaborative plan that brings radiologists and referring clinicians together to improve imaging appropriateness and optimization around more than a dozen Choosing Wisely® topics. Participants gain access to web-based educational resources, including CareSelect Imaging™, an expanded version of the foundational ACR Select clinical decision support (CDS) tool, which digitally delivers the ACR Appropriateness Criteria® (AC) at the point of order. ([Learn more about CareSelect Imaging at bit.ly/CareSelect](#))

The Riddle team leveraged these tools to analyze the appropriateness of CT ordering for PE and to teach ED physicians about



Ashima Lall, MD, system chief of performance improvement for Radiology Associates of the Main Line, engaged with emergency department colleagues at Riddle Memorial Hospital in a successful R-SCAN project.

appropriate image ordering. They also used Choosing Wisely resources to teach patients about PE symptoms and the risks associated with CT radiation exposure.

Their efforts resulted in a 45 percent improvement in appropriate CT ordering for ED patients with suspected PE, and ED patients surveyed gave a largely positive evaluation of the educational materials. Here's how they did it.

Patient Involvement

From the start, Lall, who is also the director of PET/CT at Riddle and vice chair of the Quality Experience Committee under the ACR's Patient- and Family-Centered Care Commission, wanted to involve patients in the initiative — a first for an R-SCAN project.

Lall notes that PE is a terrifying prospect for patients, and recent press coverage about the dangers of radiation exposure exacerbates their worries. "We engaged the

Patient Family Advisory Committee (PFAC) at the hospital, so the patient voice could be heard with this project," she says.

Joanne Sunick, a member of the PFAC, who works with clinicians to improve patient care across Riddle, says that the group wholeheartedly supported the collaboration to improve CT ordering and was eager to provide insights into educating patients about PE.

The group agreed that distributing handouts about PE and CT would help empower ED patients to make shared decisions with their physicians. It emphasized that the materials should be presented at a level that every patient can easily understand. "As a patient, it's confusing when you're trying to keep track of the acronyms, and you don't know what they mean," Sunick says. "Patients and families in the ED feel anxious enough; they don't need anything more to worry about. Educational materials like this can help patients better understand their conditions and their diagnostic and treatment options." (View the handout at bit.ly/RSCAN_PE)

Based on the PFAC's recommendations, Pasdon and the ED director worked with ED doctors to begin distributing a Choosing Wisely handout to patients with suspected PE. Written in patient-friendly language, the handout describes the likelihood of PE and its risk factors, as well as possible radiation dangers associated with CT. "I've always explained to my patients what we were doing, why we were concerned, and what tests we were ordering, but when they had the information sheet — something tangible to hold on to — that solidified everything," Pasdon says.

Retrospective Analysis

In addition to educating patients about PE and CT, Lall and Pasdon followed R-SCAN's quality improvement process to study CT orders and educate ED physicians about appropriate image ordering for suspected PE.

For the first step in the process, Lall and Pasdon conducted a retrospective analysis of 84 CT cases that ED physicians ordered for suspected PE during a three-month period. Pasdon created a spreadsheet with validated clinical prediction rules to estimate PE probability for each patient. These rules



Rebecca L. Pasdon, DO, distributed patient educational materials about CT for pulmonary embolism in the emergency department at Riddle Memorial Hospital.

appropriateness for patients with suspected PE. Leveraging the ACR AC, the tool takes into account medical history, basic exam results, and presenting symptoms to determine PE risk and the appropriateness of a chest CT — as also instructed by the American College of Emergency Physicians.³

All referring providers will be required to document that they have consulted CDS solutions, like CareSelect Imaging, once the Protecting Access to Medicare Act (PAMA) goes into effect in 2020. PAMA requires referring providers to consult AC before ordering advanced diagnostic imaging for Medicare patients in the outpatient setting.

R-SCAN gives providers and radiologists a chance to familiarize themselves with CDS ahead of PAMA's implementation — something the team at Riddle appreciated.

continued on page 23

"We engaged the Patient Family Advisory Committee (PFAC) at the hospital, so the patient voice could be heard with this project."

— Ashima Lall, MD

aligned with AC and included Wells scores, pulmonary embolism rule-out criteria, and D-dimer test results.

Pasdon used this criterion to determine the low, moderate, and high levels of risk for PE. Only cases with a high level of PE risk were considered appropriate for CT. Based on this scale, the retrospective analysis revealed that 63 percent of the CTs that ED physicians had ordered during the three-month period were inappropriate.

Educational Intervention

To improve imaging appropriateness, Lall and Pasdon conducted an educational intervention to teach ED physicians about image ordering for suspected PE.

During the educational intervention, Lall and Pasdon explained that for three months the ED physicians would use the CareSelect Imaging CDS tool to determine CT imaging

FOR DISCUSSION

How can you identify referring groups that would benefit from a radiology-led educational intervention to improve appropriate image ordering?

Which R-SCAN Choosing Wisely topics lend themselves to a patient-centered quality improvement initiative in your facility, and how can you help patients better understand their care?

What tools can you leverage to inform physicians about appropriate image ordering at the point of care and help them gain experience with consulting appropriate use criteria before ordering advanced imaging?

Homing in on Quality

Radiologists in rural western North Carolina are strengthening their relationships with local physicians and reducing inappropriate imaging via R-SCAN®.

KEY TAKEAWAYS

- Engaging referring clinicians in R-SCAN can help demonstrate that radiologists are more than just image readers; they are consultants in patient care.
- Asheville Radiology was the first radiology group to customize its own R-SCAN topic in order to focus on the unique needs of its rural community, making it easier for referring physicians to participate.
- The group engaged key physicians to utilize R-SCAN's free clinical decision support tool to reduce unnecessary imaging exams and prepare for upcoming government regulations.

Taking the path less traveled almost always leads to a few twists and turns. For radiologists at Asheville Radiology Associates in Asheville, N.C., paving a new route means success in educating their referring clinicians about appropriate image ordering. However, the group faces a unique challenge in doing so: Their referring providers are distributed across a wide geographical area in rural western North Carolina.

For years, the group's radiologists had done their best to familiarize their referrers with image ordering best practices. But, because the independent community hospital system they serve, Mission Health, comprises six hospitals and various outpatient and surgery centers distributed across a wide geographical area, face-to-face contact was challenging.

With the passage of the Protecting Access to Medicare Act of 2014 (PAMA), however, the leadership of Asheville Radiology perceived that their role as consultants was about to get a boost. PAMA requires referring clinicians to order advanced imaging procedures for Medicare patients through a clinical decision support (CDS) tool that is based on appropriate use criteria (AUC).

