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UCLA Health
Implementation of a Monitoring System for ACR and Proposed Joint Commission CT Requirements
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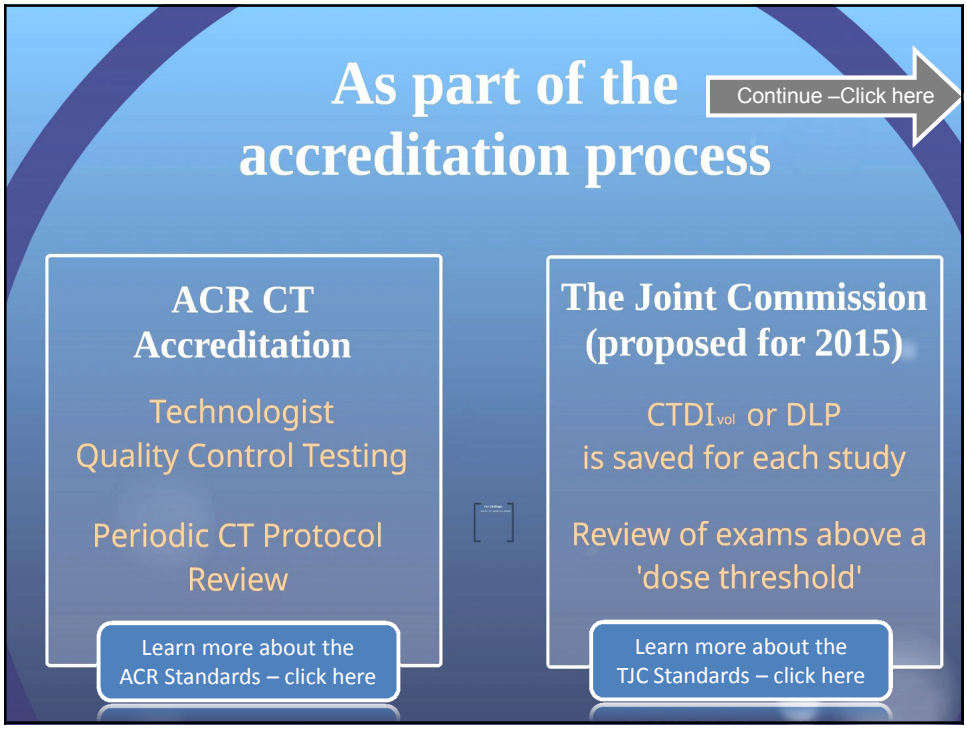


Standards released in 2012:

"Together, the lead radiologist, lead CT technologist, and QMP should design and review all new or modified protocol settings to ensure that both image quality and radiation dose are appropriate"

AND

"Institute a regular review process of all protocols to be sure that no unintended changes have been applied that may degrade image quality or unreasonably increase dose. "

There are 5 QC tests generally performed

1. Water CT Number (HU) and Standard Deviation (daily)
2. Artifact Evaluation (daily)
3. Visual Checklist (monthly)
4. Display Monitor Quality Control (QC) (monthly)
5. Wet or Dry Laser Printer QC (weekly/monthly)
   (needed if film is used for primary evaluation)

