

Observations from the ACR CT Accreditation Program: Areas of Success and Areas for Improvement

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Background

- Three accrediting organizations are recognized by CMS to fulfill the MIPPA requirements for accreditation by 1/1/12:
 - ACR: American College of Radiology
 - ICACTL: Intersocietal Commission for Accreditation of CT Laboratories
 - TJC: The Joint Commission (through its ambulatory health care program)

Background

- Number of accredited sites:
 - ACR: 4200
 - ICACTL: 250
 - TJC: unknown*

*subset of TJC Ambulatory Health Care

Requirements

- ACR:
 - Objective dose assessment:
 - Phantom-based
 - Adult Head
 - Adult Abdomen
 - Pediatric Abdomen (5 yr)

Requirements

- ACR:
 - Subjective dose assessment:
 - Patient-based
 - Are mAs, kVp, pitch appropriate for exam, body habitus?

Requirements

- ICACTL:
 - Does not assess dose, but has three standards that reflect awareness of dose:
 - 4.1.1 All CT laboratory professionals must have an understanding of the radiation exposure involved in CT to advise patients undergoing CT imaging

Requirements

- ICACTL:
 - 4.1.2 Radiation dose for CT acquisition should be set at the lowest values that are consistent with satisfactory image quality for the study ordered.

Requirements

- ICACTL:
 - 4.1.6 The laboratory should comply with the currently published ALARA recommendations for personnel and subscribe to dose optimization for patients...

Requirements

- TJC:
 - Does not assess dose
 - Policies / standards are not readily available

Success #1

- ACR CT Accreditation Program has focused attention on radiation dose monitoring and control since 2002

Phantom-Based Indices

Diagnostic Reference Levels from the ACR CT Accreditation Program

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Phantom-Based Indices

- Three exams:
 - Adult Head
 - Adult Abdomen
 - Pediatric Abd. (5 yr)
- Dose indices
 - CTDI_{vol}
 - DLP
 - Effective Dose

Phantom-Based Indices

- Dose indices judged
 - CTDI_{vol}
- Recommended DRLs (2002):

–Adult Head	60 mGy
–Adult Abdomen	35 mGy
–Pedi Abdomen	25 mGy

European Guidelines

<u>Exam</u>	<u>CTDI_w</u>	<u>DLP</u>	<u>Eff. Dose</u>
Head	60	1050	2.4
Chest	30	650	11.1
Abd	35	800	12.0
Pelvis	35	600	11.4

From Commissione Europea EUR 16260, EUR 16261, EUR 16262 -- 1998

Phantom-Based Indices

- DRLs analyzed from 2002 – 2004
 - Head-too low, Adult/Pedi Abdomen-too high
- 2008 DRLs (revised):

	<u>DRL</u>	<u>Pass/Fail</u>
–Adult Head	75 mGy	80 mGy
–Adult Abdomen	25 mGy	30 mGy
–Pedi Abdomen	20 mGy	25 mGy

Diagnostic Reference Levels

- Percentage of scanners above 2002 DRLs

	2002	2003	2004	2002-2004
Adult Head	49.6	33.3	23.8	33.4
Adult Abdomen	4.7	5.2	2.3	4.2
Pediatric Abdomen	15.0	11.7	6.9	10.8

**Should be 25% as DRLs are typically set at 75th percentile*

Diagnostic Reference Levels

- Percentage of scanners above 2008 DRLs

	2002	2003	2004	2002-2004
Adult Head	25.6	12.8	9.1	14.0
Adult Abdomen	15.9	20.3	12.7	17.0
Pediatric Abdomen	26.4	27.2	19.2	24.5

**Should be 25% as DRLs are typically set at 75th percentile*

Diagnostic Reference Levels

- Reduction in average dose from 2002 to 2004:
 - Adult Head 10.9 mGy*
 - Adult Abdomen 1.7 mGy
 - Pedi Abdomen 3.2 mGy

*data from 2003 and 2004 may have been biased by desire to meet spec (DRL), even if unhappy with image quality

Success #2

- ACR CT Accreditation Program created and revised Diagnostic Reference Levels for US practice

Limitation #1

- Diagnostic Reference Levels do not reflect true state of US practice, rather, state of US practices seeking accreditation

Diagnostic Reference Levels



Diagnostic Reference Levels in Medical and Dental Imaging: Recommendations for Applications in the United States

Recommendations of the
NATIONAL COUNCIL ON RADIATION PROTECTION
AND MEASUREMENTS

**presently under Council review*

Diagnostic Reference Levels



Nationwide Evaluation of X-Ray Trends (NEXT) Computed Tomography Dataset

A *Nationwide Evaluation of X-ray Trends (NEXT) survey* of clinical facilities performing computed tomography (CT) examinations was conducted during 2005-06. This survey was planned and conducted under the leadership of the *Conference of Radiation Control Program Directors' (CRCPD) H-4 Committee*

Approximately 260 facilities participated in the voluntary survey. The survey consisted of two components: a site visit by trained surveyors and a questionnaire completed by facility staff. Trained state radiation personnel conducted each site visit, gathering data regarding CT workload volumes, equipment data, scanning parameters for clinical exams, and radiation measurements from CT equipment. Surveyors also used a specially designed phantom to characterize CT equipment scan features that adjust radiation

**raw data was made available in April, 2010*

Patient-Based Indices

Can Experienced CT Radiologists use Technique Parameters to Predict Excessive Patient Dose? An Analysis of the American College of Radiology (ACR) CT Accreditation Database

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Patient-Based Indices

- Three clinical exams required:
 - chosen from 19 possible studies
 - 3 had corresponding phantom measurements:
 - Adult Head
 - Adult Abdomen
 - Pediatric Abdomen

Patient-Based Indices

- Clinical reviewers were asked to assess radiation dose based on technique factors:
 - mAs, kVp, pitch
- Reviewer comments were correlated with results of phantom measurements

Patient-Based Indices

Clinical reviewers were poor predictors of dose above DRL in clinical exams:

	Sensitivity	Specificity
>2002 DRL	21%	88%
>2008 DRL	13%	86%

Patient-Based Indices

- Reasons for poor performance:
 - “High-dose bias” among reviewers
 - Poor understanding of the relationship between patient size and mAs, kVp
 - Automatic exposure control resulting in mAs that varies image by image

Limitation #2

- Patient-specific dose data is of limited value
 - Exam technique is a poor surrogate for patient dose

Patient-Based Indices

- Clinical reviewers are now provided with
 - Phantom CTDIvol data
 - Clinical CTDIvol data for all exams
- Reviewers are asked to comment on appropriateness of kVp and CTDIvol

- Collect and provide feedback on dose estimate information from various modalities
- Pilot program completed with CT
 - DICOM feed of patient-specific dose data
 - Allows participants to compare average CTDIvol and DLP values across facilities
- Production program will launch in mid 2011