Joint Commission
Medical Imaging Requirements

Laura Gruber, MBA, RT(R), RDMS, RVT
Sr. Director
Department of Medical Imaging
SPR Annual Meeting
My team of professionals
Medical Physicist’s

• 3 FTE’s (Board Certified)
  – 1 Medical Physicist and RSO
  – 1 Medical Physicist with strong CT background
  – 1 dedicated MR physicist and MR Safety Officer

Key priority areas:
  Dose reduction
  Dose Thresholds established
  Dose monitoring (Radimetrics)
  Protocol development/optimization
## Vision 2025: National Leader in Achieving a Healthier Future for Every Child

<table>
<thead>
<tr>
<th>Transformational Imperatives</th>
<th>Goals</th>
<th>Strategies (multi-year)</th>
<th>Constants</th>
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<tbody>
<tr>
<td></td>
<td>Be the Employer of Choice</td>
<td>Care for More Children</td>
<td>Provide the Best Care and Experience</td>
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<td>Develop and retain an engaged workforce</td>
<td>Increase availability to Lurie Children’s clinicians and services</td>
<td>Advance evidence-based, family-centered care practices to achieve best outcomes</td>
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<td>Foster an environment of joy in clinical practice</td>
<td>Grow awareness of Lurie Children’s brand</td>
<td>Relentlessly pursue zero-harm and high reliability</td>
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<td>Develop and recruit national and international leaders</td>
<td>Expand outreach and community partnerships and engagement</td>
<td>Achieve best-in-class patient and family experience</td>
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<td>Promote employee health and wellness</td>
<td>Extend regional presence and international access</td>
<td>Expand care coordination and population health initiatives</td>
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<td>Mission and Service Principles</td>
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</table>
• EP 20: Documentation is available of verification of specified qualifications for each medical physicist supporting CT services.
EC.02.04.03

• EP17: For diagnostic computed tomography (CT) services: At least annually, a diagnostic medical physicist does the following:
  – Measures the radiation dose (in the form of volume CT dose index) produced by each diagnostic CT imaging system for the following CT protocols: adult/pediatric brain and adult/pediatric abdomen.
  – Verifies that the radiation dose produced and measured for each protocol testing is within 20% of what is displayed on the CT console. Dates, results and verifications of these measurements are documented.
JC New Standards
Annual staff training

HR.01.05.03

- EP 14: Documentation of staff annual training and ongoing education is available. The training includes:
  - Radiation dose optimization techniques
  - Safe operation of CT equipment they will be using
EC.02.04.01

• EP10: The hospital identifies quality control and maintenance activities to maintain the quality of the diagnostic computed tomography (CT), position emission tomography (PET), magnetic resonance imaging (MRI), and nuclear medicine (NM) images produced. The hospital identifies how often these activities should be conducted.
• EP 25: The hospital establishes or adopts diagnostic computed tomography (CT) imaging protocols based on current standards of practice, which address key criteria including clinical indication, contrast administration, age (to indicate whether the patient is pediatric or an adult), patient size and body habitus, and the expected radiation dose index range.

• EP 26: Diagnostic computed tomography (CT) imaging protocols are reviewed and kept current with input from an interpreting radiologist, medical physicist, and lead imaging technologist to make certain that they adhere to current standards of practice and account for changes in CT imaging equipment. These reviews are conducted at time frames identified by the hospital.
EP 5: Radiation dose index is documented for on every CT exam. The dose index is exam specific, summarized by series or anatomic area and retrievable.
JC New Standards
Dose Thresholds

PI.02.01.01

- EP 6: Incidents where radiation dose indices exceeded expected dose index range are reviewed and analyzed. These incidents are compared to external benchmarks
Pediatric Dose Management

Due to the well documented radiosensitivity of children, pediatric imaging practices must go beyond traditional dose management and seek every opportunity to reduce, replace, or optimize the use of radiation in diagnostic imaging.
Objectives of a Pediatric Radiation Dose Management Program:

1. Find every opportunity to reduce, replace, or optimize the use of radiation in diagnostic imaging

2. Improve follow-up of children who receive multiple imaging procedures or large cumulative doses

3. Create a well formulated strategy to communicate with parents/family information about their child’s radiation exposure.
Key Components of Enterprise Dose Management in the Pediatric Practice

