



IN PRACTICE

DECEMBER
2022

PEDIATRIC
RADIOLOGY



INSIDE THIS ISSUE

A Team Sport

Pediatric radiologists make a substantial difference in accurate clinical decision-making and improved outcomes for children in the safest manner possible.

The majority of radiology departments inside children's hospitals have programs to support care that is centered around patients and their families. This approach underscores the importance of viewing patients and families as partners in care and serves to promote a safe and welcoming environment for children and their families. As the adage goes, children are not small adults, and one size does not fit all.

Families are increasingly informed about exposing their children to radiation, avoiding sedation or anesthesia when possible, minimizing invasive procedures, and understanding the cost of care. Children and their families have unique needs, expectations, and concerns when undergoing imaging studies, and parents are highly vested in getting the right imaging study for their children in the safest manner possible.¹

How can we best meet the needs of children and their families? Pediatric radiologists make a substantial difference in safety, accurate clinical decision-making, and, most importantly, improved outcomes for pediatric patients. Pediatric radiology is a team sport involving clinical colleagues and close collaboration among radiologic technologists (RTs), nurses, and certified child-life specialists, who are trained to interact with and perform diagnostic imaging examinations on children.² Extending best imaging practices to benefit children across the entire house of radiology is an important part of the pediatric radiology mission. This is particularly important since most pediatric imaging is performed outside of children's hospitals.

Radiology as a specialty is the recognized leader in promoting imaging innovation. A unique challenge for children is that imaging technology innovations have been slower to come to children for a host of reasons. Despite unique pediatric challenges, the case studies in this issue are evidence that innovations in the approach to pediatric care are thriving and include radiation-dose monitoring, minimally invasive image-guided therapy, and minimal sedation. The case studies in this issue provide excellent examples for how to improve the pediatric experience in radiology and can serve as a roadmap for all radiologists.

Clinical decision support based on pediatric ACR Appropriateness Criteria® is another excellent pediatric imaging resource for advising which exam is best for different clinical scenarios (available at acr.org/AC). The Image Gently Alliance (imagegently.org) also provides highly educational resources for radiologists, families, and healthcare professionals regarding the roles of different imaging modalities and the importance of appropriately adjusting the radiation dose when imaging children.

Children are precious. Ensuring a bright future for our children is our responsibility.

Endnotes

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Ask a Radiologist

A radiology-specific online messaging system allows patients and families to ask questions directly to radiologists through the patient portal.



Key Takeaways

Inspired by other specialties, radiologists at Cincinnati Children's Hospital Medical Center spearheaded an initiative to integrate a messaging system into the electronic health record that allows patients to ask radiology-specific questions directly to radiologists through the patient portal.

Allowing patients to ask radiologists questions through the portal can decrease their anxiety. It also allows radiologists to connect directly with patients.

Gathering patient questions allows radiology groups to assess and improve healthcare procedures within their departments.

FOR THE PARENT OF A SICK CHILD, every minute circling the unknown is excruciating. Every moment spent waiting for test results or a diagnosis is a moment too long — particularly when it comes to imaging. A recent study shows that nearly half of all radiology outpatients experience anxiety as they await their imaging results.¹

To mitigate this unease and empower patients and families in their care, more than 90% of hospitals now allow patients to view their test results online, and 68% of these hospitals allow patients to message questions to their providers through a portal in the electronic health record (EHR).² A study from a large academic medical center shows that 3% of all patient-initiated messages relate to imaging studies,³ yet radiologists rarely see these messages. Instead, the messages usually go to referring physicians who may be unable to provide the most accurate information about radiology exams.

Recognizing this, radiologists at Cincinnati Children's Hospital Medical Center partnered with the hospital's information technology team to integrate a messaging system into the patient portal that allows patients to contact them directly. The system helps patients and families get the answers they need — from the experts in imaging — in a timely fashion.

The day after the system went live in 2017, the radiologists received their first message from a parent through the portal: "I would like to view the ultrasound images of my son's hip from yesterday's exam." In the weeks following the system's launch, the radiologists received approximately 20 questions.

Since then, the radiologists have continued to receive an average of three imaging-related questions per week from patients and families, allowing them to play a direct role in the patient experience. "Any time radiologists can engage

with patients and families, provide clarification, or answer questions about results or future exams, they're making a positive impact on the patient experience," says Dianne Hater, patient and family advocate for Cincinnati Children's radiology department.

Answering a Need

Connecting radiologists to patients through an online messaging system aligns with Cincinnati Children's many patient-centered care initiatives. In 2015, for example, the radiology department worked with Hater and other patient and family advocates to implement a direct-results delivery program that gives patients and families a chance to discuss their exam results with a radiologist immediately following image acquisition.

In 2017, Morgan P. McBee, MD, a resident at the time, saw the opportunity to further strengthen the radiology department's patient outreach when he got the idea for a system that would allow patients and families to directly connect with radiologists through the patient portal. "The value of patient portals is often discussed at hospital board meetings, but it seemed like we radiologists were one step short of fully realizing our potential to go the extra mile for the patient," says McBee, now assistant professor of radiology at the Medical University of South Carolina. "The patient messaging system helps us interact with patients directly without adding a significant amount of work to our schedules."

To set his vision into motion, McBee approached Alexander J. Towbin, MD, associate chief of clinical operations and radiology informatics and pediatric radiologist at Cincinnati Children's. "I thought it was a great idea," Towbin says. "We are always looking for different ways to reach out to families and connect them to our radiology team, and this seemed to fit perfectly into that goal. I wanted to work with Morgan to make it a reality."

Securing Support

Towbin took the idea to Brian D. Coley, MD, radiologist-in-chief at Cincinnati Children's and professor of radiology and pediatrics at the University of Cincinnati College of Medicine, who agreed that the messaging portal would provide great value to patients and to radiologists. "This portal is another way for us to communicate directly

with our patients and families to clarify questions and allay concerns," Coley says. "It also helps us raise awareness about the central role radiologists play in patient care while reinforcing the connection between the images we interpret and the real patients and families who are looking to us for answers."

After securing administrative support, Towbin, who oversees the radiology informatics development at Cincinnati Children's, and McBee met with radiology's lead systems analyst and the senior EHR analyst to discuss options for developing the messaging portal. During the meeting, the group outlined seven preferred functions

// Any time radiologists can engage with patients and families, provide clarification, or answer questions about results or future exams, they're making a positive impact on the patient experience. //

Dianne Hater



that it wanted the messaging portal to provide and met over several months to develop the platform. The technology team took on the radiology messaging portal as a special project, so no additional budgeting was required to customize the technology.

Working within the limitations of the EHR, the group achieved five of the seven preferred messaging functions. The two other functions involved patient access to the portal directly from the imaging report and minimizing the amount of information, like date of the study and study type, that the patient needed to manually input into the system. Both were unsuccessful due to limitations of the EHR.

Achieving the Vision

Still, the team was able to largely achieve its vision, developing a robust system that allows patients to ask about both completed and upcoming studies. "We thought it was important to allow patients to ask about future studies because they often have questions before exams, and radiologists are the best suited to answer questions about what to expect and how to prepare for an exam," Towbin says.

Regardless of whether questions involve completed or upcoming studies, all of the questions go to all of the radiologists, as opposed to just the interpreting radiologist. “We wanted to simulate the way other physician messaging portals work without tying radiologists to their inboxes,” McBee explains. “This allows the radiologists to contribute added value to a patient’s overall care without adding a lot of additional tasks to their workloads.”