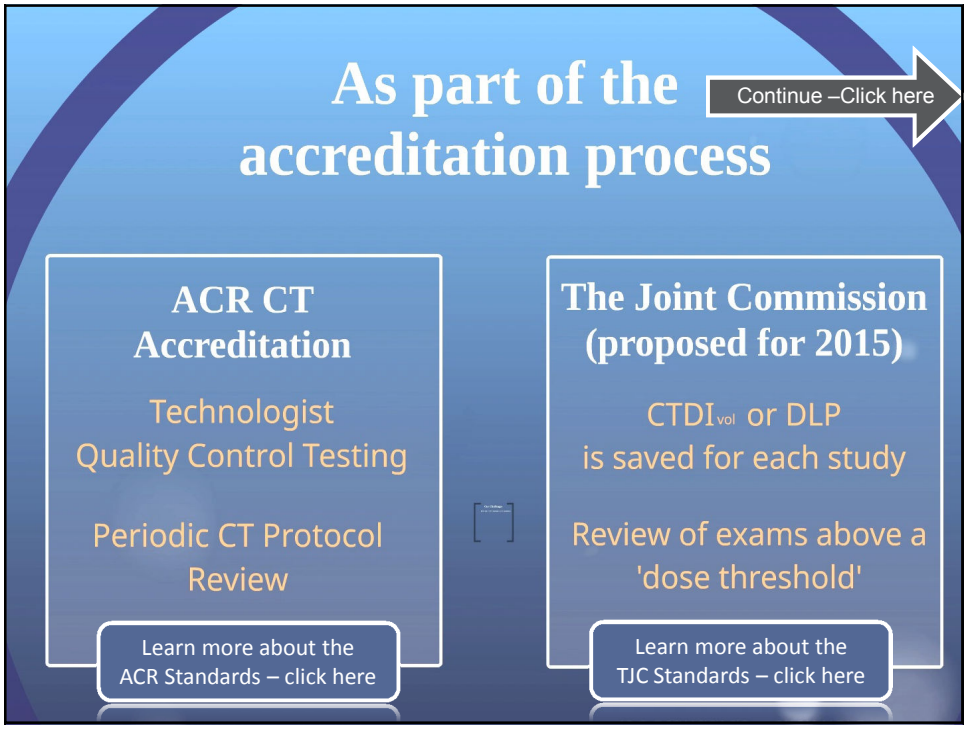
We focused on these 4

- These are proposed standards for 2015

"The organization documents the radiation dose ($CTDI_{vol}$ or DLP) on every study produced during a computed tomography (CT) examination. The radiation dose must be exam-specific, summarized by series or anatomic area, and documented in a retrievable format. "

And

"The organization reviews and analyzes incidents where the radiation dose ($CTDI_{vol}$ or DLP) emitted by the computed tomography (CT) imaging system during diagnostic CT exams exceeded expected dose ranges identified in imaging protocols."


As part of the accreditation process
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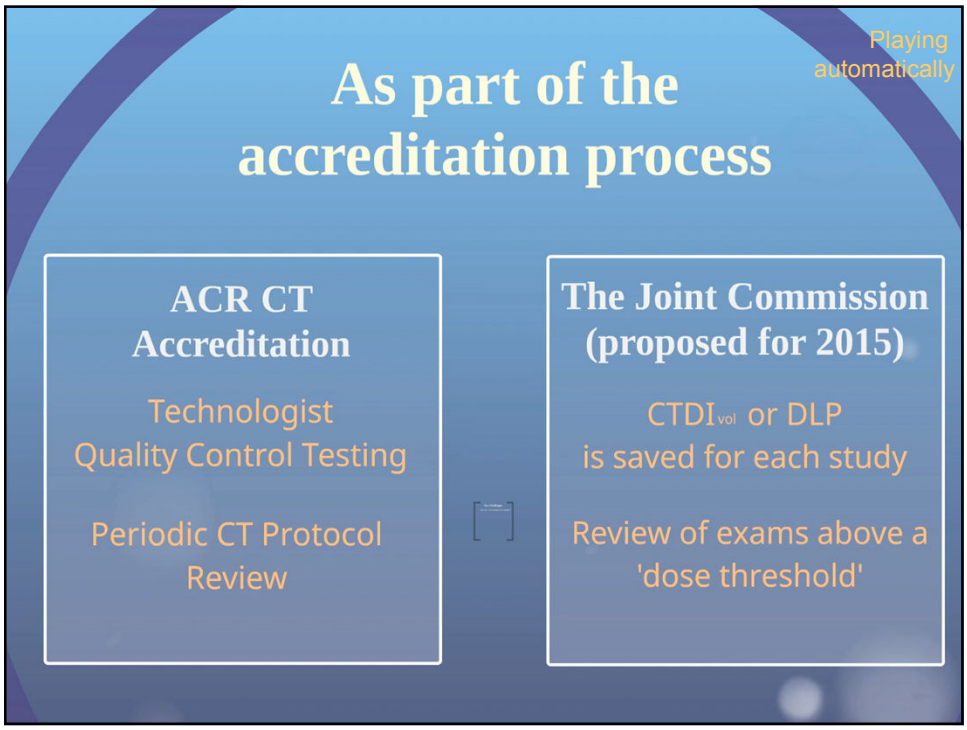
ACR CT Accreditation
Technologist Quality Control Testing
Periodic CT Protocol Review
Learn more about the ACR Standards – click here
The Joint Commission (proposed for 2015)
CTDIvol or DLP is saved for each study
Review of exams above a 'dose threshold'
Learn more about the TJC Standards – click here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(http://www.google.com/forms/about/, http://www.google.com/docs/about/)

