Landauer: Clinical Dose Optimization Symposium

The Joint Commission Diagnostic Imaging Requirements: CT Dose Optimization

Andrea Browne, PhD, DABR
Medical Physicist, Dept. of Engineering
The Joint Commission
Standards Interpretation Group
12 Elements of Performance in 7/1/2015 Revised Requirements for Diagnostic Imaging Services that pertain to CT Dose Optimization / Image Quality
CT Dose Optimization Standards Focus on:

- Equipment that functions properly and a safe environment of care...
- Qualified Staff
- Processes to ensure safety and efficiency
Radiation Dose Optimization:
Minimize radiation dose for obtaining diagnostic quality images

Minimize Radiation Dose:
Benefit-risk ratio maximized with optimized imaging techniques

Diagnostic Quality Images:
Image noise, contrast, spatial resolution, artifacts tailored to clinical indication
What are the standards?

Accreditation requirements – applicable to:

- accredited ambulatory care orgs, (including with ADI certification)
- hospitals that provide diagnostic imaging
Will the survey process change?

- No changes to the on-site survey agenda
- Compliance will be assessed as part of the *current* survey activities, (e.g. EC, Competence Assessment, Data Management, etc...)
- Will be incorporated into the current patient tracer processes
TOOLS TO OPTIMIZE CT DOSE

EQUIPMENT

Hardware: CT scanner
Image software: post processing, noise reduction

PEOPLE

Interpreting physician
Medical physicist
Health physicist
CT technologist
Vendor

PROCESSES

Imaging protocols
For hospitals that use Joint Commission accreditation for deemed status purposes: The hospital’s activities and frequencies for inspecting, testing, and maintaining the following items must be in accordance with manufacturers’ recommendations:

- Equipment subject to federal or state law or Medicare Conditions of Participation in which inspecting, testing, and maintaining be in accordance with the manufacturers’ recommendations, or otherwise establishes more stringent maintenance requirements
- Medical laser devices
- Imaging and radiologic equipment (whether used for diagnostic or therapeutic purposes)
- New medical equipment with insufficient maintenance history to support the use of alternative maintenance strategies
Survey process/ Examples of compliance:

- **Interview:**
  - **Staff**
  - What is your plan for meeting manufacturer preventive maintenance requirements?
  - Do you have a quality control program for your CT(s)? How did you put it together?

- **Observation:**
  - Review plan document
  - Organizational policy
Standard EC.02.04.03
The [critical access] hospital inspects, tests, and maintains medical equipment.

Elements of Performance for EC.02.04.03
C 15. The [critical access] hospital maintains the quality of the diagnostic computed tomography (CT), positron emission tomography (PET), magnetic resonance imaging (MRI), and nuclear medicine (NM) images produced. (See also EC.02.04.01, EP 7)
Survey process/ Examples of compliance:

- **Interview:**
  - **Staff**
  - Do you know what your PM, QC plan for this CT is?
  - Where it is?
  - Who conducts the tests, how, when?
  - How do you judge that image quality is diagnostic?

- **Observation:**
  - QC/testing logs
EC.02.04.03 EP 17

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 computed tomography dose index [CTD\text{vol}]) produced by each diagnostic CT imaging system for the following four CT protocols: adult brain, adult abdomen, pediatric brain, and pediatric abdomen. If one or more of these protocols is not used by the [critical access] hospital, other commonly used CT protocols may be substituted.

- Verifies that the radiation dose (in the form of CTD\text{vol}) produced and measured for each protocol tested is within 20 percent of the CTD\text{vol} displayed on the CT console. The dates, results, and verifications of these measurements are documented.
Survey process/ Examples of compliance:

- **Interview:**
  - Is there a process to measure/verify CT radiation output annually?
  - Which protocols are measured?
  - Who does it, how often?
  - What would you do if the displayed value was outside the 20% limit?