Radiologists keep referring physicians in the loop by ensuring they have access to the radiology messaging system, where they can review questions from patients and families, along with the radiologists’ responses. What’s more, the radiologists can also use the EHR to document phone

of radiology study, the date of the completed or upcoming study, and how the patient or family member prefers to be contacted. The form also includes a field that asks patients how they heard about the messaging portal, helping the team identify the most effective means of advertising the portal to patients.

After a patient completes the form, the system routes it to a radiology group EHR inbox, which all 36 faculty radiologists and 10 radiology fellows can access. The subject of the message automatically populates as “Radiology Question for a Radiologist,” helping the radiologists select and promptly respond to questions as they access the mailbox. Any radiologist can answer any question.

When radiologists commit to answering a question from the system, they click a box to “claim” the message, which alerts other radiologists that someone is working to address the query. From there, the responding radiologist can answer the patient’s question directly through the portal, call the patient and document the phone call in the portal, or forward the message to a referring physician.

To date, 99% of the questions have pertained to completed studies, and 47% have involved availability of results. CT, MRI, and PET/CT studies are embargoed for 48

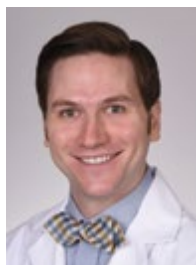
hours per hospital policy, so these questions are often easily answered. Other common questions focus on clarification of results and access to images.

Answering Questions

Once the team finished building the system, the radiologists leading the effort worked to build buy-in among the rest of the radiology team. The group introduced it during faculty meetings, offering one-on-one training to teach radiologists how to access the system and appropriately answer questions. As a result, radiologists could experience firsthand how easy the patient messaging system is to use before the team finally took it live in October of 2017.

Initially, McBee fielded most of the questions from patients and families because many of the other radiologists thought that taking the time to answer questions would be disruptive to their already heavy workloads. But with some encouragement from McBee and Towbin, more and more radiologists started responding to the questions.

Jones was one of the radiologists who were initially skeptical about the program. “I was initially concerned we



“The patient messaging system helps us interact with patients directly without adding a significant amount of work to our schedules.”

Morgan P. McBee, MD

calls they have with patients. This not only keeps referring physicians abreast of the information a radiologist shares with a patient and family, but it also informs other radiologists about how a question is addressed.

“We try to support the patient and physician relationship,” says Blaise V. Jones, MD, a professor of radiology who specializes in pediatric neuroradiology at Cincinnati Children’s. “We know the physician may have additional information that could be valuable to contextualizing imaging results, leading to better overall patient care.”

Leveraging the System

Patients and families can access the radiology messaging system through the “Ask the Radiologist a Question” link on the test-results page of the patient portal. “We thought this would be the best place for the link because it’s where patients go to view lab and imaging results and would likely be visible when questions arose,” McBee says.

Once a patient or family member clicks the link, the system presents a form where the person can enter a question. Additionally, there are places to identify the type

would be flooded with questions, adding a difficult task to our already demanding schedules,” he admits. “But it has been much less time intensive than expected. Most of the questions are straightforward and take only a few minutes to answer, and the information we provide is important to alleviating parent and patient anxiety.”

At the time of this writing, 70% of radiologists have responded to one or more questions in the system. “At the end of the day, everyone realized that this was the right thing to do to help alleviate parent and patient concerns and lessen their anxiety,” McBee says. “It is not a replacement for sitting down and talking to patients and families face-to-face, for sure, but it is a nice way to increase our patient interaction and put parents’ minds at ease without leaving the reading room.”

Increasing Job Satisfaction

Many of the contributing radiologists say that answering questions from patients and families has positively contributed to overall job satisfaction. “It is easy for radiologists to sit in a dark room and read the study and not spend much time considering the impact it has on patients and families,” Jones explains. “The patient messaging portal serves as a reminder that there are people behind these studies and that we have a responsibility to provide them with the best care possible — which includes answering their questions to reduce their anxiety.”

Additionally, the radiologists have found that fielding questions from patients and families is helping them identify areas for quality improvement. “Many questions involve clarifying terms in our reports for patients and families,”

Jones says. “Having these regular reminders that people are on the other end of our reports encourages us to make them more understandable.”

McBee agrees and says initiatives like patient-messaging portals build bridges between radiologists and patients in ways that benefit patients, their families, and radiologists. “A lot of

“ We are always looking for different ways to reach out to families and connect them to our radiology team, and this seemed to fit perfectly into that goal.”

Alexander J. Towbin, MD



patients don’t even know that radiologists are physicians,” McBee says. “Engaging patients in this way helps them better understand the integral role radiologists play in their care, and it allows us to help relieve their anxiety. It’s a win-win all around.” ■

By Chelsea Krieg

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Now It’s Your Turn

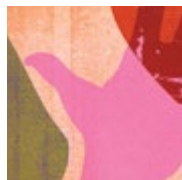


Follow these next steps to begin implementing this approach at your institution, and tell us how you did on Twitter with the hashtag #Imaging3 or email us at imaging3@acr.org:

» Work together with your technology team to determine how you can integrate patient-forward initiatives into your existing EHR.

» Connect with other departments and borrow from existing models within your health system to integrate technological improvements to patient care.

» Don’t be afraid of change. Play to the strengths of your department when considering how to connect more effectively with patients using the EHR portal.



Dedicated to Pediatric Care

An interventional radiologist leads the creation of a pediatric IR department at Peyton Manning Children's Hospital. He built buy-in and support, fostering a sense of teamwork that lasted long after the project's initial phase.



Key Takeaways

Leveraging skills learned at the Radiology Leadership Institute®, an interventional radiologist created a pediatric interventional radiology (IR) department at Peyton Manning Children's Hospital.

Building a pediatric IR department that met the needs of patients and referring physicians required buy-in and support from the diagnostic radiology group and hospital.

In its first three months, the department took on more than 80% of the hospital's pediatric IR patients.

YOUNG PATIENTS have access to more than 40 pediatric services and subspecialties at Peyton Manning Children's Hospital (PMCH), part of St. Vincent Hospital and Health System in Indianapolis. But before 2016, when children required interventional radiology (IR) procedures as basic as feeding tube replacements, a dedicated pediatric IR department wasn't available to treat them.

Sometimes, these children went to St. Vincent's adult vascular lab — which the hospital system shares with Northwest Radiology Network (NWR), the private practice that provides the system's diagnostic radiology services. Unfortunately, though, the lab wasn't equipped with the dedicated time or resources for specialized pediatric care.

"Without a dedicated workflow for all the kids we saw, the adult lab just worked kids in as it could," says Marc P. Underhill, MD, an interventional radiologist at NWR. "Pediatric IR is different than dealing with adults: You're not just treating the patient, you're also treating the parents. Reviewing treatment plans with both the patients and parents requires more time and flexibility than the adult lab can consistently provide."

As the children's hospital grew and the volume of pediatric IR cases increased, this bottleneck became more evident. "We were seeing more frequent and complex pediatric patients than the adult IR providers were comfortable treating," says Richard K. Freeman, MD, MBA, system chief medical officer at St. Vincent. "As a result, some pediatric IR patients were being delayed or transferred out of our facility."

For Underhill, who was studying business and leadership through the ACR's Radiology Leadership Institute® (RLI) (bit.ly/acr-RLI) at the time, the solution was obvious: Create a dedicated pediatric IR department to improve the patient experience and keep kids from having to seek care elsewhere.

