Requirements for Reporting Radiation Dose – The ACR Perspective

Richard L. Morin, Ph.D., F.A.C.R.
Brooks - Hollern Professor
Department of Radiology
Mayo Clinic Jacksonville
Outline

• Overview of registries
• Description of ACR Dose Index Registry
• Sample reports
• Plans
Why quality registries?

To empower facilities and physicians to monitor and improve quality, and to do so easily and correctly.
Guiding principle behind registries
Do registries work?

- There is evidence of data-driven improvement in performance from:
  - Medicine in general, outside radiology
  - Recent ACR registries
Evidence on CABG mortality from the Society of Thoracic Surgeons National Adult Cardiac Database

Evidence on CCTA From Michigan Registry

Evidence from ACR registries: Adequacy of Screening CTC Exams
Why a Dose Index Registry?

CT scans contribute 25% of radiation dose in the US.

What is the national average level of radiation administered by imaging facilities for a CT of the head?

WE DON’T KNOW
What is the Dose Index Registry?

A tool to enable facilities to optimize protocols, implement standards and contribute to the development of reference levels.
ACR Dose Index Registry

- Component of the National Radiology Data Registry
- Launched in May 2011
- Collects and compares dose index information across facilities
- Fully automated; Uses standard methods of data collection and processing (DICOM SR, IHE REM Profile, RadLex)
- Establishes national benchmarks and practice patterns in dose indices
DIR supports all aspects of the quality monitoring process

- **Standardization:** Use of
  - industry standards
  - clearly specified data dictionaries
- **Automation:** Data collection from a variety of platforms
  - with minimal effort for facilities
  - high accuracy
- **Feedback and benchmarks:**
  - Easy to understand customizable reports
How does the Dose Index Registry work?
Challenges and Solutions

- **Comparability**
  - Procedure name standardization
  - Patient size adjustment

- **Ability to capture data from new and old scanners**
  - DICOM structured report for new scanners
  - OCR on dose screen for old scanners
Mapping Exam Names

Procedure Name Standardization

• Exam names mapped to Radlex Playbook
  – http://playbook.radlex.org

• ACR used external vendor, RadMapps, to map all exam names currently in the registry
  – ~ 21,000 unique exam names

• New facilities may choose to use third party tool or may use mapping tool on website. Suggested tags are provided if an exam name is already in the database.
### DIR Exam Name Mapping

#### At a Glance:
- Not Tagged: 1
- Tagging In Process: 0
- Tagging Suggested: 0
- Tagging Completed: 2
- RPID Requested: 2
- Invalid Tag: 0
- Guidance: 0

### Search Exam

<table>
<thead>
<tr>
<th>Select</th>
<th>Exams</th>
<th>RPID or Predicate values</th>
<th>Status</th>
<th>Change Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>Cardiac~FLASH_COR_CTA_100KV (Adult)</td>
<td>ANATOMIC_FOCUS:CORONARY ARTERIES BODY_REGION:CHEST</td>
<td>RPID Requested</td>
<td>Mark as Not Tagged</td>
</tr>
<tr>
<td>☐</td>
<td>CT ANGIO CHEST</td>
<td>RPID360 RAD ORDER CT CHST ANGIO W IVCON</td>
<td>Tagging Completed</td>
<td>Mark as Not Tagged</td>
</tr>
<tr>
<td>☐</td>
<td>CT CHEST WITH CONTRAST</td>
<td>BODY_REGION:CHEST CONTRAST_ENHANCEMENT:WITH IV CONTRAST POPULATION:PREGNANT</td>
<td>RPID Requested</td>
<td>Mark as Not Tagged</td>
</tr>
<tr>
<td>☐</td>
<td>DAILY QA</td>
<td>RPID88 RAD ORDER CT</td>
<td>Tagging Completed</td>
<td>Mark as Not Tagged</td>
</tr>
<tr>
<td>☐</td>
<td>TC TX</td>
<td></td>
<td>Not Tagged</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** You can tag the selected exams by:
1) assigning an RPID using the ‘Search RPID’ button or
2) building your own mapping using the ‘Build your own mapping’ button