As luck would have it, Mission Health and the radiology group had already been evaluating CDS tools to integrate with the system's electronic medical record (EMR). Given the geographic challenges involved in keeping their referring providers abreast of periodic changes in image ordering guidelines, the group's leadership saw an opportunity to demonstrate their value to the health system.

A Consultative Approach

Bryon A. Dickerson, MD, president and executive medical director of Asheville Radiology Associates, and his radiologist colleagues were already champions of using CDS to automate and improve imaging appropriateness across a far-flung rural area. But they



Bryon A. Dickerson, MD, president and executive medical director of Asheville Radiology Associates, and his colleagues have sought to reduce inappropriate imaging and improved quality through their innovative use of R-SCAN.

quickly realized that an algorithm couldn't determine every finding.

As a result, the radiologists knew they would have to make themselves more available to ordering physicians as a consultative resource. But how would the group manage the coming demand for their time?

Beyond implementing CDS and simply increasing their consultation time, it soon became clear that another way to enhance efficiency would be for the radiologists to reposition themselves as educators. That's where the ACR's Radiology Support, Communication and Alignment Network (R-SCAN®) came in. ([Learn more about R-SCAN at \[rscan.org\]\(http://rscan.org\)](#))

By providing free tools like CareSelect Imaging™ CDS software, scholarly journal articles, and educational webinars, R-SCAN brings radiologists and referring clinicians together to improve the ordering of imaging exams. The R-SCAN action plan is based on



Related Content

Video bit.ly/RSCAN_Ashville

a growing list of Choosing Wisely® imaging topics and is aimed at promoting selection of the best imaging exam based on evidence-based AUC.

Dickerson immediately saw R-SCAN as a powerful tool to introduce both bringing CDS into their workflow and engaging their referring physicians in a dialogue. “We realized that R-SCAN would help us move forward toward successful CDS implementation. To encourage success of the program, we identified physicians who are key stakeholders and leaders in their respective service lines,” Dickerson notes.

An Educational Collaboration

From the outset, health system administrators showed an interest in CDS that was not initially mirrored by the referring clinicians. “Physicians often feel that IT systems and EMRs are designed for billing purposes rather than for patient care and communication among doctors,” Dickerson says.

“One of the referring doctors showed me his staff’s workflow and said that while he wanted to order the most correct imaging test, it would have to be done with the fewest amount of clicks,” he adds. “So we really tried to put ourselves in the referring doctor’s shoes to see how they would find R-SCAN most useful.”

To meet their referring clinicians’ stated request to fit the program within their existing workflow, the practice leaders realized their particular situation merited a novel approach to the Choosing Wisely topics. “The group really didn’t want to plug our referring doctors into the standard Choosing Wisely pathways that were outlined in R-SCAN,” Dickerson says. “We felt that if we were going to take a substantial amount of time engaging a referring clinician, we wanted it to be meaningful and useful specifically to them.”

To ensure the encounters made the most efficient use of everyone’s time, the Asheville radiologists — in close collaboration with the ACR — agreed to take a random sample of patients and then plug image ordering data into R-SCAN’s CareSelect Imaging CDS tool to find the physicians who were considered outliers (in terms of ordering patterns that reflected unnecessary imaging).

Armed with this information, the radiology group reached out to a small number of referring physicians, re-established relationships with their staffs, and began scheduling one-on-one appointments with referring providers to educate them about appropriate imaging guidelines. The practice found their rural providers receptive to this educational approach.

James Murray, director of quality and safety at Asheville Radiology Associates, notes that since embarking on the R-SCAN initiative, the group has endeavored to balance education with efficiency. “We present the provider with their CareSelect Imaging results, and we review some specific cases with them,” Murray explains. “Then we address any questions they might have and follow up by sharing the appropriate use criteria documentation that was relevant to a particular case.”

According to Arwood, the R-SCAN initiative was as valuable to the referring clinicians as it was to the radiologists. “It was very clear from the start that R-SCAN would be good for our patients and right for the health system,” he says. “There’s no other way to do it than to jump in.”

“We’d had so many delays with prior authorization requests, because we may not have been aware of some of Medicare’s standards for ordering certain tests,” says Ernesto E. De La Torre II, MD, family medicine physician at Medical Associates of Transylvania. “But Dr. Dickerson proposed R-SCAN as a way to speed things up and improve communication between radiologists and the clinicians in the outpatient setting, which we had sort of lost.”

The collaborators are currently in the post-educational intervention evaluation phase of the program. As the radiologists

“Engaging in this up front is going to help us better prepare for when CDS is required for Medicare reimbursement.”

— Richard S. Arwood, MD

A Warm Reception

The administrators of Mission Health took to R-SCAN from the beginning. “When Dr. Dickerson first came to me about R-SCAN, I was very enthusiastic,” explains Marc B. Westle, DO, FACP, senior vice president of innovation for Mission Health System. “We need to transform healthcare. It’s not one single thing that needs to change, but a number of things. But how do we do it? Dr. Dickerson had an excellent idea about how to educate physicians about how to order appropriate imaging tests in advance of when they’re actually ordering them.”

Referring clinicians within Mission Health agree with Westle’s assessment. “Engaging in this up front is going to help us better prepare for when CDS is required for Medicare reimbursement,” says Richard S. Arwood, MD, hospitalist at Mission Health. “We’d rather be in front of the curve as opposed to behind it.”

prepare to gauge if the educational efforts succeeded in improving provider image-ordering patterns, they are optimistic.

“As CareSelect Imaging is embedded into our EMRs, we’ll have to make sure the process is streamlined and not especially onerous for our physicians,” explains Norris W. Crigler Jr., MD, a 35-year veteran interventional radiologist and the practice’s regional director of community hospitals in the outlying regions of Asheville. “It’s just easier if we head that off by educating referring physicians first and helping them form an idea of what they’ll be working toward in the near future. Hopefully, they’ll become strong advocates of CDS.”

A Look Ahead

Dickerson is appealing to physician leaders at Mission Health to get the word out to their staffs regarding the importance of the upcoming implementation of CDS into their



Norris W. Crigler Jr., MD, the practice's regional director of community hospitals, has been instrumental in reaching out to referring physicians across a widespread region to engage in R-SCAN.