Presenting to the Board

In December of 2015, Underhill presented his vision to his group's board of directors — which initially responded with “nice smiles and a bit of skepticism,” he says. They understood the hospital's need for this service and recognized Underhill's passion for pediatric care but had plenty of questions about the time, cost, and resources required.

“One concern that always arises in any private practice model like our group is, what are the costs associated with providing this service?” says Matthew M. Jones, MD, a pediatric radiologist at NWR. “Other concerns include: How much dedicated time is this going to take? Is there a set of procedures and patients to start caring for immediately, or will it take a while to ramp up? And how will the group budget its time and payroll to make it worthwhile?” Collaboration was the answer to many of these questions.

W. Kent Hansen, MD, PhD, president and chief executive officer of NWR, says, “We couldn't promise Marc the dedicated time to do only pediatric interventional services. He had to be willing to sacrifice his time to grow the pediatric department while continuing to provide adult care — and the group had to make sacrifices, too, to help him out. It was critical for him to build relationships and buy-in from the rest of the group and from the hospital because he needed their support.”

Rallying Support

In the weeks following his meeting with the board, Underhill focused on building buy-in and support throughout his practice and the hospital.

Underhill had been casually bouncing the idea of a dedicated pediatric IR department off other clinicians for years. Now, he began asking more pointed questions to understand how often pediatric physicians would use dedicated IR services and to assess how he would manage their patients.

“While the initial goal of these conversations was to gain support, they actually informed how we structured the service line,” Underhill says. “They helped us develop a business plan for standardized care and determine how we would schedule patients, how we would process imaging orders, and who should perform and manage which IR services.”

Underhill credits the RLI, a professional training program specifically designed for radiologists, with

teaching him the business savvy necessary to turn these conversations into a business plan.

“Five years ago, I had no idea how to write up a business plan or how to present that plan to different groups to get buy-in,” says Underhill, who wrote his RLI practicum report about launching this pediatric IR service. “The RLI provided me with the skills I needed to turn my vision into reality.”

After receiving strong approval from hospital providers, Underhill secured a meeting with St. Vincent's chief

“A strong lesson learned, especially in the hospital setting, comes directly from ACR Imaging 3.0. That is: Get out of the reading room.”

Marc P. Underhill, MD



medical officer. He presented a list of physician-requested IR services that the new department could offer and laid out a proposal for delivering, expanding, and improving those services to increase referrals over time.

“Dr. Underhill had carefully thought through the problem and the potential solution and had gathered support within his group and among his peers,” says Freeman, who immediately saw the value in filling this care gap. “People often bring problems to me, but rarely do they present such a well-thought-out solution.”

With the support of his practice and St. Vincent Hospital, Underhill opened a dedicated pediatric IR department in January 2016 in shared space within PMCH's radiology department.

Building the Department

To achieve his objective of improving the pediatric patient experience, Underhill built the dedicated expertise and processes to treat children more effectively than the adult vascular lab.

His initial goal was to acquire at least 80% of the hospital's pediatric IR cases in the first year. He thought this was a realistic number since referring physicians would have to get used to sending him their pediatric patients.

“Referring physicians had always ordered these procedures in the adult vascular lab, so I knew there'd be a tendency to keep sending patients there,” Underhill says.

“But I was surprised by how quickly referring providers adjusted to the change.”

Leveraging the relationships and open communication lines he'd already established with referring physicians and other radiologists, Underhill exceeded his first-year goal within three months.

During this time, Underhill attended pediatric rounds, quarterly meetings, and morbidity and mortality conferences, where he continued promoting the pediatric

it also reduced the administrative burden of establishing the department because Underhill didn't require dedicated space to get started.

“Pediatric surgeons would call me and say, ‘Do you have five minutes to visit this patient?’ So I'd run up to their clinic and see the patient,” Underhill says. “That saves the patient time, streamlining things for a more collegial, team-based approach. It's a more positive experience for the patients, their parents, and the referring physicians.”

In his report, Underhill wrote that the ACR Imaging 3.0 initiative inspired his efforts:

“A strong lesson learned, especially in the hospital setting, comes directly from ACR Imaging 3.0. That is: Get out of the reading room. Performing a procedure at the bedside when it is safe to do so not only helps nursing out but also gives you invaluable face time on the floor,” Underhill wrote.

“Let the physicians see you are a physician like them. Round on your patients, take an interest in who they

are and what they want. Working with your patients will always result in better outcomes, and being seen on the floors and in clinics as part of the treatment team buys collegiality and support if times ever get tough.”

This method has established Underhill as a vital part of the care team. “Our pediatric providers overwhelmingly support this approach,” Freeman says. “We have seen a higher quality of care and the elimination of patients being delayed or transferred for procedures as a result.”



“ Dr. Underhill had carefully thought through the problem and the potential solution and had gathered support within his group and among his peers. People often bring problems to me, but rarely do they present such a well-thought-out solution. ”

Richard K. Freeman, MD, MBA

IR department and asking referring physicians how the department could help them. He also gave referring physicians his cell phone number, making himself available for any IR questions or requests.

“The referring physicians really appreciate having Marc as a point-of-care contact,” says Hansen, who's also chair of diagnostic medicine for St. Vincent. “They appreciate his accessibility and availability. They have expressed that the department is a great benefit to the hospital, referring physicians, and patients.”

Improving the Patient Experience

Underhill attributes the successful launch of this pediatric service line in part to his accessibility. He meets referring physicians and their patients where they are — whether on another floor or even in another St. Vincent hospital.

“I have made myself as portable as possible and tried to perform cases either in the patient's room, when appropriate, or at least in their hospital,” Underhill wrote in his RLI practicum report. “This has included performing cases in tandem with other physicians in the operating room, so a child could be put under anesthesia once and have a series of procedures done.”

Because many of the procedures Underhill performs are ultrasound guided, he can often treat patients at their bedsides. This not only improves the patient experience, but

Planning for Expansion

Two years into its existence, the pediatric IR department now sees as many as seven patients a day. The most common procedures include feeding tube changes, biopsies, abscess drains, and an increasing number of sclerotherapy cases. (Read more about the department's sclerotherapy services in this Imaging 3.0 vignette, “In the Same Vein,” at acr.org/Imaging3-Same-Vein).

While most ultrasound-guided procedures are done at the patient's bedside, Underhill also has access to a couple of clinic rooms in the radiology department and even a couple of operating rooms.

Additionally, Underhill is building a larger inventory of child-size supplies, including smaller feeding tubes, catheters, and IV access devices. The department also has its own

CT fluoroscopy scanner and access to ultrasound equipment. "Marc brought in the latest pediatric IR equipment to make procedures easier, faster, and more effective for these patients," Jones says.

Underhill continues to meet with hospital executives to plan the department's growth. The next step, he says, is to formalize a process for ordering supplies and to create a dedicated pediatric IR suite for more complex procedures.

Sharing Insights

The most valuable lesson Underhill learned in establishing the department was that, to succeed, he had to train other radiologists to cover some of his procedures, such as feeding tube maintenance, allowing him to focus on growing the department without burning out.

"Make sure other people can do your job," says Underhill, who now serves on the board of NWR and as president-elect of the Indiana Radiological Society. "You really need help from other groups to cover you so that you can grow."

