ACR Dose Index Registry: Early Results

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Richard L. Morin, PhD, FACR
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Disclosures

- Chair, ACR Dose Index Registry
- Co-Chair Image Wisely
- AIM Advisory Board
Acknowledgements

• Laura Coombs, PhD
• Mythreyi Chatfield, PhD
Why a Dose Index Registry?

CT scans contribute 25% of radiation

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

- One component of the National Radiology Data Registry
- Collects and compares dose index information across facilities
- Uses standard methods of data collection
  - DICOM SR, IHE REM Profile
- Establishes national benchmarks and practice patterns in dose indices
Facility and physicians submit data

Receive periodic national benchmarking reports

Develop and implement improvement plan

Analyze results

Cyclic, Data-Driven Improvement Process
• Evidence of data-driven improvement in performance from:
  • Medicine in general (outside radiology)
  • CT dose (for CCTA)
  • ACR registries (for recent registries)
Evidence on CABG mortality from the Society of Thoracic Surgeons National Adult Cardiac Database

Evidence on CCTA From Michigan Registry

How does it work?
Registration Process

• Sign Participation Agreement
• Register on NRDR website
• Download software to transmit data
  – We will contact you and walk you through the installation
• Configure scanners (or PACs)
• Data transmission to NRDR is completely automated – no personnel required beyond initial setup
### International Participation

<table>
<thead>
<tr>
<th>Country</th>
<th>Registered</th>
<th>Interested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Spain</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>UK (Ireland)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Canada</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Argentina</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>New Zealand</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Mapping Exam Names

• 1,410 names related to “Head” or “Brain”
• CT Head Without contrast
  – 224 different names from 60 facilities
  – 20,677 exams
• Brain Perfusion
  – 20 different names from 7 facilities
  – 103 exams
Examples of Names

- Head^HEAD_WO (Adult)
- Head^RoutineHead (Adult)
- BRAIN WO CT
- BRAIN CT
- BRAIN NO IV CT
- BRAIN WO CT
- HEAD OR BRAIN W/O C CY
- BRAIN WO CT HEAD WITHOUT CNTRST
- HEAD WITHOUT
• BRAIN
• BRAIN W/O IVC
• BRAIN W/OUT
• BRAIN W/WO
• BRAIN W/WOUT
• BRAIN/W/O
• BRAIN/WO CC CT
• BRAIN W/O CT SCAN
• HEAD W O CONTR
• BRAIN WITHOUT
• CT SCAIN BRAIN
• CT SCAN BRAIN
• CT SCAN BRAIN WITHOUT
• HEAD CT
• HEAD/ BRAIN C-
• HEAD C- CT
• HEAD NO CONTRAST
• CT HEAD NW CONTRAST
• CT HEAD WO CONT
## Summary of Dose Indices

<table>
<thead>
<tr>
<th>Exam</th>
<th>N</th>
<th>Mean</th>
<th>Med</th>
<th>Std Dev</th>
<th>Coeff of Var</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT HEAD WITHOUT IV CONTRAST</td>
<td>20,677</td>
<td>72</td>
<td>60</td>
<td>36</td>
<td>50</td>
<td>2.7</td>
<td>702</td>
</tr>
<tr>
<td>CT HEAD PERFUSION</td>
<td>103</td>
<td>525</td>
<td>184</td>
<td>732</td>
<td>139</td>
<td>34.3</td>
<td>2860</td>
</tr>
<tr>
<td>Examination</td>
<td>Pass/Fail Criteria CTDI\textsubscript{vol} (mGy)</td>
<td>Reference Levels CTDI\textsubscript{vol} (mGy)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------------------------------</td>
<td>----------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult Head</td>
<td>80</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult Abdomen</td>
<td>30</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pediatric Abdomen (5 year old)</td>
<td>25</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Outlier

<table>
<thead>
<tr>
<th>CT Head Scan wo Contrast</th>
<th>Mean CTDIvol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scan 1</td>
<td>59</td>
</tr>
<tr>
<td>Scan 2</td>
<td>546</td>
</tr>
<tr>
<td>Scan 3</td>
<td>37</td>
</tr>
<tr>
<td>Scan 4</td>
<td>60</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>702</strong></td>
</tr>
</tbody>
</table>
DIR Facility Characteristics
Fall 2011

Facility type
Sample Facility: Academic/Other.

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIR sites</td>
<td>13</td>
</tr>
<tr>
<td>Academic/Other</td>
<td>11</td>
</tr>
<tr>
<td>Community hospital-based</td>
<td>5</td>
</tr>
<tr>
<td>Multi-specialty clinic</td>
<td>2</td>
</tr>
<tr>
<td>Freestanding center</td>
<td>31</td>
</tr>
</tbody>
</table>

Location
Sample Facility: Metropolitan.

<table>
<thead>
<tr>
<th>Location</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIR sites</td>
<td>26</td>
</tr>
<tr>
<td>Metropolitan</td>
<td>30</td>
</tr>
<tr>
<td>Suburban</td>
<td>30</td>
</tr>
<tr>
<td>Rural</td>
<td>4</td>
</tr>
</tbody>
</table>

Census region
Sample Facility: Northeast.

<table>
<thead>
<tr>
<th>Region</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast</td>
<td>16</td>
</tr>
<tr>
<td>Midwest</td>
<td>14</td>
</tr>
<tr>
<td>South</td>
<td>18</td>
</tr>
<tr>
<td>West</td>
<td>12</td>
</tr>
</tbody>
</table>

FREQ
CT HEAD WITHOUT IV CONTRAST
Per Exam

Distribution of TotalCTDIvol

- For all patients:
  - N: 20877
  - Median: 60
  - Mean: 72
  - Std Dev: 38

- For Facility ID = 1:
  - N: 22
  - Median: 61
  - Mean: 66
  - Std Dev: 16

- For Facility ID = 999999:
  - N: 20855
  - Median: 60
  - Mean: 72
  - Std Dev: 38

TotalCTDIvol range from 10 to 690.
CT HEAD PERFUSION
CTDIvol (mGy) per Exam

<table>
<thead>
<tr>
<th></th>
<th>Facility</th>
<th>Location</th>
<th>Type</th>
<th>Region</th>
<th>DIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Median</td>
<td>439</td>
<td>368</td>
<td>598</td>
<td>411</td>
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<tr>
<td>Mean</td>
<td>626</td>
<td>597</td>
<td>598</td>
<td>579</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td>140</td>
<td>140</td>
<td>598</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>1816</td>
<td>1816</td>
<td>598</td>
<td>1816</td>
<td></td>
</tr>
</tbody>
</table>
Summary

• Average is used to summarize “typical” value at the facility and is compared using box-plots
• Outlier records at your facility can be identified using the overall distribution chart
• Look at your own facility’s data periodically
• Examine protocol names before exploring the protocols
Conclusions

- New facilities every week
- Exam name standardization is needed
- Reference levels are coming
- Adjustment for patient size is coming
For more information please contact:

Laura Coombs, PhD  
lcoombs@acr.org  
(703) 715-4383

or

Mythreyi Chatfield, PhD  
mchatfield@acr.org  
(703) 715-4394