EMRs. "My main concern is that this can't be a top-down approach," he explains. "I've encouraged all 15 of our medical directors to begin engaging and developing relationships with others to get ahead of the curve. We want the educational and training process to be on a grassroots level."

While CMS has given health systems the gift of time — pushing back the original PAMA CDS deadline — Dickerson feels it is crucial to speed up the health system's CDS implementation process to ensure all of the steps are in place well in advance of the start date. Toward that end, their efforts include using R-SCAN more widely to educate referring physicians, while also having Mission Health's IT department on hand and available to integrate the new system into physicians' workflows.

"Most importantly, we shouldn't rest on our laurels," Dickerson says. "We should really use this extra time to engage our referring physicians in a meaningful way, so that they can feel comfortable when CDS finally occurs within our system."

De La Torre recognizes the special relationship he now has with his radiologist colleagues after using R-SCAN. "R-SCAN has helped me realize that radiologists are not just people sitting in a room at the hospital somewhere reading CT scans. They are a

resource. They are consultants with vast knowledge bringing something to the table to help me care for my patients."

R-SCAN participants have several options for defining their own R-SCAN topic to meet unique practice needs and settings. There are several approaches to carrying out a practice-defined topic. Some of these, such as combining several topics from the Choosing Wisely list, may be especially desirable for small and rural practices that have limited volume for any one imaging exam.

By Amena Hassan

Next Steps

- Establish and maintain relationships with hospital and physician leaders in order to gain buy-in, cooperation, and support during the process of implementing R-SCAN.
- Become familiar with R-SCAN first and then demonstrate to clinicians its benefits for reducing inappropriate imaging tests for patients, how it saves time for the health system, and its role in reducing ordering delays.
- Plan ahead for implementing CDS into your workflow so IT departments and other players can effectively align and work with your practice or hospital.

FOR DISCUSSION

Which R-SCAN topics could help your referring providers order more appropriate imaging? What opportunities exist to customize an R-SCAN project for your facility?

Jan. 1, 2020, marks the formal implementation of the Protecting Access to Medicare Act (PAMA). What steps have you taken to implement CDS at your facility? If you haven't started, what is the first step you will take?

What types of delays have you experienced with prior authorization requests that CDS might help mitigate?

Sample R-SCAN Topics

Abdominal Imaging

Recurrent Renal Colic

Avoid ordering CT of the abdomen and pelvis in otherwise health emergency department (ED) patients (age <50) with known histories of kidney stones, or urolithiasis, presenting with symptoms consistent with acute uncomplicated renal colic.

Cardiac Imaging

CTA for Asymptomatic Patient at Low Risk for Coronary Artery Disease

Don't routinely order coronary CT angiography for screening asymptomatic individuals.

Chest Imaging

Admission and Pre-op Chest X-ray

Avoid admission or preoperative chest x-rays for ambulatory patients with unremarkable history and physical exam.

CTA for Pulmonary Embolism

Do not perform chest CT angiography to evaluate for possible pulmonary embolism in patients with a low clinical probability and negative results of a highly sensitive D-dimer assay.

Genitourinary Imaging

Adnexal Cyst Follow-up

Do not recommend follow-up imaging for clinically inconsequential adnexal cysts.

Advanced Imaging for Early Prostate Cancer Staging

Don't perform PET, CT, and radionuclide bone scans in the staging of early prostate cancer at low risk for metastasis.

Head & Neck Imaging

Incidental Thyroid Nodules Follow-Up

Don't recommend ultrasound for incidental thyroid nodule in low-risk patients unless the nodule meets age-based size criteria or has suspicious features.

Musculoskeletal Imaging

Imaging for Low Back Pain

Don't do imaging for low back pain within the first six weeks, unless red flags are present.

Neuroimaging

CT for Uncomplicated Rhinosinusitis

Don't order sinus CT or indiscriminately prescribe antibiotics for uncomplicated acute rhinosinusitis.

For a complete list of R-SCAN topics, please visit rscan.org/topics

The Benefits of Collaboration

Radiologists and emergency department physicians partner on an R-SCAN® project – successfully reducing unnecessary imaging by 52 percent.

KEY TAKEAWAYS

- At Baylor College of Medicine, radiologists partnered with emergency department (ED) clinicians to conduct an R-SCAN quality improvement project focused on reducing inappropriate image ordering for patients with possible pulmonary embolisms (PE).
- Inappropriate imaging decreased by 52 percent after an educational intervention directed ED clinicians to order a D-dimer test before a CT scan for patients with a low probability of PE.
- R-SCAN is funded through a Transforming Clinical Practice Initiative (TCPI) grant. TCPI is a program through the Centers for Medicare & Medicaid Services (CMS) that helps healthcare providers achieve transformational change.

A 2012 study published in the journal *Emergency Medicine Practice* found that each year in the U.S. as many as 900,000 people will suffer from acute pulmonary embolism (PE).¹ The classic presentation of PE is the abrupt onset of pleuritic chest pain, shortness of breath, and hypoxia. However, most patients with PE have no obvious symptoms at presentation.

To begin diagnosis and treatment of PE, emergency medicine physicians often immediately order chest imaging; however, not all of those scans are warranted, according to evidence-based appropriate use criteria. Here's how one large academic medical center leveraged the Radiology Support, Communication, and Alignment Network (R-SCAN®) step-by-step action plan to collaborate with physicians in its emergency department (ED) and reduce inappropriate imaging by more than 52 percent. ([Learn more about R-SCAN at rscan.org](http://rscan.org))

Choosing the First Topic

Reducing inappropriate imaging is a “passion project” for L. Alexandre Frigini, MD, director of quality assurance and a member of the quality committee at Baylor College of Medicine in Houston. An associate professor in the department of radiology at Baylor, Frigini teaches quality improvement to medical students and radiology residents and has created a quality improvement and patient safety “boot camp,” which incorporates principles from Imaging 3.0™, the Choosing Wisely® and Choosing Gently® campaigns, clinical decision support, and practice quality improvement (PQI) projects.

When Frigini first heard about R-SCAN, he knew it provided an invaluable platform to bring together the radiology team with referring physicians in implementing a PQI project to reduce inappropriate imaging. One of the Choosing Wisely topics available under R-SCAN is CT Angiography (CTA) for



L. Alexandre Frigini, MD, director of quality assurance at Baylor College of Medicine, led his team to reduce unnecessary scans after partnering with ED leaders for the team's first R-SCAN project.

PE. Frigini determined that he and his team should begin their R-SCAN quality improvement journey with that topic.