Hansen agrees: "Being a department of one is difficult; you have to understand that it requires a team approach — from both the hospital and the radiology group. It's critical to achieving and maintaining continuity of care." ■

By Brooke Bilyj

Now It's Your Turn

Follow these recommendations to start a pediatric radiology initiative at your organization, and tell us how you did at imaging3@acr.org.

- » Craft a comprehensive business plan, including details about the amount of time and resources required to launch and grow the service line.
- » Develop and maintain relationships with other radiologists and referring physicians to identify gaps in service and build buy-in when adding new services.
- » Become a vital part of the treatment team by being visible on the floor and accessible to physicians and patients.



ABOUT THE RADIOLOGY LEADERSHIP INSTITUTE

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THE FUTURE OF PEDIATRIC RADIOLOGY

Pediatric radiologists are dedicated to improving the health of children through imaging that is tailored to a child's unique needs. Learn more through Pediatric Radiology: Journey to Imaging Our Future, an on-demand webinar series presented by the ACR Commission on Pediatric Radiology and the Society for Pediatric Radiology. Among the topics and speakers:

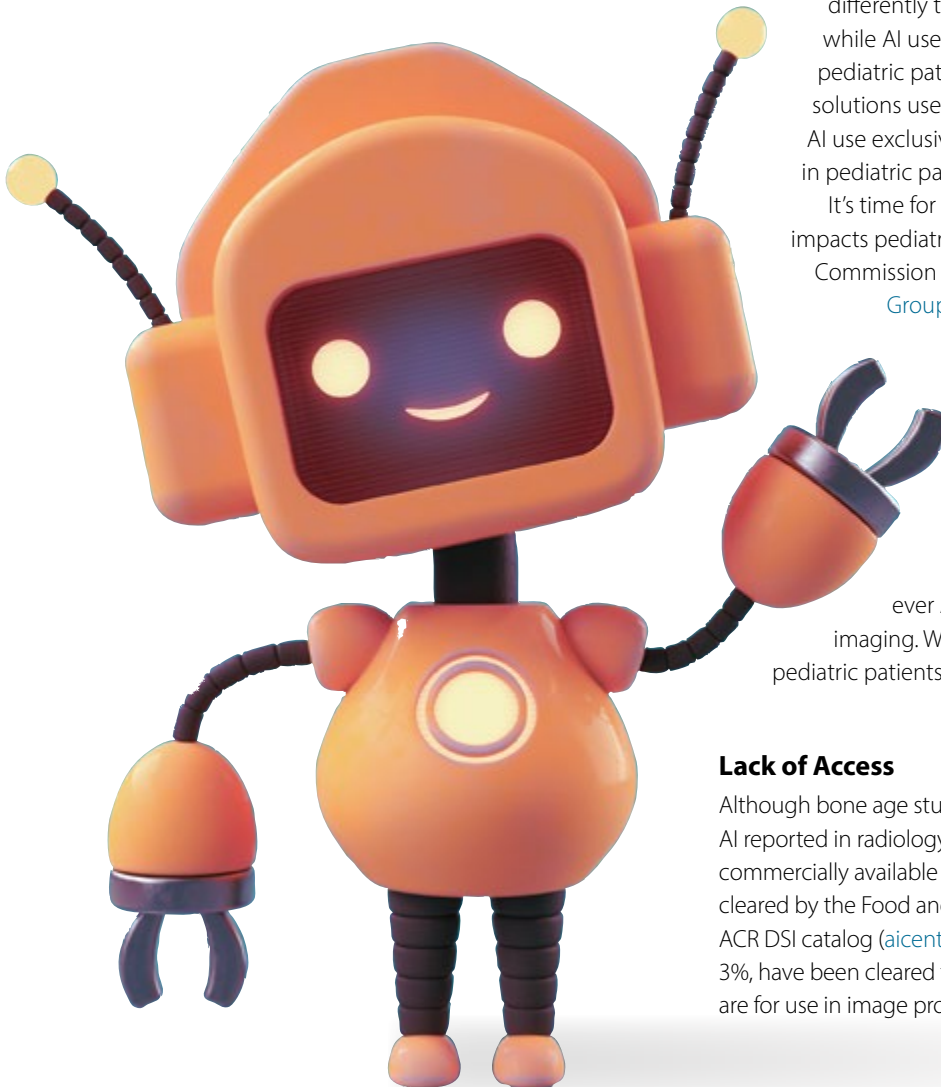
- ▶ **Introduction to Pediatric MRI – Why MRI Rocks** – Jonathan R. Dillman, MD, MSc
- ▶ **Fetal MRI** – Amy Mehollin-Ray, MD
- ▶ **A Day in the Life of Pediatric Radiology** – Asha Sarma, MD
- ▶ **The Fascinating World of Pediatric Neuroradiology** – Sarah Sarvis Milla, MD
- ▶ **Pediatric Elbow Injuries and Intervention** – Mahesh Thapa, MD
- ▶ **Using Informatics to Engage Patients** – Alexander J. Towbin, MD
- ▶ **Pediatric Radiology: AI** – Safwan S. Halabi, MD
- ▶ **Pediatric IR** – Anne Marie Cahill, MBBCh
- ▶ **Introduction to Pediatric Cardiovascular Imaging** – Ali B. Syed, MD

For other on-demand webinars and events for medical students, visit bit.ly/Pediatric-Med-Student-Resources.

One Size Does Not Fit All

While the ramifications of using artificial intelligence on pediatric patients aren't yet clear, the need for advocacy is.

Blog article posted Aug. 10, 2022



AS RADIOLOGISTS AND MEDICAL IMAGING professionals, we know pediatric patients are different from adult patients. Not only do they have different physiology, but their anatomy changes as they grow and mature. Many age-specific differential diagnoses in pediatric patients — for example, pyloric stenosis and ileocolic intussusception as causes of vomiting — are not seen in adults. Pediatric patients also are often imaged differently. For instance, given heightened sensitivity to radiation because they have longer to manifest the potentially adverse consequences of the process, CTs are infrequent. Since many younger kids can't remain still for MRI without sedation, we also perform ultrasound on children more often.

For all of these reasons, we treat children differently than adults in medical imaging. But, while AI use in medical imaging is expanding, pediatric patients are left out of most of the AI solutions used in clinical practice today. That means AI use exclusively in adults could inadvertently result in pediatric patient harm.

It's time for us to begin addressing the way AI impacts pediatric patients. Recently the ACR Informatics Commission established a Pediatric AI [Working Group](#) charged with tackling this important health-equity issue. The committee is working with the ACR Data Science Institute® ([acrdsi.org](#)), or DSI, and has established a campaign called Image IntelliGently™ to ensure access to clinically useful AI for pediatric patients and to ensure pediatric patient safety whenever AI that was designed for adults is used in imaging. What are the biggest issues surrounding pediatric patients and imaging AI?

Lack of Access

Although bone age studies made up one of the first uses of AI reported in radiology, today even that application is not commercially available for pediatric patients. Of the 193 tools cleared by the Food and Drug Administration (FDA) listed in the ACR DSI catalog ([aicentral.acrdsi.org](#)) as of July 2022, only six, or 3%, have been cleared for pediatric use, and all these AI tools are for use in image processing/quantification.

There are no AI tools for triage (CADt), detection (CADE), or diagnosis (CADx) that have been cleared for pediatric use. This is significant because the AI that works to triage studies with critical findings, like intracranial hemorrhage for priority reads or to detect findings such as pulmonary nodules and fractures, is not designed to work on pediatric patients.

