

# Dose Index Registry Pilot Project for Comparing CT Dose Across Facilities

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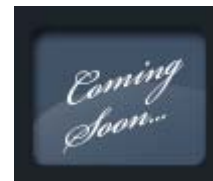
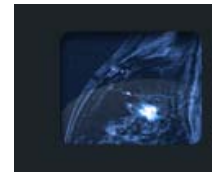
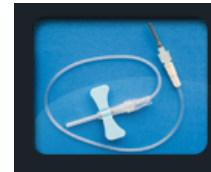
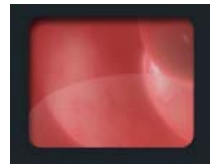
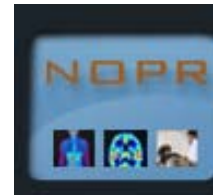
# National Radiology Data Registry (NRDR)

- Purpose of NRDR is to enhance radiology practices, the specialty of radiology, and the care patients receive by providing accurate and objective measures of practice processes and outcomes.
- Unified mechanism for data collection, storage, management and reporting related to specific radiology procedures and practices.
- NRDR is a data warehouse – a database of databases
  - Each registry functions independently
  - Allows information to be shared across registries
  - Leverages the technology



# NRDR Registries

- NOPR (National Oncological PET Registry)
- CTC (CT Colonography Registry)
- GRID (General Radiology Improvement Database)
- ICE (Intravenous Contrast Extravasation)
- NMD (National Mammography Database)
- Dose Index Registry (DIR) – in pilot phase



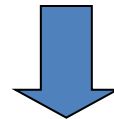
## What is the Dose Index Registry?

- Registry to collect and compare dose index information across facilities
- Uses standard methods of data collection
- Establishes national benchmarks and practice patterns in dose indices

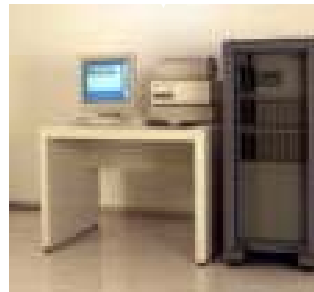
# Proof of Concept

- Proof of Concept project at 2 sites during 2005-2006:
  - Mayo Clinic – Jacksonville
  - Medical University of South Carolina
- Collected dose information for CR/DR

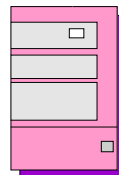
# ACR Dose Index Registry



**Image**



**Data Elements extracted from DICOM Header**



**Records entered into the ACR DIR**

**DOSE INDEX REGISTRY PILOT PROJECT  
DATA ELEMENTS**

| <b>DI Registry Field</b>                  | <b>DICOM header tag</b> |
|---|-------------------------|
| SOP Instance UID                          | (0008,0018)             |
| Study Date                                | (0008,0020)             |
| Acquisition Date                          | (0008,022)              |
| Study Time                                | (0008,0030)             |
| Modality                                  | (0008,0060)             |
| Manufacturer                              | (0008,0070)             |
| Institution Name                          | (0008,0080)             |
| Institution Address                       | (0008,0081)             |
| Station Name                              | (0008,1010)             |
| Study Description                         | (0008,1030)             |
| Series Description                        | (0008,103e)             |
| Manufacturer's Model Name                 | (0008,1090)             |
| Patient's Sex                             | (0010,0040)             |
| Patient's Age                             | (0010,1010)             |
| Body Part Examined                        | (0018,0015)             |
| kVp                                       | (0018,0060)             |
| Software Version(s)                       | (0018,1020)             |
| Exposure Time                             | (0018,1150)             |
| X-ray Tube Current                        | (0018,1151)             |
| Acquisition Device Processing Description | (0018,1400)             |



**DOSE INDEX REGISTRY PILOT PROJECT  
DATA ELEMENTS**

| <b>DI Registry Field</b>             | <b>DICOM header tag</b> |
|--------------------------------------|-------------------------|
| Relative X-ray Exposure              | (0018,1405)             |
| Filter Material                      | (0018,7050)             |
| Exposure Control Mode                | (0018,7060)             |
| Study Instance UID                   | (0020,000d)             |
| Series Instance                      | (0020,000e)             |
| Series Number                        | (0020,0011)             |
| Image Number                         | (0020,0013)             |
| Requested Procedure Description      | (0032,1060)             |
| Scheduled Procedure Step Description | (0040,0007)             |
| mAs/ref, CTDIvol, DLP                | (0029, xxxx)            |

## Dose Index Registry Pilot

- ACR installs software on a free-standing PC at a facility
- The facility signs a Participation Agreement
- Siemens patch is installed on the scanners (Sensation 64 or Definition).
- Technologist trained to push the appropriate image to the server
- ACR software extracts the appropriate DICOM header information from the CT image and transfers the data to the ACR.

