Case Study: A “Big Data” Registry

**The ACR Dose Index Registry is helping radiologists compare CT dose indices to national standards and safeguard patients.**

By Amena Hassan

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**Key Takeaways:**

- The ACR Dose Index Registry (DIR) allows radiology practices to compare their CT dose indices to national and regional averages and successfully lower the radiation dose for their patients.
- The DIR allows practices to continuously monitor radiation exposure from their protocols, which is particularly important for pediatric and young adult patients.
- The DIR helps facilities standardize CT practices and build higher patient confidence in radiation safety, offering radiology practices an opportunity for differentiation and value creation.

As word spreads and pay for performance initiatives mount, radiologists are connecting to the ACR Dose Index Registry (DIR) in increasing numbers. Earlier this year, the DIR surpassed 5 million CT scans, moving closer to its goal of becoming the definitive source for understanding radiation dose and an important conduit for facilities to compare their CT dose indices to regional, hospital-type, and national values. In a rapidly evolving health-care landscape, radiologists can leverage their commitment to protocol standardization and diminishing radiation dose. This registry participation provides assurance of quality and safety, and also serves as a marketing resource demonstrating value through data analysis.

**How the Registry Works**

The DIR provides feedback that allows a facility to compare its CT doses (CTDIvol and dose length product [DLP]) to national averages, and is the largest database of its kind. “The size of the database allows us to develop robust estimates for dose indices against which participating facilities can compare themselves,” states Mythreyi Chatfield, PhD, senior director of data registries at ACR. “We also have a very broad representation of the different types of imaging facilities, making our numbers representative of actual practice across the country.” Information related to dose indices for CT exams submitted by all participating facilities is collected, made anonymous, and sent to the ACR, where it is included in a database. Institutions are then provided with periodic reports that compare their average and variation of dose indices by exam type to corresponding measures at other facilities. The DIR is open to any CT facility worldwide.

Facilities ranging from large hospitals and medical centers to smaller radiology practices send an initial National Radiology Data Registry (NRDR) participation agreement to the ACR and designate someone at their facility as an administrator. After officially registering, information that is specifically related to CT exam dose amounts is gathered and sent to the ACR directly from the CT unit. The list of CT units that have already been used to successfully submit information to the DIR is updated monthly and can be easily accessed without a login (at http://bit.ly/DIRscanners) or from the facility’s PACS. The data that are transmitted by a facility are then added to the DIR, and facilities receive semi-annual reports that summarize dose criteria and compare their site’s information to national data. A facility’s own data are accessible at all times.

“DIR is the largest database that I know of that can allow radiologists to judge their own results in CT, benchmarked against local and national practices,” explains radiologist Alec J. Megibow, MD, MPH, FACR, director of outpatient imaging services at the New York University Langone Medical Center. “It helps us identify CT protocols that utilize too much dose, so radiologists can reassess what others are doing and bring doses down.” Megibow also states that the field of radiology could clearly benefit as radiologists continue to utilize the DIR. “The registry is a useful way for practices to distinguish themselves from one another if they act on the information that they get. You could be an ACR member but if you don’t share your data with other members, then it’s not going to help anybody. If radiologists really take a look at this data, they would lower overall patient dose.”

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**Defining a Dose**

The radiology community has long recognized that children should be most closely protected from...
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radiation exposure from CT scans. Steven B. Birnbaum, MD, of Dartmouth-Hitchcock Manchester Radiology in Manchester, NH, recognized the need for tracking specific dosage requirements, especially for his pediatric and young adult patients, after a pedestrian accident injured his then 22-year-old daughter in 2005. Younger patients are generally more radiosensitive than older adults, as shown from the Life Span Study in Japan and other population studies.

For many years, Birnbaum spot-checked the radiation dose output in the PACS tool within his own practice before the DIR’s arrival. In that review, he found instances where adult-type protocols were used on pediatric patients. “It’s not done consciously, and sometimes it just slips through the cracks,” Birnbaum explains. Unfortunately, spot-checking dose does not provide a comprehensive monitoring system for a practice or hospital where many radiologists and technologists work. In contrast, he feels the DIR provides a vital resource for radiologists double-checking dose requirements within a community environment.

