Various organizations have announced changes intended to encourage providers to better manage patient fluoroscopy dose.

**TX**

**AAPM**
E and k must be recorded and all data parameters of a procedure for which a peak skin dose of 100 mR or greater is measured must be reported.

**TJC**
Joint Commission Fluoroscopy Pre-publication Requirements
Effective Jan 1, 2019: Hospital, Critical Access Hospital, Ambulatory Health Care, Office-based Surgery

*individuals (including physicians, nonphysicians, and ancillary personnel who use fluoroscopic equipment)* participate in ongoing education that includes annual training.* *(EC.02.04.03, 34)*

*cumulative air kerma or kerma-area product are documented in a retrievable format* *(PC.01.02.15, 13)*

*organization identifies radiation exposure and skin dose threshold levels, that if exceeded, trigger further review and/or patient evaluation to assess for adverse radiation effects.* *(PC.02.01.01, 30)*

*reviews and analyzes instances where the radiation exposure and skin dose threshold levels identified by the organization are exceeded* *(PI.02.01.01, 20)*

https://www.jointcommission.org/standards_information/prepublication_standards.aspx

Key components for success

Project and Change Management  Right Technology
What is your vision?

Vision and strategy are important, but vision comes first.

Where to Start?
Sources of Variability, Fluoroscopically Guided Interventional Procedures

You don't have to boil the ocean!
Consider framing your goals in terms of health outcomes.

A common framework for health outcomes is "The Triple Aim".

Outcomes:
- Better care for individuals
- Better health for populations
- Lower per capita cost

Example outcomes associated with "Experience of Care":

<table>
<thead>
<tr>
<th>General Aim or Desired Outcome</th>
<th>Potential Dose Management Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective</td>
<td>Identify high risk patients more accurately, earlier; location of skin damage.</td>
</tr>
<tr>
<td>Efficient</td>
<td>Decreased effort to manage patient dose.</td>
</tr>
<tr>
<td>Timely</td>
<td>Faster identification of high risk patients and estimation of peak skin dose.</td>
</tr>
<tr>
<td>Safe</td>
<td>Drive dose optimization and safe practices.</td>
</tr>
<tr>
<td>Equitable</td>
<td>Access to medical physics expertise regardless of facility size or location.</td>
</tr>
<tr>
<td>Patient Centric</td>
<td>Tracking of radiosensitive patients; cumulative dose history to identify potential EFI distributions.</td>
</tr>
</tbody>
</table>

Example DoseWatch:

- Tracking Management of Outliers
- Continuous Improvement
Tracking
Collection of dose indices in a retrievable format

Tracking
Collection of detailed information for further investigation

Run specific data: frame rate, mode, angulation, table position, etc.

Data collection considerations

Equipment Age and Licensing
- Can my imaging system send dose information?
  Is there a fee?
- Can it only send to one location?

Data Type
- How complete is it?
  MPPS = Proprietary vs RDSR

Does it need to go anywhere else?
- Registry: Do I need to map study description?
- RIS, EDM
Management of Outliers
Setting of Thresholds

- Study Dose
- Create / Import / Export DRLs
- Site – Specific Thresholds
- Device
- Patient Age
- Patient Weight

Management of Outliers
Setting of Thresholds – Cumulative Dose

- User Interface
  - Customizable distribution list
  - Site specific
  - Customizable Content
    - Metric
    - Thresholds
    - Referring Physician

Management of Outliers
Notifications

- Email
- Listing of exams and alert status
- Listing of reviewed and unreviewed alerts
  - Patient Watchlist (based on cumulative air kerma)
Management of Outliers
Review and Documentation

Codes and Comments
Audit Trail

Management of Outliers
Detailed Assessment – Incidence Map (Angulation)

Management of Outliers
Detailed Assessment – 4D Skin Dose Map
Continuous Improvement

Analytics & Reporting

Purpose

Operational Visibility
- Devices
- Personnel
- Technique
- Review of Outliers

Visibility to high risk cases
Benchmarking

Practical Case

Event Information
Identify Significant Radiation Dose Level Incidents

Exam Cumulative Air Kerma

Mode | AK (mGy) | # Events
---|---|---
Fluoro | 2357 | 128
Record | 3572 | 36
Total | 6929 | 164

164 Exposure Events
51167 frames at 30 fps

Other Available Data
- DAP, FT, Table Height, Table lateral position, SID, kV, mA, patient weight, etc.
Evolution of Imaging Technique

Frame Rate

Number of Frames by Frame Rate

Physician Performance (*Real names removed)

<table>
<thead>
<tr>
<th>Performing Physician</th>
<th>Exams</th>
<th>3-5 Gy</th>
<th>&gt;5 Gy</th>
<th>% 3-5 Gy</th>
<th>% &gt;5 Gy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeff Limoff</td>
<td>1</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Carl Kwon</td>
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<td>Corbin Gaye</td>
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<tr>
<td>Jeremy Kell</td>
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<tr>
<td>Laronne Dowse</td>
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<td>2</td>
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<td>4.4%</td>
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<tr>
<td>Freeman Laverman</td>
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<tr>
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<td>2</td>
<td>0</td>
<td>11.8%</td>
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<tr>
<td>Brigitte Druff</td>
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<td>2</td>
<td>0</td>
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<tr>
<td>See Weiss</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Key Learnings

Many sites have challenges creating change in the organization: politics, goals, motivation, education, communication challenges.

Technology can enable and provide insights, but it doesn’t make the change.

Set the vision, realistic goals, and ownership.

Medical physicist insight is critical to success.

It takes a team – physicist, technologist, physician, and hospital leadership.