- **Observation:**
  - Testing reports: If not done before, dates & results completed by 7/1/16;
  - by a Diagnostic Medical Physicist
Quarterly: +/- 10 days  
Semiannual: +/- 20 days  
Annual: +/- 30 days  

Due Date  

Scheduled Month  

Quarterly  
Jan  
Feb  
March  
April  

Semiannual  
June  
July  
Aug  
Sept  
Oct  
Nov  
Dec  

Annual  
Jan  
Feb  
Mar  
Apr  
May  
Jun  
Jul  
Aug  
Sep  
Oct  
Nov  
Dec  

Frequencies required by Code may not be modified  
(e.g. EC.02.05.07 EP 4 & 7)
EC.02.04.03 EPs 19

Patient/staff safety: Annual performance evaluations of CT, MRI, Nuclear Med, and PET imaging equipment…

For diagnostic computed tomography (CT) services: At least annually, a diagnostic medical physicist conducts a performance evaluation of all CT imaging equipment. The evaluation results, along with recommendations for correcting any problems identified, are documented. The evaluation includes the use of phantoms to assess the following imaging metrics:

- Image uniformity
- Slice thickness accuracy
- Slice position accuracy (when prescribed from a scout image)
- Alignment light accuracy
- Table travel accuracy
- Radiation beam width
- High-contrast resolution
- Low-contrast resolution
- Geometric or distance accuracy
- CT number accuracy and uniformity
- Artifact evaluation
Medical physicists are accountable and must review results, make recommendations.

May be assisted by individuals with required training and skills (determined by physicist).

Medical physicists not required to be present during all data collection and testing.

Examples of assistants: biomed staff, imaging technologists, and vendor/manufacturer service personnel.
TOOLS TO OPTIMIZE CT DOSE

EQUIPMENT
Hardware: CT scanner
Image software: post processing, noise reduction

PEOPLE
Interpreting physician
Medical physicist
Health physicist
CT technologist
Vendor

Processes
Imaging protocols
Diagnostic medical physicists who support **CT services**:

Board certification:

- Diagnostic radiologic physics, radiologic physics by the **American Board of Radiology, or**
- Diagnostic Imaging Physics by the **American Board of Medical Physics, or**
- Diagnostic Radiological Physics by the **Canadian College of Physicists in Medicine, or** ...
Veriﬁcation & documentation of medical physicists qualiﬁcations…

...meet all of the following requirements:

• **Graduate degree**: physics, medical physics, biophysics, radiologic physics, medical health physics, or a closely related science/engineering discipline from an accredited college or university

• **College coursework** in: biological sciences (at least one course in biology/radiation biology and one course in anatomy, physiology, or similar topic related to the practice of medical physics

• **Documented experience** in a clinical CT environment conducting at least 10 CT performance evaluations under direct supervision of a board-certiﬁed medical physicist
Survey process/ Examples of compliance:

- **Interview:** Physicist supporting CT services/ HR staff
  - Does the individual meet Board certification requirement? If not, education, experience?

- **Observation:**
  - Review personnel files
  - “Qualified MP” concept is addressed in current HR standards
  - (e.g.HR.01.02.05: Organization verifies staff qualifications)
The hospital verifies and documents that technologists who perform diagnostic computed tomography (CT) examinations participate in ongoing education that includes annual training on the following:
- Radiation dose optimization techniques and tools for pediatric and adult patients addressed in the Image Gently® and Image Wisely® campaigns
- Safe procedures for operation of the types of CT equipment they will use

Note 1: Information on the Image Gently and Image Wisely initiatives can be found online at http://www.imagegently.org and http://www.imagewisely.org, respectively.

Note:
Image Gently and Image Wisely serve as good resources, however, vendor-provided training and other training tools may also be used.
Verification and documentation of CT technologists’ ongoing education and annual training…

Survey process/ Examples of compliance:

- **Interview:**
  - Technologist: Was training provided on CT dose optimization and safe procedures for operating the CT scanners in this institution?
  - How was it provided? When

- **Observation:**
  - Review documentation of content and dates of training, attendance by all individuals performing diagnostic CT exams.
TOOLS TO OPTIMIZE CT DOSE

EQUIPMENT
Hardware: CT scanner
Image software: post processing, noise reduction

PEOPLE
Interpreting physician
Medical physicist
Health physicist
CT technologist
Vendor

PROCESSES
Imaging Protocols
The hospital documents the radiation dose index (computed tomography dose index [CTDIvol], dose length product [DLP], or size-specific dose estimate [SSDE]) on every study produced during a diagnostic computed tomography (CT) examination. The radiation dose index must be exam specific, summarized by series or anatomic area, and documented in a retrievable format.
**PC.01.02.15 EP 5**

Documentation of CT radiation dose index...