“We need to know what our machines are putting out in terms of estimated radiation dose, so we’re using the correct parameters,” Birnbaum states. “We can set the dose a number of different ways. If you set them too high, you will get beautiful pictures, but you won’t always need that clarity in order to create diagnostic images.” He observes that radiologists often prioritize image quality over dose requirements. “Unfortunately I’ve heard radiologists say, ‘I’ve never been sued for pictures that are good, but I have been sued for pictures that aren’t so great.’”

Birnbaum cites the work of radiologist Rebecca Smith-Bindman, MD, professor at the University of California, San Francisco, who found a significant variation in CT radiation dose, up to a 13-fold variation, among different practices for the same type of study produced by the same CT manufacturer. This was a landmark study published in JAMA Internal Medicine (formerly Archives of Internal Medicine), and the results showed, among other conclusions, that practices could generate quality images without using the maximum dose possible. “CT is a wonderful test, and the benefits far outweigh the risks — if used intelligently and used well,” Birnbaum adds. “But if your dose levels are way out of line with other radiologists around the country, then you should recognize you need to make adjustments to align with best practices.” Participating in a registry that shows you how you are doing relative to your peers accomplishes just that.

Higher Patient Confidence

Along with comparing dose indices to national levels, another advantage of signing up with the DIR and acting on the information it provides is that it directly benefits patients, as participating practices continue to assess their CT protocol and lower their radiation dose index. But how does the DIR specifically safeguard patient safety? Many patients are increasingly concerned about radiation exposure during CT scans; for example, parents may be concerned about a head CT scan recommended for their child. DIR currently only covers CT, but is piloting an expansion to include digital and computed radiography, which will allow the registry to address other areas of concern. Female patients may express concern about radiation exposure to the breast during mammograms. Other areas of concern regarding excessive exposure to radiation include the lens of the eye, the thyroid, and the gonads — particularly in children and young adults. When patients express concern, members need to be proactive at providing the many ACR educational resources on radiation safety, including Image Gently® and Image Wisely®.

According to Richard L. Morin, PhD, FACR, chair of the DIR, physicist at Mayo Clinic Florida, “For those patients who are concerned about dose, the conversation is often communicated to the technologist.” He goes on to note that “The diagnostic radiologists, medical physicists, and radiologic technologists periodically review their dose indices and compare them to the DIR values. If their values are higher than average values reported in the DIR, the protocol is changed to be more in alignment. At the end of the day the radiologists must be confident that image quality is sufficient for proper interpretation, and this continual vigilance is helpful in assuring patients that the optimal amount of radiation is used to provide diagnostic images.”

After a facility submits their CT scans to the DIR they receive reports at a minimum of twice a year, but this can be customized to their needs. “In our facility, a group meets and compares the dose indices within

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the practice and then compares them to other local facilities like us, so we line up better with these similar sites,” Morin explains. “DIR is a program to continuously monitor how groups are practicing. It’s beneficial to individual radiologists and to patients because they are assured that that practice is continuously monitoring their CT protocols and the variation in what they do from day to day. Patient fears are assuaged and they become more comfortable that somebody is looking out for them.” All stakeholders should be reassured by using this quality assurance tool, not just the patients.

Some sites are advertising their DIR participation to show patients they are actively involved in monitoring and lowering CT dose. “At some point, the leaders in the radiology community will be promoting DIR participation in advertisements — just like when they advertise their mobile mammography systems,” Morin says. “That kind of ‘credential’ does have meaning to the general public, and it wouldn’t surprise us if we start seeing it even more.”

Sites in urban areas are more actively involved in the DIR than sites in the upper west such as Montana and Idaho, Morin observes (see Figure 1). Despite this geographical variation in participation, however, facilities in all areas of the country are continually enlisting. The DIR also shows promise internationally as radiologists and medical physicists representing the registry have actively presented at global conferences. This visibility is already helping the radiology community abroad recognize its role in advancing radiology in Europe and countries such as Australia and New Zealand. The DIR could eventually even become multidisciplinary, involving other medical fields that use CT imaging, such as radiation oncology, cardiology, and vascular surgery. “Increasing participation by both radiology and other disciplines that use medical imaging benefits the entire healthcare system,” Morin adds.

Please click the map to expand.

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Figure 1 — Current participants in the ACR Dose Index Registry. For a representative list of participating facilities follow the link (http://bit.ly/DIRlist).

Look for detailed explanation of the DIR, including registration information, at http://bit.ly/ACR-DIR.

Facilities interested in joining can also call the NRDR information line at 800-227-5463, extension 3535, or send an email to nrdr@acr.org.

End Notes