A Question of Safety

The impact on pediatric patient safety of an ecosystem where the imaging AI has been developed for adult use but not pediatric is not yet clear. To date, there have been no studies to indicate that AI developed for adults performs at the same level on pediatric patients. Furthermore, there are some anecdotes of AI triage algorithms used in mixed adult/pediatric settings where we're told the AI ran exclusively on the adult patients. In at least a couple instances, the lack of an AI-positive finding flag was assumed to mean the AI was run and was not abnormal, when in fact, the AI had not been run on pediatric patients. There have been no publications addressing pediatric patient safety in practices where AI developed for adults was used across all patients when the practice also cares for pediatric patients.

Take-Home Points

We know pediatric patients aren't just little adult patients, and we must keep in mind that the AI developed for adults has not been shown to work as well across the pediatric patient population as in adults. None of the FDA-cleared triage (CADt), detection (CADE), or diagnosis (CADx) tools are intended for use in pediatric patients, and that puts pediatric patients at a disadvantage. To Image IntelliGently, everyone is needed, not just pediatric radiologists. If you want to get involved, consider the recommendations included with this article or learn more at bit.ly/ACR-informatics-commission.

Marla Sammer, MD, MHA, FAAP
pediatric radiologist, associate professor
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WHAT CAN RADIOLOGISTS DO?

If you're using AI on adults in your practice, but not pediatric patients, address its impact on pediatric patients. For example:

- ▶ Ask if radiologists and technologists are aware that most AI hasn't been designed for pediatric patients. If not, communication is probably needed to ensure that AI-related conclusions are not being made about the entire patient population.
- ▶ Check if turnaround times on pediatric patients' studies are being impacted if AI triage and/or worklist prioritization is used only in adults.
- ▶ If you're using AI to shorten MRI sequences, make sure it works as well in pediatric patients as it does in adults.

If you're using AI in pediatric patients, share your experience. For example, some things it would be extremely helpful to know include:

- ▶ Which AI tools are you using for pediatric patients?
- ▶ Does the AI work well across all pediatric ages, or are there differences for subset groups? For example, does the AI work well in teenagers but not in infants?
- ▶ Are you taking extra steps to make sure AI continues working as well in pediatric patients as it does in your adult patients?

If you want to help, but aren't yet using AI, educate and advocate for pediatric imaging AI. Some of the items the ACR Pediatric AI Workgroup is advocating for are:

- ▶ Consistent inclusion of pediatric applicability labeling on FDA clearance documents. This would be much like the "nutritional label" style, but for AI devices. It could give consumers consistent access to information on the patient population used when developing and testing the AI tools, including the age of patients.
- ▶ Incentives to promote the development of pediatric AI. These could take the form of additional funding for research studies or resources within the FDA for clearance, among others.

Support prioritization of pediatric radiology AI anytime you have the opportunity to influence what is being developed. It's needed ASAP, just to catch up!



Patient-Centered Optimization

Physicists at Duke University lead efforts to optimize imaging quality and dose using actual patient cases. The key is to consider factors such as gender, weight, age, and clinical condition.



Key Takeaways

Duke physicists are working with radiologists and other imaging team members to optimize radiation dose and imaging quality based on actual patient profiles for consistent care.

The team implemented a system that sends every CT and radiography case to a central server, which ascertains radiation-dose and image-quality information for each image to ensure high-value imaging across the board.

The approach has spurred a perpetual improvement in the consistency of imaging practice and has helped Duke achieve dose levels below the national average.

FOR MANY PEOPLE, the idea of patient-centered care conjures thoughts of providing warm blankets and delivering exam results directly to patients. At Duke University Health System (DUHS), the radiology team has taken patient-centered care to another level — optimizing image quality and radiation dose through a retrospective and quantitative review of actual patient cases.

Ehsan Samei, PhD, professor of radiology and the chief imaging physicist for DUHS, and his team are leading an ongoing project to quantify the radiation dose and image quality of every radiology exam performed at Duke's three hospitals and outpatient imaging clinics. The information allows the radiology team to optimize dose and quality based on individual patient characteristics — including gender, weight, age, and clinical condition — and based on each piece of radiology equipment.

“We want to make sure our procedures are customized and matched to the specifics of each patient,” says Samei, who is also the director of the medical physics graduate and residency programs at Duke. “The whole concept really grows out of the desire to deliver consistent patient-centered care.”

Samei and his team, known as the Duke Clinical Imaging Physics Group, started developing the approach in 2012 for modalities that use ionizing radiation. Now they capture dose and image quality data based on image resolution, noise, contrast, and other measures for every exam performed at DUHS, starting with CT and radiography and expanding to fluoroscopy, mammography, and nuclear imaging. They analyze this information for each patient exam and take corrective action when necessary, such as adjusting the protocols or patient positioning, to ensure future exams are of high value systemwide.

“The consistency of imaging in our facilities across the health system has increased as a result of our work,” Samei says. “Now, if somebody asks whether the image quality is high and whether we’re exposing patients to the correct dose, we can say with confidence that we are, as opposed to just assuming that we are good because we are Duke.”

Pushing the Envelope

Before the Clinical Imaging Physics Group began focusing on patient-centered dose and image-quality optimization, Duke’s radiology department did what many groups do and estimated what the radiation dose should be for patient exams. The team was meeting accreditation requirements with no problem, but the physicists knew they could do better.

“You can be accredited and your protocols can all make sense, but you can still find yourself exposing patients to doses that are too high or too low for a particular exam,” says Jay A. Baker, MD, professor in the department of radiology and vice chair of clinical affairs at Duke University Medical Center. “Dr. Samei and his group wanted to push the envelope to figure out exactly how much dose is necessary to produce images at a high-enough quality to answer the specific clinical questions. It’s really about using the right amount of dose for the right patient for the right study.”

Samei and his team are embedded within Duke’s radiology department, so the dose- and quality-optimization project developed organically through conversations among physicists, radiologists, radiologic technologists (RTs), and other department members. The radiologists were on board with more meticulously quantifying dose and quality when Samei explained that doing so could lead to more precise and consistent care.

“It’s like counting calories: If you don’t put the calorie quantities on the menu, you don’t really know how many calories you’ve consumed; you can make a reasonable guess, but you don’t really know,” Samei says. “What we did with our project is essentially put numbers next to those ‘calories’ or, in this case, our exam dose and quality. So we know what the dose is, and we know what the image quality is for each exam, and therefore, we can be more informed about the way we approach, monitor, and optimize imaging.”

While radiology groups have been attuned to dose for years, measuring image or exam quality as part of those efforts is relatively new, says Donald P. Frush, MD, FACR,

former professor of pediatrics and radiology and vice chair of quality and safety at Duke. “To develop a performance quality program that considers both dose and quality is really a quantum leap above what most anyone else has right now,” says Frush, who is now professor of radiology and medical director of operations at Lucile Packard Children’s Hospital at Stanford.

It was a concept that some Duke radiologists hadn’t considered possible. “You don’t know what you don’t know,” says Baker, who is also the division chief of breast imaging at Duke. “What Dr. Samei’s group did was show us that we could do more in-depth analysis and learn more about our protocols,

“We want to make sure our procedures are customized and matched to the specifics of each patient. The whole concept really grows out of the desire to deliver consistent patient-centered care.”

Ehsan Samei, PhD



our dose, and the impact on quality down to the machine level for each patient. It has the potential to reduce repeat imaging because we’re considering dose and quality together, rather than simply lowering the dose and hoping the quality remains high enough to answer the clinical question. We know we’re getting the best image we can get at the lowest possible appropriate dose.”