## Issues with the Pilot

- Participation Agreement/IRB approval
- Installation of special software
- Installation of Siemens patch
- Cooperation among Siemens-Germany, local Siemens, ACR and facility
- Non-standard naming conventions of study descriptions

## Example of Non-standard naming conventions

**Pelvis** CT PELVIS W/IVC  
CT PELVIS W/O CONTRAST-MUSC  
CT PELVIS WITH CONTRAST-BODY  
Pelvis^01\_0\_Acetabular\_Fracture (Adult)  
Pelvis^01\_ORTHO\_PELVIS (Adult)  
Pelvis^01\_SINGLECUT\_HIP (Child)  
Pelvis^11\_0\_Pelvis\_3D (Adult)  
Pelvis^1PELVIS\_ROUTINE (Adult)  
Pelvis^1\_HIP (Adult)  
Pelvis^HIP\_WITH (Adult)  
Pelvis^HIP\_WO (Adult)  
Pelvis^Hip (Adult)  
Pelvis^PelvisRoutine (Adult)

## Four Methods

- CTDIvol – per scan
- CTDIvol sum – per exam (sum across scans)
- DLP – per scan
- DLP sum – per exam (sum across scans)
- Example:

| ID          | Date              | Study Description            | Entry Name    | CTDIvol    | DLP         |
|-------------|-------------------|------------------------------|---------------|------------|-------------|
| 9999        | 2009-05-17        | Abdomen^6_EXU (Adult)        | PRE           | 19         | 849         |
| 9999        | 2009-05-17        | Abdomen^6_EXU (Adult)        | PreMonitoring | 12         | 12          |
| 9999        | 2009-05-17        | Abdomen^6_EXU (Adult)        | Monitoring    | 61         | 58          |
| 9999        | 2009-05-17        | Abdomen^6_EXU (Adult)        | CTA           | 18         | 522         |
| 9999        | 2009-05-17        | Abdomen^6_EXU (Adult)        | 55 SEC        | 19         | 858         |
| 9999        | 2009-05-17        | Abdomen^6_EXU (Adult)        | 9 MIN         | 20         | 897         |
| <b>9999</b> | <b>2009-05-17</b> | <b>Abdomen^6_EXU (Adult)</b> |               | <b>149</b> | <b>3196</b> |

# CT of the Head

| Head        |      | CTDIvol Sum per Exam |         |     |      | DLP Sum per Exam |         |     |       |
|-------------|------|----------------------|---------|-----|------|------------------|---------|-----|-------|
| Institution | N    | Avg CTDI vol         | Std Dev | Min | Max  | Avg DLP          | Std Dev | Min | Max   |
| Total       | 1830 | 83                   | 52      | 12  | 1239 | 1196             | 429     | 131 | 11946 |
| A           | 965  | 94                   | 65      | 36  | 1239 | 1250             | 530     | 515 | 11946 |
| B           | 633  | 73                   | 25      | 17  | 510  | 1172             | 236     | 131 | 2794  |
| C           | 108  | 66                   | 20      | 12  | 141  | 1053             | 236     | 150 | 2040  |
| D           | 45   | 79                   | 35      | 28  | 214  | 1120             | 470     | 398 | 3184  |
| E           | 50   | 67                   | 13      | 65  | 129  | 1000             | 83      | 841 | 1294  |
| F           | 29   | 49                   | 23      | 38  | 165  | 926              | 407     | 647 | 2890  |

