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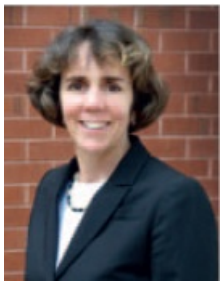
Benchmarking Radiation Dose Indices: The American College of Radiology's Dose Index Registry

Author



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Concerns about the risks of radiation dose have received increasing attention from physicians, patients and the media over recent years. In the USA, initiatives such as Image Wisely® and Image Gently® have set out to guide referring physicians and radiologists to think carefully about the impact of radiation dose on patients. Appropriateness criteria also exist to ensure that imaging exams are carried out only when necessary, based on the best available evidence.

Benchmarking radiation dose is another tool to improve quality and patient care. The American College of Radiology (ACR) launched the Dose Index Registry (DIR) in May 2011. The DIR was established to allow facilities to compare their average dose indices for a given exam to that of other facilities.

To make accurate comparisons, the data that was being collected, especially the name of the exam being compared, had to be standardised. In addition, the data submission process had to be automated, or facilities would not have the time or resources to participate. Having solved these issues, the registry now aims to establish national benchmarks and practice patterns in CT dose indices by collecting and comparing dose index information across facilities.

As at January 2013 there are 619 registered facilities, with 328 of those actively providing data (see Figures 1-4). International facilities are eligible to participate: currently there are 13 facilities registered from outside the USA, with one facility from Canada actively participating.

The DIR is one component of the National Radiology Data Registry (NRDR), which also includes registries/ databases for CT Colonography, General Radiology Improvement, IV Contrast Extravasation, National Oncology PET, National Mammography Database and Quality Improvement Registry for CT Scans in Children.

While there are other countries that monitor dose indices through different mechanisms, the DIR is currently the only dose-related registry that automatically collects data from each CT exam at participating facilities and provides comparison reports.

Registration Process

Participating facilities are required to sign a Participation Agreement, register on the NRDR website, pay a registration fee and an annual participation fee based on the number of radiologists in practice and number of sites.

The technical setup involves downloading the software to transmit data to the registry and configuring the scanner or PACS. Beyond the time for set up (approximately 2-4 weeks) the process is automated, so there is no additional time involved in participating.

Reports

Participating facilities can run reports on their own data at any time via the registry website. Facilities receive benchmark reports every six months comparing their data by body part and exam type to aggregate results (see Figures 5-6). The reports map facility procedure names to standard tags to facilitate meaningful comparisons between facilities.

Reports include include size specific dose estimates (SSDEs). Facilities transmit the localiser image to the DIR and an estimate of patient width

is obtained from the localiser. The patient width is then used to calculate the SSDE. The SSDE is, therefore, a size-adjusted value so it takes into account that some facilities may have a larger-sized patient population than others.
The CT scanner automatically sends the appropriate DICOM SR object to the PC for every CT exam performed on the scanner. TRIAD is the software used to anonymise and transmit data to the registry. An algorithm measures patient thickness from the localiser, calculates the effective diameter and determines the normalised dose conversion factor using effective diameter and phantom size according to the American Association of Physicists in Medicine Task Group 204 methods. Then the conversion factor is applied to CTDIvol to get the SSDE. The current DIR reports include the SSDE for all body exams. Head exams are not size adjusted since the difference in head sizes does not vary as much across patients.
Facilities can select by exam type (e.g. chest exam) and the SSDE value is already adjusted for patient size. For paediatric patients selection by age group is possible.

How it Works

DIR uses standard methods of data collection: DICOM structured reporting and the IHE Radiation Exposure Monitoring Profile (see Figure 7).

DIR has the ability to capture data from new and old scanners: a DICOM structured report is used for new scanners. For older scanners, optical character recognition is used to capture the data from the dose report or dose screen. The dose report is sent directly from the scanner or the PACS to a computer that has the ACRs software installed. This software anonymises the data so that personal identifiers are removed, and sends the data to the DIR.