Partnering with the ED

The Baylor radiologists chose the PE topic due to a perception that patients were receiving too many unnecessary scans, thus making it one of the areas that would provide the most impact to the hospital. Frigini and his radiology colleagues, in partnership with ED leaders, chose to focus on the PE topic as their first project for two reasons.

First, radiologists believed that too many unnecessary scans were being ordered for ED patients that did not meet the CT pulmonary angiography (CTPA) criteria protocol. Second, the team wanted to partner with an interested group of clinicians. Since the ED chief is a champion of quality improvement

and the Choosing Wisely campaign, he was receptive to R-SCAN.

To begin the R-SCAN project, Frigini approached Shkelzen Hoxhaj, MD, MPH, MBA, former chief of emergency medicine at Baylor College of Medicine, expressing his concern and desire for change. Frigini was surprised by the response. Hoxhaj, a leader in quality improvement, also believed Baylor's ED physicians ordered too many unnecessary scans, partly due to lack of awareness of and education about CT appropriate use criteria.

"The chief was extremely supportive and on board right away," explains Frigini. "He agreed there was an issue with unnecessary for suspected pulmonary embolism. Luckily, we had that initial buy-in, which made it possible to collaborate on an R-SCAN project and eventually change the ordering pattern."

Creating a Baseline

Frigini and his team embarked on an R-SCAN campaign to evaluate the rate of the inappropriate CT chest PE protocol in the Baylor ED. They used R-SCAN and applied both Choosing Wisely guidelines and the CareSelect Imaging™ clinical decision support tool to evaluate appropriateness criteria. ([Learn more about CareSelect Imaging at bit.ly/CareSelect](#))

Here's how the R-SCAN project unfolded:

- The IT department worked with radiologists to identify 100 retrospective CT Chest PE protocol studies performed in the ED over two months in 2014. Hoxhaj helped the team add missing data and fill any gaps in information from departmental patient charts (particularly modified Wells classification²).
- The team classified studies based on the following criteria: results, either positive or negative for PE; indication; demographics; and clinical probability of PE according to modified Wells criteria and results of D-dimer test² (if it had been obtained).
- A group of emergency medicine staff, under the supervision of Hoxhaj, retrospectively determined the likelihood of PE, based on modified Wells criteria. Evaluation of the baseline data

demonstrated that a quarter of the cases showed inappropriate imaging. The radiology team was particularly concerned that ED clinicians were not ordering D-dimer blood tests for patients with a low probability of PE and ordering CTPA for patients with negative D-dimer results. If a D-dimer test is negative, a CT scan is not appropriate.

In fact, more than 18 percent of inappro-

prate CT PE protocol studies were ordered for patients who did not have a D-dimer test. "ED protocol in our institution requires all patients with low probability of PE to have a D-dimer test prior to obtaining advanced imaging studies, which is also recommended by the Choosing Wisely campaign," says Frigini.

"(R-SCAN) is a framework and resources that facilitate multispecialty, collaborative quality improvement and teamwork."

— Marc H. Willis, DO

"More importantly and surprisingly, the baseline evaluation revealed a high rate of patients who, in spite of a low clinical probability and a negative D-dimer result, still went on to have a CT chest PE protocol. Many times the patient was getting a CT scan even before the D-dimer results were back from the lab," Frigini adds.

Educating the Clinician

With the baseline study showing a high rate of unnecessary CT imaging for PE, the team implemented and measured the efficacy of an educational intervention among referring physicians. For the intervention, Frigini and his colleagues used R-SCAN's educational tools for PE to help modify the physicians' ordering pattern. The team established one-hour emergency medicine grand rounds to reduce the rate of inappropriate exams.

With the help of Hoxhaj, who played a prominent role in the educational intervention, the grand rounds gathered together

clinicians, residents, and medical students to educate them about appropriate ordering of CTA for PE, including the need for a D-dimer test. The educational intervention began with an overview of the PE project, followed by a discussion of cases and visual examples. This consisted of a presentation of study results, a presentation of the Choosing Wisely cam-

paign, and an ACR video on appropriateness criteria. As part of the presentation, Hoxhaj also reviewed guidelines from the Society of Academic Emergency Medicine.

Radiologists found that when clinical leaders presented physicians with recommended changes in the image ordering pattern, the outcome was much more positive. "It is best to work with clinician leaders and have them present the information as their own," says Frigini. "If we talk to them as radiologists, there might be more pushback and less acceptance."

Marc H. Willis, DO, associate professor of radiology and orthopedic surgery, part of Frigini's team and one of the main clinical advisers for R-SCAN, adds, "One of the things I really like about R-SCAN is that it's not just radiologists doing process improvement or quality improvement within their department. It is a framework and resources that facilitate multispecialty, collaborative quality improvement and teamwork."

He continues, "What was particularly helpful to the success of our project was having buy-in and support from our ED leadership. Dr. Hoxhaj presented the recommended evidence-based clinical guidelines and introduced R-SCAN at a grand rounds. It validated that we were aligned and all working together to provide high-value care for our patients."

Analyzing the Results

After the R-SCAN educational component was implemented, the team evaluated a new set of 100 PE CTs and compared the appropriateness scores to the baseline. They found that inappropriate use of imaging tests decreased by 52 percent, including:

- The number of inappropriate CTs dropped from 25 to 12.
- The number of appropriate CTs rose from 75 to 88.
- Nine CTs were positive for PE and 91 were negative.
- Only 8 low-probability cases had no D-dimer tests.
- Four cases had a low clinical probability and negative D-dimer test.

Continuing Education

As part of its continuing education efforts, the team now posts the imaging guideline indicators on computers and within the emergency room. It also periodically sends email blasts, continually reminding ED faculty, residents, and allied health personnel of the correct imaging protocols.

“The attending physicians may be more or less the same people throughout the year, but we always have new residents and medical students,” says Frigini. “In order to sustain good habits, information has to be reiterated frequently.”

Frigini’s team is also working with the IT department to implement “hard stops” in the future ordering process. Before clinicians order a CT scan, they will have to enter a patient’s Wells criteria and D-dimer test results, if applicable. If the clinicians fail to enter this information into the patient’s electronic medical record, the system will prevent ordering a CT scan.

“When a patient can benefit from having an ultrasound, then you don’t have to do a CT scan,” says Frigini. “You may get the same answer from a test that is not only less costly but also safer for the patient. If we can minimize any further harm to the patient, then that’s definitely a big deal.”