| Head        |      | CTDIvol per Scan |         |     |     | DLP per Scan |         |     |      |
|-------------|------|------------------|---------|-----|-----|--------------|---------|-----|------|
| Institution | N    | Avg CTDI vol     | Std Dev | Min | Max | Avg DLP      | Std Dev | Min | Max  |
| Total       | 2256 | 67               | 22      | 7   | 643 | 970          | 316     | 8   | 3127 |
| A           | 1307 | 69               | 25      | 8   | 643 | 923          | 347     | 8   | 3127 |
| B           | 680  | 68               | 14      | 17  | 358 | 1091         | 235     | 26  | 1563 |
| C           | 126  | 57               | 12      | 7   | 81  | 902          | 231     | 142 | 1193 |
| D           | 56   | 64               | 16      | 19  | 74  | 900          | 334     | 101 | 1239 |
| E           | 52   | 65               | 0       | 65  | 65  | 961          | 156     | 162 | 1165 |
| F           | 35   | 40               | 9       | 7   | 53  | 768          | 170     | 171 | 1051 |

| Head  |      | CTDIvol Sum per Exam |         |     |      | DLP Sum per Exam |         |     |       |
|-------|------|----------------------|---------|-----|------|------------------|---------|-----|-------|
| Age   | N    | Avg CTDIvol          | Std Dev | Min | Max  | Avg DLP          | Std Dev | Min | Max   |
| Total | 1830 | 83                   | 52      | 12  | 1239 | 1196             | 429     | 131 | 11946 |
| 0-9   | 26   | 45                   | 28      | 17  | 139  | 666              | 490     | 131 | 2428  |
| 10-19 | 67   | 74                   | 23      | 29  | 139  | 1130             | 272     | 416 | 2285  |
| 20-29 | 132  | 75                   | 26      | 41  | 208  | 1117             | 156     | 813 | 2040  |
| 30-39 | 149  | 74                   | 20      | 40  | 179  | 1139             | 216     | 799 | 2794  |
| 40-49 | 185  | 88                   | 68      | 38  | 772  | 1261             | 510     | 755 | 5103  |
| 50-59 | 236  | 87                   | 94      | 39  | 1239 | 1218             | 485     | 675 | 6623  |
| 60-69 | 309  | 86                   | 42      | 38  | 512  | 1243             | 677     | 647 | 11946 |

| Head  |      | CTDIvol per Scan |         |     |     | DLP per Scan |         |     |      |
|-------|------|------------------|---------|-----|-----|--------------|---------|-----|------|
| Age   | N    | Avg CTDIvol      | Std Dev | Min | Max | Avg DLP      | Std Dev | Min | Max  |
| Total | 2256 | 67               | 22      | 7   | 643 | 970          | 316     | 8   | 3127 |
| 0-9   | 32   | 37               | 17      | 17  | 69  | 541          | 349     | 83  | 1249 |
| 10-19 | 77   | 64               | 11      | 29  | 71  | 983          | 300     | 101 | 1373 |
| 20-29 | 146  | 68               | 4       | 41  | 85  | 1010         | 255     | 104 | 1360 |
| 30-39 | 163  | 67               | 6       | 28  | 74  | 1041         | 238     | 26  | 1563 |
| 40-49 | 237  | 69               | 28      | 17  | 434 | 984          | 295     | 16  | 1499 |
| 50-59 | 291  | 71               | 47      | 12  | 643 | 988          | 303     | 16  | 1851 |
| 60-69 | 394  | 67               | 9       | 12  | 162 | 975          | 348     | 12  | 3127 |
| 70+   | 916  | 67               | 12      | 7   | 358 | 954          | 320     | 8   | 1555 |

# CT of the Abdomen

| Abdomen     |      | CTDIvol Sum per Exam |         |     |     | DLP Sum per Exam |         |     |      |
|-------------|------|----------------------|---------|-----|-----|------------------|---------|-----|------|
| Institution | N    | Avg CTDI vol         | Std Dev | Min | Max | Avg DLP          | Std Dev | Min | Max  |
| Total       | 1829 | 26                   | 22      | 1   | 293 | 1079             | 643     | 45  | 7433 |
| A           | 938  | 28                   | 20      | 5   | 293 | 1196             | 636     | 227 | 5159 |
| B           | 505  | 16                   | 11      | 1   | 189 | 787              | 368     | 45  | 2866 |
| C           | 85   | 33                   | 31      | 8   | 200 | 982              | 675     | 263 | 5512 |
| D           | 119  | 40                   | 26      | 8   | 179 | 1605             | 1060    | 232 | 7433 |
| E           | 164  | 32                   | 35      | 7   | 245 | 989              | 508     | 252 | 2851 |
| F           | 18   | 29                   | 22      | 8   | 87  | 948              | 459     | 345 | 2159 |