- [Search RPID](#)
- [Build your own mapping](#)
Size-Specific Dose Estimate (SSDE)

- DIR allows sites to submit localizer images along with Dose Report
- Algorithm developed by Duke physicists will measure patient thickness from localizer
Size Specific Dose Estimate (SSDE)

Patient Size Adjustment

- Measure patient thickness (from AP or lateral image or average of the two)
- Calculate effective diameter
- Determine normalized dose conversion factor using effective diameter and phantom size (AAPM TG204)
- Apply conversion factor to CTDIvol to get SSDE
July 2013: Over 750 facilities, 458 of which are fully active; 4.8 million exams and 8.5 million scans
Representation by a variety of facilities nationwide
Sample feedback report

- Uploaded to registry website every six months
- Available to all facility users
## Executive Summary: Facility 999999

### CTD./vol Per Scan (mGy)

<table>
<thead>
<tr>
<th>RPID Shortname</th>
<th>1: Site 999999</th>
<th>2: All DIR sites</th>
<th>3: Sites in location Metropolitan</th>
<th>4: Sites in the South</th>
<th>5: Sites of type Community hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT ABD</td>
<td>(14/16/21)</td>
<td>(14/17/24)</td>
<td>(12/16/21)</td>
<td>(12/17/22)</td>
<td>(13/17/22)</td>
</tr>
<tr>
<td>CT ABD PELVIS KIDNEY CALC</td>
<td>(10/14/18)</td>
<td>(10/15/19)</td>
<td>(10/14/20)</td>
<td>(10/15/21)</td>
<td>(10/14/20)</td>
</tr>
<tr>
<td>CT ABD PELVIS W IVCON</td>
<td>(10/15/21)</td>
<td>(11/16/22)</td>
<td>(11/16/22)</td>
<td>(11/16/22)</td>
<td>(11/16/22)</td>
</tr>
<tr>
<td>CT ABD PELVIS WO &amp; W IVCO</td>
<td>(11/17/28)</td>
<td>(13/19/25)</td>
<td>(14/19/26)</td>
<td>(14/20/27)</td>
<td>(13/20/26)</td>
</tr>
<tr>
<td>CT ABD PELVIS WO IVCON</td>
<td>(10/15/23)</td>
<td>(10/16/22)</td>
<td>(10/15/21)</td>
<td>(11/17/23)</td>
<td>(11/16/23)</td>
</tr>
<tr>
<td>CT C SPINE WO IVCON</td>
<td>(26/40/69)</td>
<td>(20/30/49)</td>
<td>(21/31/49)</td>
<td>(22/34/52)</td>
<td>(20/31/56)</td>
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<tr>
<td>CT CHST</td>
<td>(13/16/24)</td>
<td>(8/12/16)</td>
<td>(8/11/15)</td>
<td>(9/12/16)</td>
<td>(9/12/17)</td>
</tr>
<tr>
<td>CT CHST ABD PELVIS W IVCO</td>
<td>(12/17/24)</td>
<td>(12/16/22)</td>
<td>(12/15/22)</td>
<td>(13/17/24)</td>
<td>(11/16/22)</td>
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<tr>
<td>CT CHST ANGIO W IVCON</td>
<td>(13/14/18)</td>
<td>(13/18/27)</td>
<td>(13/17/23)</td>
<td>(13/16/24)</td>
<td>(13/17/26)</td>
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<tr>
<td>CT CHST PULM ARTS EMBO W</td>
<td>(17/25/36)</td>
<td>(13/21/33)</td>
<td>(14/22/33)</td>
<td>(14/23/36)</td>
<td>(13/22/35)</td>
</tr>
<tr>
<td>CT CHST W IVCON</td>
<td>(9/14/17)</td>
<td>(9/13/20)</td>
<td>(9/13/19)</td>
<td>(9/13/16)</td>
<td>(10/14/20)</td>
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<tr>
<td>CT HEAD SINUSES WO IVCON</td>
<td>(13/20/36)</td>
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<td>(13/23/44)</td>
<td>(14/19/28)</td>
<td>(14/19/28)</td>
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<tr>
<td>CT L SPINE WO IVCON</td>
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<td>(20/31/45)</td>
<td>(18/27/43)</td>
<td>(22/34/51)</td>
<td>(20/29/43)</td>
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<tr>
<td>CT NECK W IVCON</td>
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<td>(14/20/36)</td>
<td>(14/21/41)</td>
<td>(13/22/48)</td>
<td>(14/19/33)</td>
</tr>
</tbody>
</table>
For each exam, facility data are compared to that of similar facilities.
Facility’s own data available at all times