By Amena Hassan

Next Steps

- Look for an R-SCAN topic that is relevant to your hospital or practice, and find a department where Choosing Wisely guidelines are getting traction. Having a highly engaged and motivated collaborator on the clinical side is critical to achieving success.
- Secure the help of hospital and clinician leadership in order to obtain the support and attention of clinician groups and relay information effectively during the educational presentations.
- When educating the clinician or changing ordering patterns, use multiple methods — including email, signs, and ordering systems — to reiterate the message and reinforce best practices related to image ordering.

ENDNOTES

1. Church A, Tichauer M. “The emergency medicine approach to the evaluation and treatment of pulmonary embolism.” *Emerg Med Pract.* 2012 Dec;14(12):1-22. Available at bit.ly/BaylorRSCAN.
2. van Belle, Arne. “Effectiveness of Managing Suspected Pulmonary Embolism Using an Algorithm Combining Clinical Probability, D-Dimer Testing, and Computed Tomography.” *JAMA.* 2006;295(2):172-179. Available at bit.ly/WellsD-dimer.

FOR DISCUSSION

How often do you worry that chest imaging for suspected pulmonary embolism is unwarranted?

How can you recruit residents or other radiology colleagues to identify retrospective studies that can serve as baseline data for an R-SCAN project?

Dr. Frigini and his colleagues established one-hour emergency medicine grand rounds to reduce the rate of inappropriate exams. What format would your educational sessions take?

YOU’VE PLEDGED TO BE A PART OF THE R-SCAN PROJECT. NOW WHAT?

Don’t stop there.

Take the next step to increase collaboration with your referring colleagues and boost patient care. Get started today at rscan.org. Help your colleagues be successful under the new imaging CDS mandate.

How does R-SCAN work? A simple process brings Choosing Wisely topics into practice and the R-SCAN website has everything you need to complete the program. The steps include:



Collaboration between referring physicians and radiologists is formed to improve the ordering of value-added imaging exams.



Baseline data are reviewed to evaluate the ordering patterns of a referring practice.



Data are reviewed to evaluate improvements in imaging exam ordering.



Radiologists and referring clinicians engage in an educational collaboration to improve imaging ordering.

Check out the new CDS R-SCAN Registry at acr.org/CDS-RSCAN-Registry.

Engaging the Physician

Using R-SCAN[®], radiologists collaborate with family medicine clinics to enhance imaging appropriateness of lumbar spine orders.

KEY TAKEAWAYS

- Baylor College of Medicine radiologists worked with referring physicians to reduce unnecessary imaging for low back pain through R-SCAN.
- Incorporating educational interventions into a CME track within the health system encouraged involvement by referring providers, nurse practitioners, and physician assistants.
- Following a radiologist-led educational intervention, clinicians ordered nearly 38 percent fewer imaging studies for low back pain and increased their appropriateness rating for such orders by approximately 23 percent.

Sometimes the best patient care involves no imaging at all. So when the radiologists at Baylor College of Medicine noticed that some referring physicians were ordering more MRIs for low back pain than seemed appropriate, they took the lead to study the situation and deploy a solution for improved patient care.

In doing so, the radiologists turned to the ACR's Radiology Support, Communication, and Alignment Network (R-SCAN[®]), an innovative quality improvement initiative that brings radiologists and referring clinicians together to enhance image ordering and reduce unnecessary imaging. ([Learn more at rscan.org](http://rscan.org))

Funded through the Centers for Medicare & Medicaid Services' Transforming Clinical Practice Initiative, R-SCAN offers radiologists and referring physicians tools to study image ordering practices, institute educational interventions for improved ordering, and conduct post-intervention impact analyses. ([Learn more at bit.ly/RSCAN_TCPI](http://bit.ly/RSCAN_TCPI)) Among these tools is CareSelect Imaging[™], a clinical decision support (CDS) system that uses the ACR Appropriateness Criteria[®] (AC) to optimize image ordering, reduce unnecessary imaging exams, and lower the cost of care. ([Learn more at bit.ly/CareSelect](http://bit.ly/CareSelect))

To begin, radiologists and referring physicians enroll in R-SCAN and select a targeted improvement area from a list of Choosing Wisely[®] topics.

In Baylor's case, the radiologists chose the "Imaging for Low Back Pain" topic and collaborated with referrers from Harris Health System in Harris County, Texas, to improve image ordering in that area. Their efforts led to a nearly 38 percent reduction in lumbar spine MRI orders and an approximately 23 percent increase in the appropriateness rating for such orders. Here's how they did it.

Approaching the Clinicians

Christie M. Malayil Lincoln, MD, assistant professor of radiology and neuroradiology



Christie M. Malayil Lincoln, MD, assistant professor of radiology and neuroradiology and faculty senator at Baylor College of Medicine, co-led the effort for reducing imaging for low back pain at Baylor.

and faculty senator at Baylor College of Medicine, and Melissa M. Chen, MD, who was a neuroradiology fellow at Baylor College of Medicine at the time, led Baylor's effort to reduce inappropriate imaging for low back pain using R-SCAN.

They selected the topic after noticing that two of Harris Health System's high-volume family practice clinics were ordering more imaging studies for low back pain than were probably necessary. (Most patients with uncomplicated acute low back pain do not require imaging.¹) Lincoln and Chen wanted to explore whether the clinics were ordering the studies as a force of habit. "When a patient complained of back pain, was the automatic response to order imaging time and time again?" Lincoln wondered.

To answer their question, Lincoln and Chen approached Brian C. Reed, MD, director of disease control and clinical prevention at Harris County Public Health, who at the beginning of the project was the vice chair

of community health in the Department of Family & Community Medicine. Reed immediately recognized the value of the project and how it aligned with Harris Health System's commitment to implementing higher quality standards in line with the Institute for Healthcare Improvement's Triple Aim.

In addition to reducing unnecessary imaging, Reed hoped the project would shorten wait times for patients who truly need MRIs. "We were involved in another quality improvement project that reduced wait times for patients who needed imaging for osteoarthritis of the knee," says Reed, who is also an associate professor of family and community medicine. "I thought this project might have a similar effect for patients who required imaging of the lumbar spine."

Reed introduced Lincoln and Chen to Samuel Willis, MD, and Luu Phong, MD, the directors of the two Harris Health clinics with the highest incidence of inappropriate image ordering for low back pain. Both clinicians were receptive to using R-SCAN to enhance imaging appropriateness, and they recommended a third clinic that also struggled with appropriate image ordering.