- Free
- Cloud based customizable forms
  - Easily deployed within an organization
  - Form updates automatically populate/update a spreadsheet which is monitored by the QC tech
- Google spreadsheets have limitations on data analysis
  - But exportable to Microsoft Excel™
- Automatic email notifications can be sent to QC techs in case of failed tests/incompliances (future work)

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- Used to create two separate forms
  - Daily QC Form
    - Filled out by each scheduled technologist in the morning after Siemens QC is performed
    - Form allows the selection of a scanner from a list of scanners
    - Prompts the technologist to answer a series of questions (fail/pass)
    - Results are auto-populated in a spreadsheet which is monitored by the QC tech
  - Monthly QC Form
    - QC tech visits each side on a monthly basis and preforms required monthly QC
    - Results are auto-populated in a spreadsheet
  - Medical Physicist has access to both spreadsheets and can monitor/evaluate technologist QC

- Siemens ™ CT protocols are exportable into a universal .xml data file format.
  - Extensible Markup Language file
  - Protocol technical variables (kVp, mA, rotation time etc..) are saved in data fields
- Microsoft Visual Basic Studio™ was used to program an ASP.NET based web page that compared data fields
- This structure will allow the technologist to upload CT xml files and initiate the analysis. Emails with changes can be sent to committee members (future work)

- Captures CT protocol and dose information from PACS
  - $CTDI_{vol}$
  - DLP
- Interactive Dosimetry
  - Calculates organ doses*
  - Effective Dose based on ICRP 103 and 60
- Reporting
  - Summaries of CT dose information
  - Used to track or identify high dose procedures

*See scientific poster "A Comparison of Organ Dose Estimates between Several Monte Carlo Simulation-based Methods for Chest and Abdomen CT Scans Using Tube Current Modulation (TCM)" on Wed Dec 03 2014 12:15PM - 12:45PM ROOM PH Community, Learning Center

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Results: Daily QC monitoring with Google Docs

For a 6 month period

40% Compliance during 1st week of QC testing (4 out of 12)

100% Compliance by 4th week of QC testing

~85% Compliance during the 8-20th week - oversight of program dropped

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Results: Monthly QC monitoring with Google Docs

For a 6 month period

100% Compliance (performed by QC technologist)

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Results: Monitoring Protocol Changes

For a 6 month period

Protocol Changes – First 3 months
Hundreds of pre-authorized changes were noted
- due to protocol harmonization across scanners

Protocol Changes – Next 3 months
5 new (un-vetted) protocols were identified
- Physician specific
- Research related

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Results: Monitoring Protocol Changes

Other protocol changes were non-significant
- Naming convention changes
- Modified notes or comments

	September 2014	August 2014
ProtocolName	1Brain_Lab (Adult)	1Head_Brain_lab (Adult)
ScanType	Topo	Topo
Range	Brain Lab	Head BrLab

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Results: Radimetrics Dose Monitoring

Thousands of scans per month (cumulative for all scanners

Oct 2014:

10 Head exams (> 70mGy threshold)
2 Perfusions, 5 CTA Brain-Neck, 3 Routine Brain
All were deemed appropriate

8 Body exams (>50mGy threshold)
8 CTA CORONARY
CT Committee consulted with the Radiologist and were deemed appropriate

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Results: Radimetrics Dose Monitoring