- Web-based reports
- Displays exam details and comparisons of scanners
## Results of Dose Information by Exam

### Dose Information by Exam Report

**Facility ID** | **Study**                        | **Institution** | **Total CTDivol (mGy)** | **Total DLP (mGy.cm)** | **Study Date**
---|---|---|---|---|---
100001 | Abdomen\^01\_ABD\_PEL\_WO (Adult) | MJH            | 25 | 1966 | 20100618
100001 | Abdomen\^01\_ABD\_PEL\_WO (Adult) | MH CT P        | 14 | 248  | 20100617

*Note: The report can be exported to Excel 97-2000.*
Results of scanner & Exam search
Additional Benefits of DIR to facilities

In addition to size-adjusted standardized comparisons to enable meaningful protocol review, participation in DIR supports quality initiatives.

- Certified as PQI project for ABR MOC
- Supports PQRS measure for 2014 on participation in national dose index registry
- Endorsed by the National Quality Forum
Summary of Data: January-June 2013

To be released mid-August

• 424 facilities to receive feedback reports on adult exams, and 398 on pediatric

• Reports on over 2 million adult CT exams and 1 million pediatric CT exams with standardized names,

• Results reported on exams where SSDE and CTDIvol were available
<table>
<thead>
<tr>
<th>Exam</th>
<th>N</th>
<th>Mean SSDE</th>
<th>Std Dev</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; %ile</th>
<th>25&lt;sup&gt;th&lt;/sup&gt; %ile</th>
<th>Median SSDE</th>
<th>75&lt;sup&gt;th&lt;/sup&gt; %ile</th>
<th>99&lt;sup&gt;th&lt;/sup&gt; %ile</th>
<th>Range</th>
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<tbody>
<tr>
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<td>20</td>
<td>11</td>
<td>6</td>
<td>13</td>
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<td>CT Abdomen/Pelvis With IV Contrast</td>
<td>95,076</td>
<td>19</td>
<td>10</td>
<td>5</td>
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<td>17</td>
<td>23</td>
<td>55</td>
<td>225</td>
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<tr>
<td>CT Chest Without IV Contrast</td>
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<td>14</td>
<td>10</td>
<td>1</td>
<td>8</td>
<td>12</td>
<td>18</td>
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<td>184</td>
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<tr>
<td>CT Chest With IV Contrast</td>
<td>30,136</td>
<td>17</td>
<td>10</td>
<td>3</td>
<td>10</td>
<td>15</td>
<td>21</td>
<td>52</td>
<td>239</td>
</tr>
</tbody>
</table>
Coming soon to DIR

- CR/DR later this year
  - RDSRs
    - Pilot in summer, anticipated launch in Fall
- New report format for online reports
- Identifiable data available to facilities, with transmission of anonymized data to registry
Contact ACR DIR

nrdr@acr.org
X3535

Mythreyi Chatfield, PhD
Debapriya Sengupta, MBBS, MPH
Lu Meyer, MS
Victoria O’Brien, BS