Coaching the Clinics

With the referring clinicians on board, Lincoln and Chen partnered with three other members of the radiology group — Christopher J. Yen, MD; Darshan Variyam, MD; and Kevin Y. Wang, MD. Together, the radiologists reviewed the 300 MRIs that referring clinicians from the three clinics ordered for patients experiencing low back pain during a 10-month period. Focusing on outpatient studies, the team used the CareSelect Imaging tool through the R-SCAN portal to analyze 90 of those exams and determine whether they met the evidence-based guidelines in the AC.

"When we looked at the lumbar MRIs, we focused on the outpatient population because they all have very different acuity levels than inpatients or emergency room patients, and we didn't want to dilute our information," Lincoln explains.

The review process confirmed that the referrers were in fact ordering lumbar spine MRIs inappropriately based on the evidence-based guidelines.

In response, the radiologists attended the monthly continuing medical education (CME) luncheons at each of the three health clinics and taught referring providers, nurse practitioners, and physician assistants about appropriate image ordering for lumbar spine. Incorporating the lessons into scheduled CME time limited the impact to the clinicians' regular workflow.

During each session, the radiologists highlighted various scenarios — for example, one showing a patient who has cancer and another presenting a choice between ordering a lumbar spine MRI in the acute or chronic stage. At the conclusion of each session, attendees were given time to contemplate the different scenarios and ask questions before determining whether imaging should be ordered.

The educational effort had a positive impact on radiologist/clinician relationships. "The sessions allowed me to meet with the referring providers, whether they were physicians, nurses, or physician assistants," Lincoln says. "It let us engage in a conversation about how providers should order studies in a more targeted way and helped us understand their predicament as well."

According to Lincoln, the "predicament" refers to the number of patients providers see on a daily basis and the difficulty they have in finding the time, in peripheral clinics, to assess whether or not the imaging is necessary. In some cases, patients want imaging regardless of the situation.

Achieving Positive Results

In the 10 months following the educational period, clinicians from the three clinics ordered a combined 187 MRIs for low back pain, down from the 300 orders made during the pre-intervention period.

Using CareSelect Imaging, the radiologists found that referring physicians consulted the AC for 79, of the post-intervention scans, equating to 42 percent of the total scans ordered. The combined average appropriateness rating for MRIs from all three clinics was 5.8 during the post-intervention period, significantly more than the 4.7 rating received during the pre-education period. These results indicated that the



As a neuroradiology fellow at Baylor, Melissa M. Chen, MD, who is now a clinical neuroradiologist and assistant professor in the department of diagnostic radiology at the University of Texas MD Anderson Cancer Center, co-led the effort to reduce inappropriate imaging for low back pain.

educational intervention led to improved image ordering.

The results also indicate that referring clinicians are now looking for other ways to treat lower back pain before turning to advanced imaging. "After we suggested that physicians should explore alternate ways to treat patients before ordering an MRI, we saw an increase in the time from the initial clinic visit to the MRI exam," Chen explains.

continued on page 23

FOR DISCUSSION

Where do you suspect are the largest pockets of inappropriate ordering in terms of types of imaging orders and groups of physicians?

How does inappropriate ordering impact your patients in terms of finances, healthcare status, and patient satisfaction?

How can you handle the challenge of patients who insist on imaging orders that we know to be medically inappropriate?

Teaching Imaging Appropriateness

A simulation-based educational program increases medical students' abilities to identify appropriate imaging.

KEY TAKEAWAYS

- Baylor College of Medicine partnered with ACR and National Decision Support Company to develop a web-based program that uses case vignettes and clinical decision support to teach students and practicing providers about appropriate imaging through simulation education.
- Known as Radiology-TEACHES™ (Technology Enhanced Appropriateness Criteria Home for Education Simulation), the program fills an existing imaging appropriateness training gap in traditional medical education curricula.
- The platform is scalable and can be customized to address gaps in curricula across the continuum of medical education.

Nearly every hospital patient undergoes some type of radiological exam. Yet, undergraduate medical education curricula have traditionally lacked comprehensive instruction about ordering appropriate imaging. This training gap means referring trainees and practicing providers are often unprepared to order appropriate imaging in the clinical setting — and as a result, some patients receive unnecessary imaging that can expose them to undue radiation and costs.

Improving education about appropriate imaging is imperative for better patient care, and all radiologists have an important role to play in advancing such training.

Radiologists at Baylor College of Medicine in Houston are addressing the issue by partnering with clinicians to launch a web-based program called Radiology-TEACHES, which uses case vignettes in ACR's Cortex case management system integrated with the CareSelect® Imaging clinical decision support (CDS) tool to simulate the image ordering process and educate learners about appropriate imaging. ([Learn more about Radiology-TEACHES at bit.ly/RadiologyTEACHES.](http://bit.ly/RadiologyTEACHES))

Baylor radiologists developed Radiology-TEACHES in collaboration with ACR and National Decision Support Company (NDSC) — the licensing agent for CareSelect Imaging, which offers the digital version of the ACR Appropriateness Criteria™. ([Learn more about CareSelect Imaging at bit.ly/CareSelect](http://bit.ly/CareSelect))

In 2015, the team conducted a pilot of the program with 34 medical students, 85 percent of whom indicated that the program should be incorporated into the medical school curriculum.¹ Now, the team is expanding the program's reach throughout the medical community with a multisite pilot project.

Volunteer Effort

The idea for Radiology-TEACHES was born in 2013. As ACR and NDSC began offering

CareSelect Imaging to clinical practices, Marc H. Willis, DO, associate professor of radiology and associate chair for quality improvement at Baylor, started thinking. He knew ACR Select was a valuable tool to help clinicians identify appropriate imaging at the point of order, but he also recognized the potential for leveraging it in the medical education setting.

"I saw a great opportunity for a program where learners can access case vignettes and simulate the ordering process with the CareSelect Imaging product," says Willis, who is also the chief of musculoskeletal imaging and intervention and associate program director of the diagnostic radiology residency program at Baylor.

Willis shared his idea with his department chair and Baylor's medical school leadership, who liked the concept but didn't have the money to fund its development. With his leadership's support, Willis turned to ACR and NDSC, which both agreed to partner with him on the project.

Soon thereafter, efforts began to build the program's user interface with a direct link to CareSelect Imaging. "Connecting to CareSelect Imaging was essential to give students access to evidence-based appropriateness criteria, information about how to order contrast, relative radiation dose data, and a cost range for different imaging exams," Willis explains.