***Note: This EP only applies to systems capable of calculating and displaying radiation dose indices***

**Survey process/ Examples of compliance:**

- **Interview: CT staff, medical physicist**
  - What is the process for capturing radiation dose index?
  - Which measurement is used?
  - How do you retrieve data?

- **Observation:**
  - Review selected exams
  - Information include: exam specific, summarized (series or anatomic area)
  - Documented in retrievable format?
For hospitals that provide diagnostic computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), or nuclear medicine (NM) services: Prior to conducting a diagnostic imaging study, the hospital verifies the following:
- Correct patient
- Correct imaging site
- Correct patient positioning
- For CT only: Correct imaging protocol
- For CT only: Correct scanner parameters
Survey process/ Examples of compliance:

- **Interview**: CT staff can describe:
  - Verification processes
  - Exam set-up, procedures
  - CT protocols and scanner parameters verification

- **Observation**:
  - Exam set-up, patient positioning, and verification
  - Patient intake policy or procedure that includes elements
CT Dose Optimization

Benefit to the patient: Accurate Diagnosis

Exam appropriateness: Inappropriate exam - #1 cause of unnecessary radiation exposure
IAEA: ~30% of CT scans are unjustified and can be avoided through appropriate medical judgement
A 12. For [critical access] hospitals that provide diagnostic computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), or nuclear medicine (NM) services: The [critical access] hospital considers the patient’s age and recent imaging exams when deciding on the most appropriate type of imaging exam.  

Note 1: Knowledge of a patient’s recent imaging exams can help to prevent unnecessary duplication of these examinations.

Note 2: This element of performance does not apply to dental cone beam CT radiographic imaging studies performed for diagnosis of conditions affecting the maxillofacial region or to obtain guidance for the treatment of such conditions.
PC.01.02.15 EP 12

Survey process/ Examples of compliance:

**Interview:** CT staff can
- List patient information obtained prior to testing
- Describe considerations when determining type of imaging exam; pediatric patients
- Policy: patient scheduling/preparation/ intake
- Discuss frequency and reasons for duplicated exams

**Observation:**
- Review imaging order, intake and processing
- Availability of prior imaging reports
- Patient age/ prior imaging exams considered *(recent and relevant* imaging exams)
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.
Survey process/ Examples of compliance:

- **Interview: CT staff, radiologist, physicist**
  - What is the process/ criteria for establishing protocols?
  - Process for selecting/ modifying imaging protocols depending diagnosis, age, and size?

- **Observation:**
  - Protocols are established/ contain all elements (expected dose range identified)
  - Set-up and/or performance of CT exam; imaging protocol selection
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.
Survey process/ Examples of compliance:

- **Interview**: CT staff, interpreting physician, physicist
  - What is the frequency of review?
  - Who are the review personnel?
  - What is the review process?
  - How do you know you are current with protocol development?

- **Observation**:
  - Evidence that review is taking place in accordance with organization policy.
  - Evidence that organization has process for staying current with knowledge of CT imaging protocols.
PL.02.01.01 EP 6

Review and analysis of incidents where the dose index exceeds expected limits; comparison to external benchmarks…