Sept 2014:

6 Head exams (> 70mGy threshold)
4 Perfusions, 2 CTA Brain
All were deemed appropriate

14 Body exams (>50mGy threshold)
10 Coronary CTA, 2 Chest CTA, 1 CTA Thoracic Aorta, 1 Chest_Triple_Phase_Live
13 deemed appropriate
and 1 error found in the $CTDI_{vol}$ calculation*

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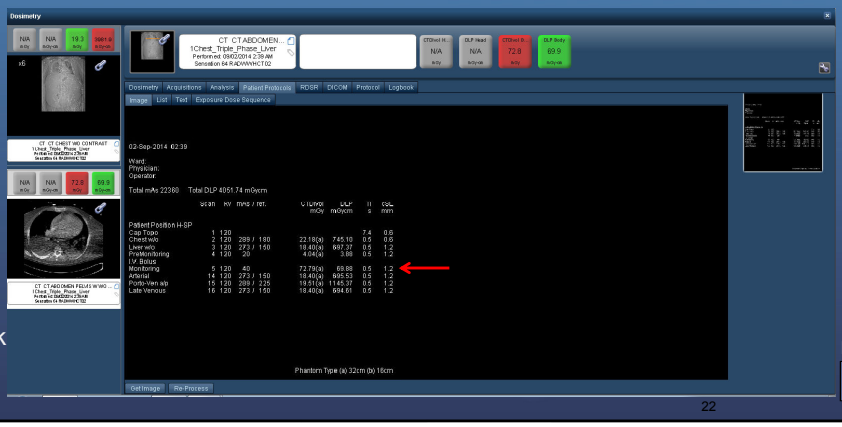
Results: Radimetrics Dose Monitoring

*$CTDI_{vol}$ from monitoring scan was reported as the average $CTDI_{vol}$ of the examination in the imported data



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Results: Radimetrics Dose Monitoring

August 2014:

1 CTA Brain exams (> 70mGy threshold)
It was deemed appropriate

12 Body exams (>50mGy threshold)
6 Coronary CTA, 5 Chest CTA, 1 CTA Thoracic Aorta
All were deemed appropriate

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Results: Radimetrics Dose Monitoring

July 2014:

3 Head exams (> 70mGy threshold)
1 Perfusions, 2 CTA Brain
All were deemed appropriate

9 Body exams (>50mGy threshold)
4 Coronary CTA, 2 Chest CTA, 2 Routine Abdomen/Pelvis (obese patient, high monitoring exam),
1 Routine Chest (obese patient)
All were deemed appropriate

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Results: Radimetrics Dose Monitoring

June 2014:

5 CTA Brain exams (> 70mGy threshold)
All were deemed appropriate

5 Body exams (>50mGy threshold)
1 Coronary CTA, 3 Chest CTA, 1 CTA Thoracic Aorta
All were deemed appropriate

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Results: Radimetrics Dose Monitoring

May 2014:

2 CTA Brain exams (> 70mGy threshold)
Both were deemed appropriate

9 Body exams (>50mGy threshold)
6 Coronary CTA, 3 Chest CTA
All were deemed appropriate

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Tips & Conclusions:

Monitoring of QC program needs to be consistent

- Even with remote monitoring, we had difficulties with compliance
- "Set it and forget it" may not work

Google Docs was easy to setup and implement

- The form and spreadsheet was created and implemented within a few weeks across all locations

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Tips & Findings:

Monitoring protocol changes and additions using an automated system can be effective.

Most results were due to name changes and added notes

Review Time ~ 2 hours per month

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Tips & Findings:

The Radimetrics software quickly identifies patients with high $CTDI_{vol}$ values.

- These need to be manually reviewed to confirm/validate reported $CTDI_{vol}$ values.

Review Time ~ 2-3 hours of data analysis, individual exam follow up and committee reporting

All identified high dose examinations to date have been deemed appropriate mostly because of scan type, i.e. perfusion and CTA , but also because of larger patient size

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Thanks for watching!

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