1.) A Productive and Proactive Radiation Safety Committee
2.) A Productive and Proactive CT Protocol Review Committee
3.) Well-configured Automatic Dose Monitoring Software
4.) A highly specific Radiation Dose/Risk Management Policy
5.) Education and Training of Operators/Providers
6.) Communication with families (pre and post procedure).
7.) Investigation of Dose Sparing Strategies and Early Adoption of Clinical Research

Adapted from: Neomi Mullens, “7 Requirements for an Enterprise Dose Program” AHRA (2013)
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Adapted from: Neomi Mullens, “7 Requirements for an Enterprise Dose Program” AHRA (2013)
Productive and Proactive Radiation Safety Committee (RSC)

• In addition to the standard RSC duties (occupational exposure, badges, aprons, radioactive material use) a proactive RSC is composed of individuals who contribute to the radiation dose surveillance program.

• In our institution, the RSC has members who are dedicated patient advocates for various clinical areas.

• The purpose of the patient advocates is to find opportunities to improve our responsible use of radiation in diagnostic procedures.
# Productive and Proactive Radiation Safety Committee (RSC)

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<thead>
<tr>
<th>Title</th>
<th>Role in RSC</th>
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<tbody>
<tr>
<td>(MD) Attending Radiologist</td>
<td>Chairman</td>
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<td>Medical Physicidan</td>
<td>Radiation Safety Officer</td>
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<tr>
<td>Administrator</td>
<td>Representative, Administration</td>
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<tr>
<td>Director</td>
<td>Representative, Medical Imaging</td>
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<tr>
<td><strong>Technologist - Nuclear Medicine</strong></td>
<td><strong>Nuclear Medicine Patient Advocate</strong></td>
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<tr>
<td><strong>Technologist - CT &amp; IR</strong></td>
<td><strong>CT/IR/CC Patient Advocate</strong></td>
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<td><strong>Technologist Lead - Xray OR</strong></td>
<td><strong>General Xray and OR Patient Advocate</strong></td>
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<tr>
<td>Director ORIC</td>
<td>Representative, IRB</td>
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<tr>
<td>(MD) Attending Cardiologist</td>
<td>Representative, Cardiac Cath</td>
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<td>(APN) Staff Development Specialist</td>
<td>Representative, Nursing I-131</td>
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<td>(APN) OR</td>
<td>Representative, OR Nursing</td>
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<tr>
<td>(MD) Head, Division of Genetics</td>
<td>Representative, Laboratory/Path</td>
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<tr>
<td>Technologist - Laboratory</td>
<td>Laboratory Deputy RSO</td>
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<tr>
<td>Facilities Manager LCRC</td>
<td>Radioactive Waste/Facilities</td>
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<tr>
<td>Research Associate</td>
<td>Research Deputy RSO</td>
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</table>
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Adapted from: Neomi Mullens, “7 Requirements for an Enterprise Dose Program” AHRA (2013)
AProductive and Proactive CT
Protocol Review Committee

- Appropriate management of pediatric dose mandates that we make every effort to personalize the use of radiation to each indication and each child

- Optimizing automatic dose-modulation technologies in pediatric CT can be extremely challenging.

- High levels of customization are required to keep every CT scanner in the enterprise operating in well definite Dose Reference Levels

- Dose notification alerts at the modality need to be carefully set at the level of individual protocols (before acquisition).

- Committee must have a radiologist who consistently checks the protocol page for CTDI.
Size-Specific Dose Estimates (SSDE) in Pediatric and Adult Body CT Examinations

Report of AAPM Task Group 204, developed in collaboration with the International Commission on Radiation Units and Measurements (ICRU) and the Image Gently campaign of the Alliance for Radiation Safety In Pediatric Imaging
A Productive and Proactive CT Protocol Review Committee

AAPM Medical Physics Practice Guideline 1.a: CT Protocol Management and Review Practice Guideline

3. Staffing Qualifications and Responsibilities

a. The Protocol Review and Management Team

Protocol Review and Management requires a team effort; this team must consist of at least a lead CT radiologist, the lead CT technologist, and qualified medical physicist (QMP). In addition, a senior member of the facility administration team should also be involved. This could be the Chief Medical or Administrative Officer for the facility, or a dedicated Radiology Department Administrator/Manager, as determined by hospital leadership. If a senior member of the facility administration team is not a member of the Protocol Review and Management Team, there should be a clear delineation of the reporting structure.
A Productive and Proactive CT Protocol
Review Committee, Example 1

- Review of age groups for the head CT at our institution
- Important to standardize across CT platforms so that overflow work on one CT scanner is conducted with the same adherence to dose optimization as routine clinical work would be.