Analyzing Actual Cases

To achieve this level of dose and quality optimization, Samei and his team knew they needed to measure radiation dose and image quality on actual patient cases — not just test cases conducted with phantoms. “Traditionally in radiology, we use phantoms, which are essentially single-sized plastic objects, to ascertain some of the aspects of dose and image quality,” Samei explains. “The challenge is that a phantom image doesn’t have the same properties as a patient image, so your estimation of dose and image quality is a bit removed from what is actually happening to the patients in your clinic. The hallmark of our work is that we’re looking at actual patient cases.”

The Duke team looked for a commercial product to analyze patient cases, but they couldn’t find what they

needed. Instead, they worked with Duke's IT team to develop an in-house system that sends every case to a central server, which ascertains radiation-dose and image-quality information for each image through an automatic process. In addition to dose exposure level, the system analyzes image resolution, noise, contrast, and other measures.

"These attributes are not just things that physicists cooked up; we actually interviewed our radiologists and asked them, 'So when you say an image is bad or an image is good, what do you mean?'" Samei explains. "Then we put numbers to their responses. With the numbers, we can measure the quality



“To develop a performance quality program that considers both dose and quality is really a quantum leap above what most anyone else has right now.”

Donald P. Frush, MD, FACR

and dose, we can target it, and we can optimize it. Without the numbers, you cannot do any of those things. In the same way that you can't really come up with a diet if you cannot quantify calories and servings."

While the system reviews all of the cases, the radiologists can also manually flag noteworthy cases as they read them. These cases might contain suboptimal artifacts, or they might be highly optimal cases that the radiologists want to hold up as ideal examples. The radiologists and physicists discuss these cases along with system-identified outliers during regular meetings, which RTs, clinicians, and other stakeholders also attend.

"We set up open lines of communication with team members who are focused on dose and quality optimization," says Lynne M. Koweeck, MD, FACR, cardiothoracic imaging specialist at Duke. "We try to give the physicists input about the challenges we're facing on the clinical side, so they can understand how to best help us on the technical side. It's really collaborative."

Implementing Improvements

When the system or the radiologists identify a suboptimal case based on the quality and dose score, the physics team reviews the entire imaging chain — from the time an exam was ordered to the time the radiologist read the study and reported their findings — to determine why that particular

study was an outlier. It's a different approach to medical physics, which usually involves just qualifying imaging equipment, Samei says. "We look at the imaging equipment, how the technologist used the equipment, what protocol was used, what dose was used, what position the patient was in — everything up the imaging chain," he says. "It's like a forensic investigation to find out what went wrong."

In one instance, the physicists noticed a discrepancy in the dose and quality of two different classes of CT scanners that the hospital uses. For one class, the dose was increasing as the patient size increased (which is normal), but for the other class, the dose was not changing with patient size. "The smaller patients were getting beautiful image quality and the larger patients were getting not-so-beautiful images," Samei explains. "We saw this pattern, and we scratched our heads. It turned out that for the class of cases where the dose was not changing, the setting of the scanner had to be changed. After we fixed the setting, everything was working as it should, and we could verify that improvement in our results."

While correcting the scanner class discrepancy involved a simple setting change, other issues require more in-depth adjustments to protocols and patient positioning. In these cases, the Clinical Imaging Physics Group team develops potential solutions to the issues and tests them on phantoms before recommending them for practice. "We still acquire phantom data, but as one of the pieces of the puzzle, not the whole thing," says Samei, who shares tested solutions with the radiologists, RTs, and other team members for discussion and implementation.

The collaborative approach ensures that everyone remains committed to dose and quality optimization. "It helps keep the words 'dose' and 'image quality' on the technologists' tongues," says Tammie Bateman, chief RT for CT radiology at Duke. "People can become desensitized to dose due to the fact that ionizing radiation isn't visible. But it's important to keep both dose and image quality at the forefront of our minds when imaging patients."

The approach is having a positive impact on patient care, driving a gradual decrease of repeat imaging since 2015, Samei says. What's more, a comparison of CT dose levels with the benchmarks of the ACR Dose Index Registry® (bit.ly/acr-DIR) shows lower dose levels compared to national averages as a result of Duke's efforts. "Over time, we have seen more consistency and adherence to targeted quality and dose levels," Samei says. "Through this system, we're

ensuring that we use the minimum radiation dose to obtain the actionable information that we need for diagnosis and treatment.”

Expanding the Project

With the system initially working for modalities that use ionizing radiation, Samei and his team intend to gradually expand it to non-radiation-based modalities, including ultrasound and MRI. “With those modalities, radiation dose is not a concern. But we still care about the image quality, scan parameters, dose of the contrast medium, and, of course, about the imaging condition and performing the exam exactly to meet the need of the individual patient,” Samei says. “We think the system we have in place can help ensure quality in these areas, as well.”

Samei also hopes to eventually make the system that Duke developed to measure the dose and quality of actual patient cases available to other institutions and practices. He hopes it will encourage more groups to make consistent patient-centered quality and dose a priority.

“I would like to see a situation where I don’t have to wonder whether the CT scan at one institution or another provides the same information; that is an obligation that we have to every patient who entrusts us with his or her care,” Samei says. “We need to start deploying comprehensive monitoring systems, such as the one we have employed here, to look at the consistency and quantification of care, as consistency and quantification are hallmarks of high-quality evidence-based medicine. With medical images, we should be capturing the exact information we need — nothing more and nothing less.” ■

By Jenny Jones

“ We try to give the physicists input about the challenges we’re facing on the clinical side, so they can understand how to best help us on the technical side. It’s really collaborative.”

Lynne M. Kowcek, MD, FACR



CHILD-SIZE RADIATION DOSAGE

The ACR Dose Index Registry® (DIR), introduced in October 2021, can help radiology facilities adjust CT protocols and doses for pediatric patients by comparing them to national benchmarks, according to an article in the *ACR Bulletin* (bit.ly/ACR-DIR-article). The research paper announcing the DIR was the first of its kind and the result of a years-long endeavor based on data from about 1.5 million CT exams from a wide range of facilities.

The registry provides benchmarks for optimizing radiation doses in the 10 most common pediatric exams:

- ▶ Head Without IV Contrast
- ▶ Sinuses Without IV Contrast
- ▶ Maxillofacial Without IV Contrast
- ▶ Neck Soft Tissue With IV Contrast
- ▶ C-Spine Without IV Contrast
- ▶ Chest Without IV Contrast
- ▶ Chest With IV Contrast
- ▶ Abdomen/Pelvis Without IV Contrast
- ▶ Abdomen/Pelvis With IV Contrast
- ▶ Chest/Abdomen/Pelvis With IV Contrast

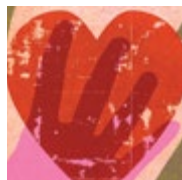
Learn more at bit.ly/DIR_Rad.

Now It’s Your Turn



Follow these recommendations to start an initiative toward optimizing dose and quality based on individual patient characteristics. Tell us how you did at imaging3@acr.org.

- ▶▶ Prioritize optimization of imaging dose and quality beyond what’s required for accreditation.
- ▶▶ Commit to analyzing actual patient cases, not just phantoms, and implement a system to do so.
- ▶▶ Collaborate with radiologists and other team members to quantify optimal radiation dose and image quality and implement adjustments as needed.
- ▶▶ Partner with other institutions to assure the ability to distribute a program with efficient and effective implementation and function.



