Analyzing Consistency in Physician Performance in Cardiac Fluoroscopic Procedures within Six Facilities Using Outlier Analyses

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Introduction

- NCRP Statement 11 recommends
  - “quality assurance program that incorporates quality improvement and provides ongoing feedback…”
- NCRP 168 and TJC suggest/require review of procedures with dose values above thresholds
  - Reviews emphasize identifying radiation tissue injuries due to individual procedures
- Sources of variability in fluoroscopic procedure doses
  - Procedure difficulty
  - Equipment
  - Patient size
  - Performing Physician

Purpose

- Provide greater context for procedure review within facilities
- Identify causes for higher radiation dose studies
- Create action items to remediate
Methods

• Six Different Radiology Facilities

• Collected twelve months of fluoroscopic procedure data for each facility
  • Data collected using two dose monitoring software products
    • Landauer OPTIMIZE (Fluke Health Solution, Glenwood, IL)
    • Radimetrics (Bayer HealthCare, Leverkusen, Germany)
  • Facility, scanner model, performing physician, study description, and reference point dose (RPD)

• Identified the most frequently performed cardiac procedure and scanner model per facility
  • Calculated RPD means ($\mu$) and standard deviations ($\sigma$) for each facility
  • Defined facility outlier: Procedures with $\text{RPD} > \mu + 3\sigma$

• Calculated the percent of total procedures that were outliers
  • For each facility
  • For each facility’s physicians

• Calculated cumulative percentage values for total exams and outliers
  • Sorted by Performing Physicians’ outlier percentage
Results

- Facility outlier percentage ranged from 1.5-2.7%
  - Determined an individual physician achievable target for percent of outliers > 3%
- Considered Physicians with > 10 procedures
  - Individual physician outlier percentage values ranged from 0% to 16.7%
  - Physicians with outlier percentage exceeding the achievable target identified for Quality Review (QR)
Results (continued)

- The number of studies and outliers performed by physicians marked for quality review were compared to facility totals.
- In five of six facilities, physicians marked for QR accounted for
  - > 65% of facility outliers
  - < 42% of the total facility procedures

<table>
<thead>
<tr>
<th>Facility</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Description</td>
<td>Left Heart Cath</td>
<td>CARD</td>
<td>Cardiac Cath</td>
<td>Diagnostic Cath</td>
<td>CL CATH LAB</td>
<td>LHC/POSS</td>
<td>N/A</td>
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<tr>
<td>Number of Studies</td>
<td>377</td>
<td>346</td>
<td>1572</td>
<td>905</td>
<td>913</td>
<td>456</td>
<td>4569</td>
</tr>
<tr>
<td>Number of Outliers</td>
<td>10</td>
<td>8</td>
<td>24</td>
<td>22</td>
<td>20</td>
<td>8</td>
<td>92</td>
</tr>
<tr>
<td>Facility Outlier %</td>
<td>2.7%</td>
<td>2.3%</td>
<td>1.5%</td>
<td>2.4%</td>
<td>2.2%</td>
<td>1.8%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Physicians marked for Quality Review (QR) (Physician's Individual Outlier % &gt; 3%)</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>% of Studies performed by Physicians marked for QR</td>
<td>40%</td>
<td>39%</td>
<td>10%</td>
<td>42%</td>
<td>18%</td>
<td>37%</td>
<td>29%</td>
</tr>
<tr>
<td>% of Outliers performed by Physicians marked for QR</td>
<td>90%</td>
<td>88%</td>
<td>42%</td>
<td>82%</td>
<td>65%</td>
<td>100%</td>
<td>72%</td>
</tr>
</tbody>
</table>
Results (continued)

• Sorted physicians from highest to lowest percentage of outliers (per facility)
• Calculated cumulative percentages of exams and outliers
  • Among ALL performing physicians
    • 17% of physicians were responsible for 100% of outliers
    • These physicians performed up to 67% of procedures
  • Among performing physicians with > 10 procedures
    • 58% of physicians were responsible for 100% of outliers
    • These physicians performed up to 65% of procedures
Discussion

• High dose outliers are performed by a disproportionately smaller group of physicians

• The data analyzed are sufficient to give valuable (targeted) physician feedback to improve fluoroscopy patient doses

• Use of these data in a quality improvement context can lower clinical radiation doses resulting in fewer adverse radiation effects (e.g. soft tissue damage)

• This approach identifies physicians who may benefit from shared education from those physicians identified as less prone to having high dose procedures
Limitations

- This study presumed physicians using the same study description and system are performing similar procedures
- Experienced physicians may perform more difficult procedures
- Differences in clinical outcomes associated with differences in patient dose were not considered
- Dose Distributions may be non-normal
  - Alternate definitions for outliers may be superior (e.g. quartile-based)
Thank You!