- **Siemens Flash**
  - Under 1 year
  - 1-5 years
  - 6 and over

- **GE PET/CT (VCT)**
  - 0-18 months
  - 18 months-5 years
  - 5-18 years

- **GE ED (HD 750)**
  - Under 3 years
  - 3-13 years
  - Over 12 years
• Alternatively, Siemen’s Flash has only 3 pediatric weight groups:
  – <5 kg
  – 5-55 kg
  – >55 kg

• Relies on automatic dose modulation and kV selection
A Productive and Proactive CT Protocol Review Committee, Example 2

Standardization of CT dose may require a complete make-over of your systems protocols by the CT protocol committee

- < 5 kg
- < 55 kg --> break this into
  - 6-20 kg
  - 21-55 kg
- 55-109
- Obese > 110-kg
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Adapted from: Neomi Mullens, “7 Requirements for an Enterprise Dose Program” AHRA (2013)
Well-configured Automatic Dose Monitoring Software

- Dose Notification Threshold automatically alerts RSO/MP
- Notifications serve as the initiating event for the Radiation Dose Management Policy.
- Provides means to standardized dose across enterprise
- Provides means to compare dose to national registries
- Summaries individuals dose history
- Aids with protocol optimization
Well-configured Automatic Dose Monitoring Software

• Dashboards only work if, like previous example, protocols are standardized across the enterprise.

• Must configure dose notification thresholds so the radiation dose management policy is consistently applied for every pediatric imaging procedure.
1. Pass/Fail Criteria and Reference Levels

CTDINVOL is one of the pass/fail criteria for all protocols: adult head, adult abdomen, pediatric head and pediatric abdomen. Reference levels have also been determined for these examinations. Please refer to the ACR CT Accreditation Program Requirements for more information on reference levels and their use.

**Note:** The pediatric head and abdomen reference values and pass/fail criteria have been adjusted and were effective July 1, 2013.

*If the CTDINVOL for your unit is above any of the pass/fail criteria described in the table below OR if the dosimetry images are not submitted, the unit will fail accreditation.*

<table>
<thead>
<tr>
<th>Examination</th>
<th>Pass/Fail Criteria CTDINVOL (mGy)</th>
<th>Reference Levels CTDINVOL (mGy)</th>
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<tbody>
<tr>
<td>Adult Head</td>
<td>80</td>
<td>75</td>
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<tr>
<td>Adult Abdomen</td>
<td>30</td>
<td>25</td>
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<tr>
<td>Pediatric Head (1 year old)</td>
<td>40</td>
<td>35</td>
</tr>
<tr>
<td>Pediatric Abdomen (5 year old, 40-50 lb.)</td>
<td>20</td>
<td>15</td>
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</tbody>
</table>
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Adapted from: Neomi Mullens, “7 Requirements for an Enterprise Dose Program” AHRA (2013)
Radiation Dose Management Policy

- Defines Dose Notification Threshold
  - Example:
    1.) Organ/Effective Dose (Gy)
    2.) Total fluoroscopy time
    3.) Total number of procedures
    4.) CTDI

- Detailed instructions for responding to dose notification thresholds.
- Policy should script communication to be used by providers.
- Define EMR or RIS-based Decision Support?
Radiation Dose Management Policy

Special Issue:
Radiation Dose Optimization

Guest Editors:
Rebecca Smith-Bindman, MD
John M. Boone, PhD
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Adapted from: Neomi Mullens, “7 Requirements for an Enterprise Dose Program” AHRA (2013)
Education and Training of Operators/Providers

- Pediatric imaging procedures often have numerous bystanders to procedures including parents, social workers, nurses, and child life specialists.

- Non-operators need to be educated in radiation safety so that they do not interfere with the appropriate operation of the device.