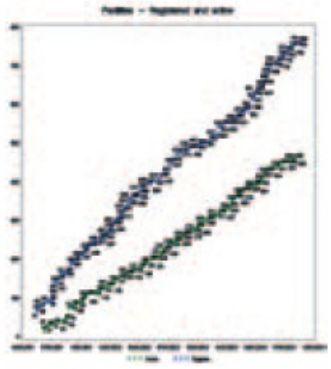

Figure 1.
DIR Registration Tracking

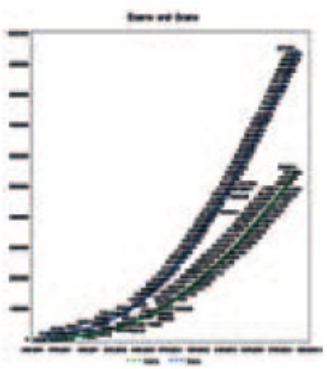

Figure 2.
DIR Tracking

Figure 3.
Map of DIR Facilities

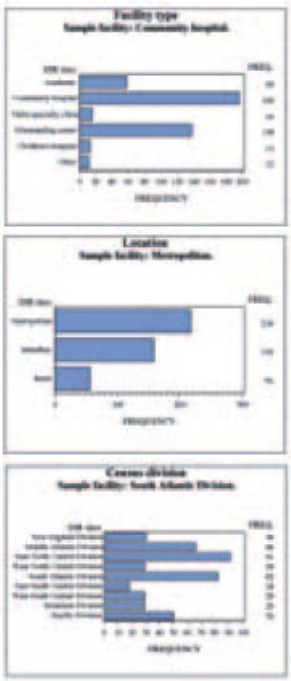

Figure 4.
DIR Facility Characteristics - Spring 2013

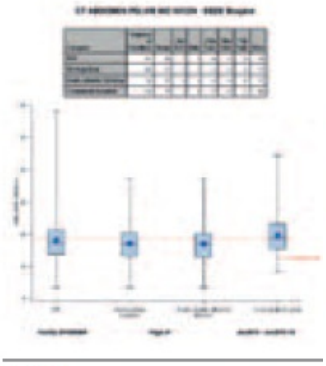

Figure 5.
Screen capture of report showing mean size specific dose estimate for abdominal pelvic CT without IV contrast. The red line shows the facility's median dose compared with medians for DIR as a whole, metropolitan facilities, regional facilities and freestanding centres

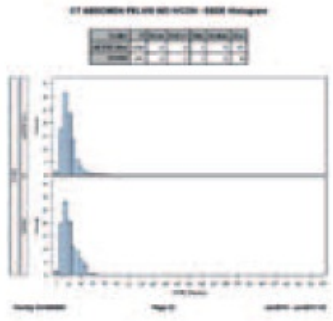

Figure 6.
Screen capture of report on size specific dose estimate (SSDE) for abdominal pelvic CT without IV Contrast. The histogram at the bottom shows the facility's data compared to all DIR sites

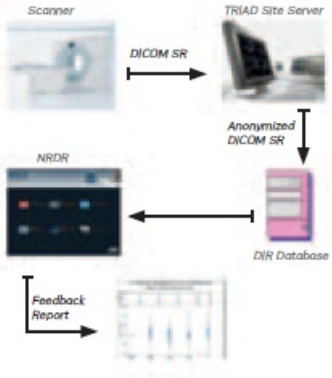

Figure 7.
How does the Dose Index Registry work?

Exam names are mapped to Radlex Playbook. ACR used RadMapps, the web-based procedure mapping, classification and normalization service to map all exam names that were in the registry as of May 2012 (approximately 21,000). New facilities may choose to use RadMapps or the mapping tool on the website. In either case, the exam name at the facility is mapped to a term in the Radlex Playbook.

Challenges

Procedure names are not standardised across facilities. The decision was made to map procedure names to Radlex. However, the wide variation in procedure names was not anticipated. For example, we found over 4,000 different names for head exams across the registry and one facility had over 400 names within its own institutions.

Using the localiser to determine patient width is not perfect, with an estimated error rate of 5-10%. Ideally, a measure of patient width could be made by the scanner while the patient is on the table and automatically recorded into the DICOM structured report or header.

The Future

The goal of the DIR is to collect dose information from every facility that has a CT scanner. In addition , the DIR is expanding to other modalities, with CR/DR coming in late 2013, followed by fluoroscopy. Benchmarks from the DIR are expected to be published this year.

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