Scanning Without Sedation

A pediatric radiology department in Boston created a program that has reduced the use of anesthesia in patients undergoing MRI by 73%. The Try Without Anesthesia initiative helps children keep still and reduces stress on families.



Key Takeaways

To reduce the number of children who are sedated for imaging exams, radiologists at Boston Children's Hospital began exploring alternatives to anesthesia.

The team implemented several techniques to help patients get through their exams without anesthesia, including shortening image acquisition sequences, scheduling appointments to coincide with nap and bedtimes, recreating children's bedtime routines in the hospital, and helping families practice for exams.

Through these efforts, the radiology team successfully reduced sedation rates from 55% to 15% for MRI procedures.

WHEN DOCTORS SCHEDULED a brain MRI for Angela Polizzotti's 10-month-old son, she was understandably concerned about the procedure. She couldn't imagine a baby like Blake lying still through the exam, which could take up to an hour. But she didn't like the idea of anesthetizing her child to keep him motionless. "He was so little, and he'd never had anesthesia before," Polizzotti says. "I was nervous about sedating him."

Luckily, Boston Children's Hospital's radiology department had been developing a program called Try Without Anesthesia to reduce the number of children who are sedated for their imaging exams. The team knew that limiting the use of anesthesia would have a twofold benefit: Patients could get their imaging sooner and they would avoid the potential risks associated with anesthesia.¹ When the Polizzotti family found out about the program, they decided to try the exam without sedating Blake.

"Obviously, MRI scans are not painful procedures. The only reason children need sedation is because they struggle to remain motionless long enough to capture clear images," says Richard L. Robertson, MD, radiologist-in-chief and chair of the department of radiology at Boston Children's Hospital. "By avoiding sedation, you reduce the overall risk, time, and cost of doing a diagnostic study."

Since radiologists at Boston Children's Hospital began exploring alternatives to anesthesia around 2007, they have formalized the Try Without Anesthesia program to get children through imaging exams without sedation. By helping children like Blake lie still during MRI procedures, the program has reduced sedation rates from 55% to 15% for these procedures. "This program provides a valuable service for patients and their families while also making our radiology practice safer and more efficient," says Robertson, who is also the John A. Kirkpatrick associate professor of radiology at Harvard Medical School.

Getting Started

Prior to 2007, radiologists at Boston Children's Hospital generally assumed that most children younger than 7 required sedation to remain still during MRI procedures. But as the hospital's appointment volume increased and the wait times for sedation swelled beyond 60 days, that assumption left many patients and their families waiting months for answers. To get children through imaging faster, the radiology team began exploring ways to reduce the need for sedation for imaging.

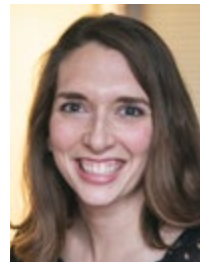
Around that time, Robertson learned about MRI-compatible video goggles that allowed children to watch movies during scans — a distraction that reduced the need for sedation by nearly 20% in early studies.² Impressed with the results, Robertson asked hospital administrators



When doctors at Boston Children's Hospital scheduled a brain MRI for 10-month-old Blake Polizzotti, his mother was nervous about sedating him. She agreed to Try Without Anesthesia to explore options outside of sedation.

to invest in the goggles, and they quickly agreed. "The administration understood the importance of reducing the use of anesthesia," Robertson says. "They recognized that when you avoid sedation, you decrease the risk of the exam for the patient. It's also significantly less expensive."

// Through the Try Without Anesthesia program, families become more involved in the MRI scan. Even if patients must ultimately be sedated, families appreciate having the opportunity to at least try it first without anesthesia. //



Kellyn Mahan

According to a study published in *Radiology*, the average cost of an outpatient MRI in 2011 was \$665 without anesthesia and \$902 with anesthesia.³ Other research suggests that pediatric MRI costs for sedated and anesthetized patients are, respectively, 3.24 and 9.56 times higher than MRI costs for patients who stay awake.⁴

By monitoring the exams from the reading room through the PACS, Robertson and his fellow radiologists could instantly determine whether the goggles and other techniques were working for each child. "Our radiologists actively supervise MRI cases as they're being performed," Robertson says. "We set up our PACS with the ability to send images at the end of each series acquisition, so we can watch the study in action and instantly decide, 'We've captured the information we need; we can stop the exam now,' or, 'This child's moving; we need to repeat that scan to get a clear picture.'"

Scanning Faster

As part of this work, the radiology department adjusted the imaging protocols for faster acquisitions so that babies would be in the scanner for less time. "Shortening the image acquisition times is the single most important thing that we can do as radiologists to reduce the need for anesthesia," Robertson says. "We found that many

children can stay still for one minute but not for four minutes during a standard acquisition.”

To convince radiologists that faster protocols were diagnostically equivalent to standard acquisitions, Robertson and his colleagues conducted a blind review of brain MR imaging comparing fast scans to standard scans. After collecting images from 60 cases and redacting the image acquisition details, Robertson asked radiologists in his department to compare each image set. “Half of the time, they said the conventional acquisition was better,



“ Obviously, MRI scans are not painful procedures. The only reason children need sedation is because they struggle to remain motionless long enough to capture clear images. By avoiding sedation, you reduce the overall risk, time, and cost of doing a diagnostic study.”

Richard L. Robertson, MD

and the other half of the time, they said the faster acquisition was better,” says Robertson, who outlined his findings in a study that was published in 2019.⁵ “Through the blind review, the radiologists saw that faster acquisitions were diagnostically equivalent, which secured their buy-in.”

Although it wasn’t a formal program yet, more nurses, technologists, and radiologists were convinced of the idea of trying exams without sedation. They allowed extra time for parents to swaddle and calm their babies before their exams and utilized faster acquisition times to shorten the length of each scan. Through these informal efforts, the radiology department reduced the sedation rate for babies under age 1 by more than half — cutting the use of anesthesia from about 55% to 20% in that population within a couple of years.

Formalizing the Program

With positive results from their early efforts, the radiology department began to formalize and expand the Try Without Anesthesia program. In 2015, Robertson convened a group of schedulers, radiologic technologists (RTs), radiologists, nurses, MRI physicists, image analysts, and faculty members from radiology’s research center to develop the program logistics. He also engaged the hospital’s information

strategy department and external MRI vendor to establish the program’s technology workflow for faster imaging protocols and streamlined appointment-setting prompts.

“For this initiative to work, we needed to look at all of the factors around imaging,” Robertson says. “The schedulers had to be able to identify candidates upfront. The radiologists needed to know what imaging protocols to use to minimize exam durations, and the techs and nurses had to be patient in working with the children. The physicists and image analysts also had a significant role in redesigning the imaging protocols, and the informatics team helped support the workflow.”

Through monthly meetings, the committee developed the workflow for the Try Without Anesthesia program — starting with a digital dashboard that was developed in-house to aggregate information from the electronic medical record, scheduling system, PACS, and protocoling applications to help identify candidates for the program. Schedulers are prompted to share the benefits of the program whenever families call to schedule anesthesia appointments, and the radiologists and technologists can also flag

patients who seem like good candidates for the program based on certain indications or conditions.