- Operators (particularly junior operators) need adequate training to empower them to be leaders in keeping our use of radiation “as low as reasonably achievable”
# Education and Training of Operators/Physicians

## Education Matrix Example

<table>
<thead>
<tr>
<th>Operator?</th>
<th>Clinical Role</th>
<th>X-Ray</th>
<th>DXA</th>
<th>RF</th>
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<th>Mini-C</th>
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Education and Training of Operators/Physicians

1. Radiation Badge Program
2. Radiation Safety for Non-operators
3. Safe handling of Radioactive Materials
4. Radiation Safety for Operators of X-ray producing Equipment
   - General X-ray (standard and portable xray)
   - Dexa
   - General Fluoroscopy
   - Computed Tomography
   - Operating Room Devices
   - Interventional Radiology and Cardiac Cath
   - Dental
Key Components of Enterprise Dose Management in the Pediatric Practice

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Adapted from: Neomi Mullens, “7 Requirements for an Enterprise Dose Program” AHRA (2013)
Communication with Families

- The need for well-structured communication with parents regarding radiation dose is one the most challenging elements of pediatric enterprise dose management

- Information regarding radiation dose management efforts needs to be readily available (pamphlet or website) in order to partially mitigate the increasing number of parents who are interested in radiation effects.

- Providers and technologists who interact with parents need to be coached in the appropriate response to inquiries.
Communication with Families

- We have found that pamphlets/literature for communication with families is also crucial in our teaching hospital environment where new residents and fellows are often the patient’s first point of contact regarding radiation exposure.

- It’s helpful to prep them with some key points: “Today you child will have a medically indicated procedure that uses x-ray radiation to produce images. Our team of medical physicists and radiologists have made every possible effort to optimize the use of radiation so that your child’s radiation exposure is as low as reasonably achievable. If you have specific questions as to the amount of exposure you may contact the Office of Radiation Safety.....”
Communication with Families

• Marilyn J. Goske, “Communicating with Parents about Radiation Risk: Doctor, is a CT scan safe for my child?” SPR 2014


Communication with Families

• Good Communication is also Good “Marketing”:
  • Literature and pamphlets prepared for pre and post procedure describing the efforts made to use radiation responsibly give parents confidence in your practice.

  • Conspicuous signage regarding Radiation Dose Management Program advertises your program’s due diligence.

  • Training personnel who interact with parents the appropriate analogies to explain dose (accurate, helpful, and well referenced) will help educate your families and improve their experience.
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Investigation of Dose Sparing Strategies and Early Adoption of Clinical Research

- Keeping up with Alternatives and Triage Criteria

Investigation of Dose Sparing Strategies and Early Adoption of Clinical Research

- Implementing the existing bells and whistles
  - CT Example: Iterative Recon, 70 kVp, Low Dose Indications (ex. Renal stones), Dose Modulation
  - OR/RF/IR/Cath Example: Universal use of pulsed fluoroscopy, optimization of dose/frame (Not too high and not too low!)
  - DR Example: Optimization of dose index (using exposure indices)
  - Nuclear Medicine Example: Image Gently Guidelines
Lurie dose sparing strategy

CT Volumes
- FY12: 6158
- FY13: 5761
- FY14: 5814
- FY15: 5640
- FY16: 5441

MR Volumes
- FY12: 12646
- FY13: 13043
- FY14: 14481
- FY15: 15718
- FY16: 16077
The Future of Pediatric Dose Management...Collaborative Research!

ACR Committee on Pediatric Imaging Research (ACR-PIR):
Co-Chairs: Heike E. Daldrup-Link, MD, PhD and Stephan Voss, MD, PhD

Vision: To revolutionize the care of children by fostering high-impact diagnostic and therapeutic imaging innovations

Research Priorities for Transformative, High Impact Pediatric Imaging Research Directions: Single center research studies often produce limited impact due to small evaluated patient populations. We want to form inter- and cross-disciplinary research teams that will work together to improve pediatric patient outcomes through multi-center research activities.

1. Substantially reduce or eliminate radiation exposure of pediatric imaging procedures

Leader: Christina Sammet, PhD, Lurie Childrens Hospital and Kassa Darge, MD, PhD, The Children's Hospital of Philadelphia, Don Frush kindly agreed to serve as an advisor for this initiative. The image gently campaign has revolutionized our field. Given many already optimized procedures, some new research directions in this area target only incremental further improvements. We aim for further major reductions in radiation dose: At least 50% dose reduction for radiographic technologies, sub-mSv acquisitions for computed tomography as well as development of radiation-free imaging technologies.
Thank you for your attention!

Acknowledgements:

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