Update on Diagnostic Reference Levels
February 28, 2013
NCHPS Spring Meeting
Carolina Beach

Laura Pring, BA RT(R)(M)(QM)(BD),RRPT
Nationwide Evaluation of X-ray Trends
American College of Radiology
RAD-IR Study (Miller, et al.)
Society of Nuclear Medicine, NCRP 2008, 2010 Surveys

NCRP REPORT No. 172
Reference Levels and Achievable Doses in Medical and Dental Imaging: Recommendations for the United States
September 30, 2012
Diagnostic reference levels (DRLs), which are a form of investigation levels (ICRP, 1996), represent an important tool to optimize image quality and the radiation dose delivered to patients.

Diagnostic reference levels and achievable doses are dynamic values changing over time and with changes in technology.
Diagnostic Reference Levels (DRL)

DRLs are suggested action levels above which a facility should review its methods and determine if acceptable image quality can be achieved at lower doses. (Optimization)

Investigational level to identify unusually high radiation doses for common diagnostic medical X-ray imaging procedures.

ACR-AAPM PRACTICE GUIDELINE FOR DIAGNOSTIC REFERENCE LEVELS IN MEDICAL X-RAY IMAGING
DRLs have been set at approximately the 75th percentile of measured patient or phantom data.

This means that the procedures performed at 75% of the institutions surveyed have exposure levels at or below the DRL.
ACR PRACTICE GUIDELINE FOR DIAGNOSTIC REFERENCE LEVELS IN MEDICAL X-RAY IMAGING
Achievable Dose (AD)

Achievable doses represent the median (50th percentile) of the dose distribution.

50 % of the facilities are operating below this level already.

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# Diagnostic Reference Levels and Achievable Dose for Adult and Pediatric X-Ray Exams

*(incident air kerma, free in air)*

<table>
<thead>
<tr>
<th>Projection</th>
<th>DRL (mGy)</th>
<th>AD (mGy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult PA Chest (grid)</td>
<td>0.15</td>
<td>0.11</td>
</tr>
<tr>
<td>Pediatric PA Chest (grid)</td>
<td>0.12</td>
<td>0.07</td>
</tr>
<tr>
<td>Adult AP Abdomen</td>
<td>3.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Adult AP Lumbar Spine</td>
<td>4.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Dental Bitewing</td>
<td>1.6</td>
<td>1.2</td>
</tr>
</tbody>
</table>
## Diagnostic Reference Levels and Achievable Dose for Under Table Adult Fluoroscopic Imaging

<table>
<thead>
<tr>
<th>Phantom: Adult PA Abdomen w/grid</th>
<th>DRL</th>
<th>AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper GI fluoroscopy, w/o oral contrast media</td>
<td>56 mGy/min</td>
<td>40 mGy/min</td>
</tr>
<tr>
<td>Upper GI fluoroscopy, with oral contrast media</td>
<td>81 mGy/min</td>
<td>72 mGy/min</td>
</tr>
<tr>
<td>Fluoroscopic image, w/o contrast Film</td>
<td>3.9 mGy</td>
<td>2.5 mGy</td>
</tr>
<tr>
<td>Fluoroscopic image, w/o contrast Digital</td>
<td>1.5 mGy</td>
<td>0.9 mGy</td>
</tr>
<tr>
<td>Fluoroscopic image, with contrast Film</td>
<td>27.5 mGy</td>
<td>18.7 mGy</td>
</tr>
<tr>
<td>Fluoroscopic image, with contrast Digital</td>
<td>9.9 mGy</td>
<td>5.3 mGy</td>
</tr>
</tbody>
</table>
## Diagnostic Reference Levels and Achievable Doses for Adult and Pediatric CT (CTDIVERI)

<table>
<thead>
<tr>
<th>Exam</th>
<th>DRL (mGy)</th>
<th>AD (mGy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Head</td>
<td>75</td>
<td>57</td>
</tr>
<tr>
<td>Adult Abdomen</td>
<td>25</td>
<td>17</td>
</tr>
<tr>
<td>Adult Chest</td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td>Pediatric 5 y old head</td>
<td>40</td>
<td>31</td>
</tr>
<tr>
<td>Pediatric 5 y old abdomen-pelvis</td>
<td>20</td>
<td>14</td>
</tr>
</tbody>
</table>
Problems Identified during NC Inspections

- Training
- Equipment
Training

- **Training Issues**
  - Non-registered and untrained operators
  - No local review of protocols and technical settings
  - Operators modify protocols / techniques without approval
  - Exposure Indices not evaluated - Dose creep
  - Installers not up to date on current DRLs
Equipment

**Equipment Issues**

- PM / calibration schedules not followed
- AEC detector malfunction
- CT protocols not password protected
- Technique charts inadequate
- Film to digital imaging system conversion without adjustments
- Film and cassettes improperly matched
- Facilities using archaic imaging systems (slow speed receptors)
DRL’s Going Forward

- Focus High Dose Exams (FGI and CT)
- Facility DRL INFO
Dose Registries

DRLs and ADs

Patient Doses

As Low As Clinically Justifiable
Questions?