From there, Willis approached one of his colleagues, Karla Sepulveda, MD, associate professor of radiology and fellow associate program director of Baylor's diagnostic radiology residency, about co-leading the program's development. Sepulveda, who is also the radiology department's director of medical student education, agreed, and together she and Willis assembled a team of colleagues to help author the pilot program's case vignettes. The team included representatives from eight radiology sub-specialties: musculoskeletal, breast imaging, gastrointestinal imaging, neuroradiology, thoracic

and cardiac imaging, genitourinary imaging, women's imaging, and vascular imaging.

For two years, the team spent countless hours authoring cases in ACR's RCMS, a computer application for collecting, storing, and distributing educational materials in various formats. "Without a budget, we primarily worked on this during nights and weekends as volunteers," Willis says. During that time and since then, the team has authored more than 150 vignettes, covering topics in each of the represented sub-specialty areas. In the future, users will be able to author their own cases to fit specific educational needs.

Cross-Domain Collaboration

By January of 2015, Radiology-TEACHES was ready for its initial pilot. Willis approached Baylor's medical school leadership and faculty about using the program with their students. Nadia J. Ismail, MD, MPH, associate dean of clinical sciences, says she immediately saw value in the project, which aligns with medicine's shift toward high-value care as well as with Baylor's efforts to make radiology more explicit in its curriculum. "Radiology is really core to most patient care, so any chance we have to educate our students about it, the better," she says.

"Radiology is really core to most patient care, so any chance we have to educate our students about it, the better."

— Nadia J. Ismail, MD, MPH

With faculty members on board, Willis and his team recruited volunteers to participate in the pilot from a group of second-year medical students who had completed their clinical classroom work and were entering clinical rotations. Volunteers were recruited through verbal announcements at the start of their regular classes and through emails, including one from the associate dean of Baylor's Office of Undergraduate Medical Education. As a result of these efforts, 34

students signed up to participate in the project, which did not impact their grades.

Allison M. Khoo, a third-year medical student at Baylor who plans to specialize in interventional radiology, was one of the students who volunteered for the pilot. Khoo says she signed up to learn about the decision-making process for different types of imaging studies — training she wouldn't have otherwise received as an undergraduate. "Generally, we don't learn much about imaging, like when to use contrast, what kinds of contrasts are available, the differences between CT and MRI, or the relative costs of different exams," she explains. "This, unfortunately, opens the door for a lot of overuse and wasteful imaging in the clinical setting."

Initial Pilot

Willis kicked off the pilot with a 10-minute presentation to student participants. He explained what evidence-based medicine and CDS are and how they can optimize decision-making to improve patient outcomes. Then, the students took a 20-minute pre-assessment exam to gauge their ability to order appropriate imaging before logging into the Radiology-TEACHES portal to review a few practice cases.

Once the students understood how to use the platform, they had two weeks to work through 48 case vignettes within the program. The format is learner-directed, allowing each student to complete the vignettes at his or her own pace. "One advantage of this educational model is that it creates an asynchronous learning environment, where students can log in remotely and do the cases," Willis says. "It doesn't have to fit into classroom time."



Marc H. Willis, DO, associate professor of radiology and orthopedic surgery, is a main clinical advisor for R-SCAN.

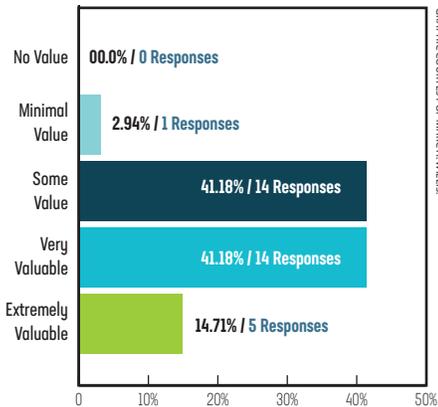
Here's how the program works:

1. A student logs into the Radiology-TEACHES web-based portal and reads a case vignette, outlining a patient's clinical scenario.
2. Then the student clicks on the CareSelect Imaging tab, where he or she enters the patient's demographic and clinical information.
3. From there, CareSelect Imaging provides a list of imaging exams, ranking them from the most to least appropriate based on the appropriateness criteria — just as it does in the clinical setting.
4. The student then selects the study he or she wants to order and, most importantly, receives immediate decision support feedback before moving to the next case vignette.

Positive Results

At the end of the two-week pilot, participants took a post-assessment exam. Compared to the pre-assessment test, the students showed a "statistically significant" improvement in identifying the most appropriate imaging exams in multiple areas: intermediate cases, advanced cases, and cases covering Choosing Wisely topics. "Most encouraging was the students' improvement ($p=.0207$) in vignettes covering Choosing Wisely topics, a national campaign aimed at reducing the amount of waste in medicine," Willis says.

How valuable did you find the virtual classroom simulated clinical decision support experience in learning about appropriate utilization?



The students also reported feeling more prepared to order appropriate imaging after participating in the program. On the pre-assessment test, 70 percent of participating students said they were “unprepared” or “totally unprepared” to order appropriate imaging. On the post-assessment test, after the simulation module, 53 percent of participants said they were at least “slightly prepared” to order appropriate imaging.

Additionally, the students provided feedback about the program’s value as a curriculum tool, with 96 percent reporting that it provided “some value” or was “very valuable” or “extremely valuable.”

“Radiology-TEACHES really fills a gap in our current working knowledge in medicine,” Khoo says. “I feel fortunate to have had the opportunity to get this robust training early in my career; it has definitely bolstered my interest in becoming a radiologist. Hopefully, more people will use this tool in the future.”

Additional Pilots

To turn that hope for further dissemination into reality, Willis and his team have begun several additional Radiology-TEACHES projects. One of them involves piloting the program with Baylor’s physician assistant students, bringing appropriate imaging education to the allied health arena. Willis notes that this is an important project because, in many practices, physician assistants often order imaging studies.

In another effort, Willis and his team are collaborating with the directors of Baylor’s

seven required medical student core clinical clerkships (general surgery, internal medicine, family and community medicine, pediatrics, neurology, obstetrics-gynecology, and psychiatry) to integrate the program into those rotations. This project blossomed after Ismail invited Willis and his team to present Radiology-TEACHES at a clerkship director’s meeting, and Willis received a 2016 Radiological Society of North America Education Scholar Grant to fund the initiative.