| Abdomen     |      | CTDIvol per Scan |         |     |     | DLP per Scan |         |     |      |
|-------------|------|------------------|---------|-----|-----|--------------|---------|-----|------|
| Institution | N    | Avg CTDI vol     | Std Dev | Min | Max | Avg DLP      | Std Dev | Min | Max  |
| Total       | 2581 | 18               | 10      | 1   | 182 | 765          | 418     | 1   | 4272 |
| A           | 1288 | 20               | 8       | 5   | 170 | 871          | 400     | 5   | 2607 |
| B           | 561  | 14               | 6       | 1   | 85  | 708          | 306     | 41  | 1964 |
| C           | 168  | 17               | 14      | 1   | 101 | 497          | 441     | 1   | 2472 |
| D           | 227  | 21               | 10      | 6   | 64  | 842          | 546     | 6   | 4272 |
| E           | 298  | 17               | 17      | 6   | 182 | 544          | 371     | 12  | 2438 |
| F           | 39   | 13               | 8       | 3   | 46  | 437          | 324     | 3   | 1125 |



| Abdomen |      | CTDIvol Sum per Exam |         |     |     | DLP Sum per Exam |         |     |      |
|---------|------|----------------------|---------|-----|-----|------------------|---------|-----|------|
| Age     | N    | Avg CTDIvol          | Std Dev | Min | Max | Avg DLP          | Std Dev | Min | Max  |
| Total   | 1829 | 26                   | 22      | 1   | 293 | 1079             | 643     | 45  | 7433 |
| 0-9     | 9    | 8                    | 6       | 1   | 21  | 225              | 131     | 45  | 442  |
| 10-19   | 38   | 15                   | 6       | 6   | 28  | 721              | 324     | 258 | 1405 |
| 20-29   | 155  | 21                   | 17      | 4   | 127 | 893              | 554     | 208 | 4460 |
| 30-39   | 196  | 23                   | 13      | 4   | 82  | 1020             | 466     | 194 | 3455 |
| 40-49   | 280  | 25                   | 20      | 5   | 179 | 1065             | 696     | 242 | 7433 |
| 50-59   | 339  | 30                   | 29      | 6   | 293 | 1173             | 690     | 263 | 5512 |
| 60-69   | 337  | 28                   | 25      | 5   | 245 | 1195             | 701     | 237 | 4820 |
| 70+     | 475  | 26                   | 21      | 5   | 189 | 1067             | 609     | 227 | 5159 |

| Abdomen |      | CTDIvol per Scan |         |     |     | DLP per Scan |         |     |      |
|---------|------|------------------|---------|-----|-----|--------------|---------|-----|------|
| Age     | N    | Avg CTDIvol      | Std Dev | Min | Max | Avg DLP      | Std Dev | Min | Max  |
| Total   | 2581 | 18               | 10      | 1   | 182 | 765          | 418     | 1   | 4272 |
| 0-9     | 12   | 6                | 3       | 1   | 12  | 169          | 100     | 45  | 359  |
| 10-19   | 44   | 13               | 5       | 6   | 25  | 623          | 284     | 152 | 1405 |
| 20-29   | 195  | 16               | 7       | 2   | 44  | 710          | 392     | 2   | 2312 |
| 30-39   | 263  | 17               | 6       | 2   | 42  | 760          | 388     | 2   | 2162 |
| 40-49   | 382  | 18               | 9       | 2   | 73  | 781          | 463     | 2   | 4272 |
| 50-59   | 502  | 20               | 13      | 2   | 170 | 792          | 454     | 2   | 2526 |
| 60-69   | 496  | 19               | 11      | 1   | 182 | 812          | 431     | 1   | 2594 |
| 70+     | 687  | 18               | 8       | 2   | 101 | 738          | 369     | 2   | 2370 |

## Where do we go from here?

- Open up to all vendors
- IHE Radiation Exposure Monitoring Profile
- DICOM SR Supplement 127
- Recruit sites to participate