The hospital reviews and analyzes incidents where the radiation dose index (computed tomography dose index [CTDIvol], dose length product [DLP], or size-specific dose estimate [SSDE]) from diagnostic CT examinations exceeded expected dose index ranges identified in imaging protocols. These incidents are then compared to external benchmarks.
Tracking radiation safety metrics: Development of information systems and analysis tools to track radiation safety metrics will play an important role in promoting radiation protection and patient safety. Collection of equipment parameters and dose for imaging exams in dose registries can be used to benchmark imaging practice through establishing diagnostic reference levels, thus improving the practice of radiology through quality assurance. A long-term goal is automated real-time updating of dose registries to facilitate comparison of exam parameters and dose indices with established reference levels, enabling immediate notification and mitigation of patient safety hazards. Tracking adverse events can establish trends and allow prospective correction of possible radiation safety problems related to equipment or operator training. Automated tracking of radiation safety metrics (e.g., through participation in a dose registry) will help fulfill quality assurance and quality improvement requirements for facility accreditation and personnel continuing education, while ensuring that operators use equipment optimally to promote patient safety.

Survey process/ Examples of compliance:

- **Interview: CT staff, physicist, radiologist**
  - Any incidents that exceeded the expected dose index?
  - Describe process for review and analysis of incidents; Who is involved? Action taken?
  - How is data benchmarked?

- **Observation:**
  - Review collected data, if any
  - Look for evidence of benchmarking
  - Review results of analysis
Hospitals are encouraged to follow the recommendation in the EPA’s Guidance Report No. 14 concerning patient radiation dosage. The report says “As the ICRP [International Commission on Radiological Protection] has stated, ‘Provided that the medical exposures of patients have been properly justified and that the associated doses are commensurate with the medical purpose, it is not appropriate to apply dose limits or dose constraints to the medical exposure of patients, because such limits or constraints would often do more harm than good’ (ICRP 2007b). While dose limits do not apply to medical exposures, radiation doses to patients should always be optimized. All responsible parties should always strive to minimize patient irradiation to the dose that is necessary to perform the procedure with adequate image quality. The recommendation against establishing absolute dose limits should not discourage a facility from implementing diagnostic reference levels for imaging and interventional procedures. Exceeding these levels should prompt a review of practice at the facility as a quality assurance measure. Dose notification and alert values for CT, notification levels for use during interventional procedures, and trigger levels for follow-up after interventional procedures are also appropriate QA measures [emphasis added]...(EPA Guidance Report No. 14, p.6)
Hospitals are encouraged to also address the following in their Radiologic Services:

- Encouraging physicians and other practitioners with privileges to order radiologic studies or procedures that utilize ionizing radiation to consider both the benefits and risks of the procedures.

- Recording and tracking the dosing patients receive. There are several nationally recognized quality assurance programs designed to assist health care providers in developing and maintaining this data, including, but not limited to:
  - The Alliance for Safety in Pediatric Imaging (www.Imagegently.org)
  - The Conference of Radiation Control Program Directors
  - The American College of Radiology data registry (http://nrdr.acr.org)
  - The Nationwide Evaluation of X-ray Trends (NEXT program)
Survey Experience

<table>
<thead>
<tr>
<th>Date</th>
<th>Total Scores DI EPs</th>
<th>PI.02.01.01, EP.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/1/2015-11/30/2015</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>7/1/2015-3/31/2016</td>
<td>61</td>
<td>2</td>
</tr>
</tbody>
</table>

Areas of Noncompliance by Modality-CT
N=17

- Annual equipment eval not done-CT: 29%
- Patient positioning not verified -CT: 6%
- Lack of required staff training -CT: 6%
- Quality control logs incomplete -CT: 12%
- CT protocols not reviewed or updated: 18%
- CT radiation dose not reviewed: 29%
Why the Joint Commission’s Revised Requirements for Diagnostic Imaging Services?

Dr. Richard Morin: “We learned it in kindergarten, when someone is watching, behavior changes.”
The Joint Commission Disclaimer

- These slides are current as of 5/2/16. The Joint Commission reserves the right to change the content of the information, as appropriate.

- These slides are only meant to be cue points, which were expounded upon verbally by the original presenter and are not meant to be comprehensive statements of standards interpretation or represent all the content of the presentation. Thus, care should be exercised in interpreting Joint Commission requirements based solely on the content of these slides.

- These slides are copyrighted and may not be further used, shared or distributed without permission of the original presenter or The Joint Commission.