Andrew C. Caruso, MD, assistant professor of medicine and director of Baylor’s internal medicine clerkship, says he looks forward to sharing the program with the students in his rotation. “Radiology-TEACHES will expose students to the various imaging studies and help them learn which ones are safe and cost-effective based on a patient’s clinical condition,” he says. “This evidence-based information is vital for them to experience prior to becoming trainees.”

To expand Radiology-TEACHES’ footprint even further, the Baylor, ACR, and NDSC team has initiated a multisite pilot at four other institutions across the nation: University of Chicago, Montefiore Medical Center, Uniformed Services University of the Health Sciences, and Augusta University. The team expects this project to prove that the program’s success at Baylor is transferable to other institutions.

Additionally, Willis and his team are creating case vignettes for ACR’s Radiology Support, Communication, and Alignment Network (R-SCAN®), an initiative that brings radiologists and referring physicians together to improve image ordering. (Learn more about R-SCAN at rscan.org) Willis is an advisor for R-SCAN, which is funded through the Centers for Medicare and Medicaid Service’s Transforming Clinical Practice Initiative.

Future Efforts

Once these additional projects are completed, the Baylor, ACR, and NDSC team plans to make Radiology-TEACHES available as an educational resource to other academic institutions, hospitals, and practices. Willis anticipates that at that time more medical schools, particularly those with highly engaged radiology departments, will implement the program to fill similar gaps in their curricula. He also expects hospital and medical groups to find value in the program as a

continuing education tool to teach practicing providers more about appropriate imaging.

“The goal of Radiology-TEACHES is to prepare current and future medical providers to deliver high-value healthcare by decreasing waste and increasing patient safety through improved imaging utilization, as outlined in healthcare’s Triple Aim,” Willis explains. “The platform provides a simulated education environment that is flexible and scalable. It can be used across a wide spectrum — from individual learners to inter-professional teams — ensuring patients receive the best care possible. That’s something we should all be focused on as we transition from volume- to value-based care.”

By Jenny Jones

Next Steps

- Determine whether Radiology-TEACHES is a good fit for your academic institution, medical practice, hospital, or healthcare system.
- Start engaging collaborators and leadership within your institution to begin exploring ways to integrate this program into your organization’s portfolio of educational resources.
- Email radiologyteaches@acr.org to learn more and engage in the program.

ENDNOTES

1. Willis, MH, Frigini, LA, Lin J, et al. Clinical Decision Support at the Point-of-Order Entry: An Education Simulation Pilot with Medical Students. 2016;23(10):1309-1318. Available at:

FOR DISCUSSION

How would students at your institution benefit from clinical decision support software and embedded case vignettes to simulate the ordering process?

How would you organize a team of volunteers from various radiology subspecialties to author the case vignettes?

How would you recruit volunteers, particularly second-year medical students who are entering clinical rotations, to participate in a pilot project like this?

Engaging the Physician

continued from page 19

"Physicians are now recommending treatments such as medication, physical therapy, or other interventions before they send their patients for imaging."

As Reed had hoped, the reduction in unnecessary imaging also seems to have reduced wait times for patients who urgently need MRIs. The Baylor team is working to measure this reduction in patient wait times for MRI as part of the next iteration of the project.

Lincoln attributes the project's positive results in large part to the camaraderie that developed between the radiologists and referring clinicians. "The back-and-forth dialog through the educational sessions opened a direct, two-way line of communication we didn't have before, positioning us as consultants who now guide appropriate imaging," she says. "We wanted to impact patients in a positive way, and we wanted to do it in partnership with our referring providers. We achieved both objectives."

Along the way, the radiologists cemented their role beyond image interpretation as partners in providing quality patient care. "R-SCAN allows radiologists to be seen as leaders in decreasing inappropriate imaging in a meaningful way," Chen says. "It allows radiologists to be more in control when caring for patients, rather than sitting back and waiting for things to happen."

By Amena Hassan

ENDNOTE

1. Patel ND, Broderick DF, Burns J, et al. ACR appropriateness criteria for low back pain. *J Am Coll Radiol*. 2016; 13(9):1069-1078.

Next Steps

- Uncover opportunities for improving imaging appropriateness at your institution.
- Reach out to referring providers about participating in an R-SCAN project to improve imaging appropriateness.
- Explore providing CME credit for the educational intervention phase of an R-SCAN project.

Partners in Quality

continued from page 11

Outstanding Outcomes

Following the educational intervention, Lall reviewed 90 cases of suspected PE in the ED and found that with CDS, the appropriateness of the ED physicians' CT orders for PE improved by 45 percent. "These results indicate that collaborative initiatives like R-SCAN can have significant impact on reducing unnecessary imaging for patients," Lall says.

Additionally, a quality nurse (or, in some cases, Lall herself) called 25 patients after they were discharged from Riddle to collect feedback about the educational handout. "It was important for me to hear the meaningful responses personally, not just look at the data," Lall says.

A majority of the patients said that they found the handout "very useful" and "of high quality." All respondents recommended that the CT information be shared with future ED patients.

"Patients really responded positively to the handouts," says Pasdon. "Patients want to be involved in their care. When patients understand what's happening to them, they are more actively engaged and empowered. Giving them even this small piece of the puzzle is really important."

Future Plans

Based on these results, Lall envisions using R-SCAN to improve appropriate image

ordering in other areas, like primary care. She describes R-SCAN as an "easily scalable and amazing platform" for better patient engagement across healthcare. Both Lall and Pasdon say that sharing best practices like these is critical to providing more appropriate, more affordable care.

"We need to keep innovating and building on what's been done," Lall says. "R-SCAN provides an opportunity to do that in an engaging and effective way."

By Kerri Reeves

ENDNOTES

1. National Heart, Lung and Blood Institute. What Is Pulmonary Embolism. nhlbi.nih.gov/health-topics/pulmonary-embolism. Accessed May 19, 2018.
2. Venkatesh, AK, et al. Trends and variation in the utilization and diagnostic yield of chest imaging for medicine. *AJR Am J Roentgenol*. 2018; 210(3): 572-577.
3. Choosing Wisely. American College of Emergency Physicians. October 27, 2014. choosingwisely.org/clinician-lists/acep-ct-pulmonary-angiography-in-ed-patients. Accessed May 18, 2018.

Next steps

- Determine which referring groups would benefit from a radiology-led educational intervention to improve appropriate image ordering.
- Enroll in R-SCAN and use the tools to educate referring physicians about appropriate image ordering.
- Identify areas of need for patient education and distribute handouts to engage and empower patients.

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