The committee officially launched the Try Without Anesthesia program in January of 2016. The team initially limited the sedation-free appointments to four 105-minute slots every Sunday afternoon, when the hospital’s slower schedule permitted 30 minutes of one-on-one prep time with a child life specialist and 75 minutes of scanning time. These appointments initially focused on patients between 4 and 7, since patients in that age group had success using the video goggles to avoid sedation in prior years.

As more families learned about the anesthesia-free option, however, the program quickly expanded. By the time the Sunday-focused program concluded in July of 2019, 320 patients between the ages of 1 and 16 had participated in the Sunday Try Without Anesthesia appointments alone, with 91% of patients successfully completing the exams without anesthesia.

Recruiting Patients

The program received an additional incentive in December of 2016, when the Food and Drug Administration (FDA) issued an advisory about the potential neurocognitive effects of prolonged anesthesia exposure in young children.

The warning urged pediatric healthcare professionals to balance the risks and benefits of sedation. “The FDA advisory strengthened our resolve to advance the program,” Robertson says. “But we needed a more structured approach if we were going to expand it further.”

To that end, Robertson hired Kellyn Mahan, who worked as a scheduling coordinator in the radiology department for several years and who had recently finished training to become a child life specialist, to take ownership of Try Without Anesthesia as the program coordinator in January of 2017.

Mahan’s main responsibility was to recruit patients for the program by calling families to discuss their options without sedation and informing families about the program when they called to schedule anesthesia appointments. Nurses and technologists also recommended the program when children seemed calm, unfazed, or even eager to interact with them in the prep room before an anesthesia appointment.

To reach more patients, Mahan created brochures to distribute throughout the radiology waiting rooms and local clinics and collaborated with the marketing department to develop materials to educate referring providers about the program. “We want to reach as many patients as possible,” Mahan says, “so anything we can do to spread the word about these appointments is beneficial.”

Additionally, to keep the program top-of-mind among referring providers, Robertson and other departmental leaders talked about the importance of reducing anesthesia rates in weekly operations meetings, multidisciplinary conferences, and the radiology group’s annual quality management plan. “We constantly bring up the Try Without Anesthesia option,” he says. “Now, a lot of referring clinicians specifically request this approach for their patients, which has been really nice to see.”

Imaging at Bedtime

As the program grew in popularity, Mahan worked with the committee to explore other alternatives to anesthesia. Recognizing that children were likely to remain still for an MRI if they were asleep, the committee decided to try later appointment times to coincide with patients’ bedtimes. In October of 2017, the Try Without Anesthesia program began offering 9 p.m. appointments one day per week. These appointments allow families to schedule exams when the hospital is quiet and their children are sleepy. Since the hospital already had MRI technologists and radiologists working overnight shifts, staffing wasn’t a big issue.

“Our intention was to bring in children when they’re as tired as possible,” says Mahan, who initially advised patients’

families to keep children from napping on the day of the scan — but that approach just made kids cranky, not sleepy. “We realized that our success depended not just on how tired the kids were but on how well we helped families prepare for these appointments.”

Now, as soon as a family schedules a Try Without Anesthesia appointment, Mahan sends them a detailed email that explains the imaging process and encourages families to help children practice for their exam. The email includes a link to a YouTube video (bit.ly/MRISounds) that plays the sounds of an MRI machine, and Mahan sends the earmuffs and noise-reducing ear putty that children can wear during their scan. “We suggest that they play the sounds as much as possible during the child’s bedtime so that the child gets used to hearing the noises,” Mahan explains. “We also ask them to use the ear protection leading up to the appointment because it’s often a new sensation for the children.”

Polizzotti played the MRI sounds for her son Blake during naps and bedtimes leading up to his appointment. “It definitely helped,” she says. “By the time he went in for his exam, the noise didn’t startle him at all.”

Replicating Routines

For additional support, Mahan asks a lot of questions about each child’s bedtime routine so that she can recreate that environment when families arrive for their nighttime appointments. She encourages families to bring their children’s blankets or stuffed animals to help them relax and asks families to arrive for their nighttime appointments around 7:15 p.m., giving the children plenty of time to get comfortable and fall asleep before their 9 p.m. exams, which the department now offers two days a week and hopes to eventually offer five days a week.

“They gave Blake a stuffed animal and provided a rocking chair for me to rock him to sleep and even allowed his favorite blanket to go in with him,” Polizzotti says. “My son is obsessed with Michael Bublé, so they actually played Michael Bublé music in the background, which really helped soothe him. They gave him little headphones, and he slept through the whole thing.”

Over time, the hospital added more MRI-compatible tools to keep kids comfortable inside the scanner, including a crib made of PVC pipes. They also began offering custom DockATots, oval-shaped pillows that cradle babies and prevent them from rolling around. “The DockATot company donated products to us,” Mahan says. “They even changed the metal zipper to a plastic zipper so that we can use them to transfer sleeping children onto the MRI bed.”

If all else fails, radiologists allow parents to join their children on the MRI bed during a scan. “Although it’s not optimal, it can be one of our last resorts to keep a child still,” Robertson says.

When Blake Polizzotti returned for a spinal MRI about six months after his first exam, he tossed and turned until his mother joined him on the bed. “I had to do a half-plank over his legs for the duration of the 30-minute exam, but he fell asleep as soon as I got on the bed,” Polizzotti says. “Because the team was so patient and willing to try anything, my son made it through both MRIs without sedation.”

Reporting Results

Blake is just one of many sedation-free success stories at Boston Children’s Hospital. Robertson estimates that prior to 2007, about 55% of the hospital’s patients were sedated for MRI exams, but now thanks to the Try Without Anesthesia program, only about 15% of children require sedation for these studies.⁶ For certain cases — like a high-resolution study for a pre-operation epilepsy evaluation, for example — sedation may still be the best option, but many children just need a little patience and preparation to get through an exam without anesthesia.

By working together with families to help children through imaging procedures without sedation, the radiology department is creating a more collaborative approach to care. “Through the Try Without Anesthesia program, families become more involved in the MRI scan,” Mahan says. “Even if patients must ultimately be sedated, families appreciate having the opportunity to at least try it first without anesthesia.”

For the Polizzotti family, the program positively impacted their overall healthcare experience. “It gave us a lot of peace of mind and relief,” Polizzotti says. “My husband and I were thrilled that Blake didn’t have to go through the sedation process. We’re so thankful to the amazing team that runs this awesome program. You can tell that they want your baby to get through this as much as you do.”

As the program moves forward, the team continues to explore new tools and creative techniques to prepare children for imaging. They’re currently looking into augmented reality and even a therapy dog to keep kids at ease. It’s all part of the group’s ongoing commitment to minimize the use of anesthesia.

“As much as possible, we ought to avoid sedation of children for diagnostic imaging procedures,” Robertson says, “but there’s not one right way to go about this. It requires some experimentation and a real dedication to doing this

because it’s the right thing to do. You provide a valuable service to the patient, and in the end, it can actually be more efficient for your practice, as well.” ■

By Brooke Bilyj

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Now It’s Your Turn



Follow these next steps to begin implementing a Try Without Anesthesia program in your practice, and tell us how you did at imaging3@acr.org.

- » Engage a committee to explore alternatives to anesthesia, evaluating tools and techniques to distract and relax young patients during imaging exams.
- » Adjust appointment times, imaging sequence protocols, and even the atmosphere of the prep room to make imaging exams more comfortable for young patients.
- » Develop instructions to help families practice at home before an imaging appointment to prepare children for the sounds and other sensory experiences of an MRI exam.



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