DEMONSTRATION OF THE NATIONAL QUALITY FORUM (NQF) PATIENT SAFETY MEASURE: RADIATION DOSE OF COMPUTED TOMOGRAPHY (CT)

JILLIAN KEEGAN
Contributors:

Jillian Keegan ¹
Pratik Mehta ¹
Kate MacGregor, MPH ¹
Choonsik Lee ²
Diana Miglioretti, PhD ³
Rebecca Smith-Bindman, MD ¹

¹ University of California, San Francisco. Radiology and Biomedical Imaging
² National Cancer Institute, Division of Cancer Epidemiology and Genetics, Radiation Epidemiology Branch
³ University of Washington, Seattle. Group Health Research Institute
Utilization of CT has risen sharply in the last two decades.

Recent studies show an unacceptable variation within and between institutions\textsuperscript{1,2}

Measures are needed to assess and compare dose across institutions to ensure doses are ALARA and that institutions limit the doses they use.
Background on The NQF measure

- NQF measure #0739, Radiation Dose of Computed Tomography (CT), is a simple method for compiling CT radiation dose using readily available information from the DICOM of any scanner.

- The data assembled per the NQF measure can be used to make comparisons within a facility over time, and across facilities, by assessing dose levels by equipment and by sex, age, and anatomic area.

- Benchmarks can be created if facilities share the data collected in a standardized format.
NQF Specifications

- Distribution in Volumetric Computed Tomography Dose Index (CTDlvvol) and Dose Length Product (DLP) for a minimum of 100 consecutive adult CT scans of the abdomen-pelvis, chest, head or lumbar spine (can summarize data on 1-4 anatomic areas)

- Distribution in CTDlvvol and DLP for a minimum of 50 consecutive Pediatric scans within age groups of the same anatomic areas.
You Can Compare Your Dose Information

- UCSF’s Radiology Outcomes Research Laboratory (RORL) has developed a website to allow facilities to upload their data and compare their doses to established dose reference levels and to those of other facilities.
- All facility level information is confidential and data is anonymized as soon as it is uploaded.
- Go to: www.rorl.radiology.ucsf.edu and view our Dose Registry page for more information.
Purpose of This Project

- Demonstrate the simplicity of the NQF CT dose measure using two methods
  - Manual collection of dose information using abstraction from the dose sheet in the Picture Archiving and Communications (PACS)
  - Automatic collection of dose information using dose analysis software (e.g., eXposure™ from Radimetrics)
- Summarize the results of two months of adult CT dose information from 2010 and 2012 from the University of California, San Francisco using the NQF format
Methods:

- Manual transcription from PACS: of accession number, age, date of scan, anatomic area, gender, CTDIvol, DLP, Total DLP from the dose sheet
- 600 patient scans were downloaded from eXposure;™ dose information included all of the above and $E_{(ICRP103)}$ and Size Specific Dose Estimate (SSDE) per AAPM TG204
- An anatomic area was assigned to each scan based on the study name
- Descriptive statistics were used to summarize the dose information using each method of data extraction
- For the paper all 4 anatomic areas were reviewed, but for this presentation, only abdomen/pelvis will be highlighted
Time to Collect Dose Data

- **Manual data collection**
  - 50 scan doses were collected in 2 hours and 15 minutes
  - Collecting 600 scans was estimated to take 27 hours of abstraction

- **Automatic data collection**
  - eXposure™ data collection through “dashboard” summaries
  - 600 scan doses were collected in a matter of minutes
Abdomen-Pelvis mean DLP was 1020 mGy-cm in 2010 and 676 mGy-cm in 2012, a 34% reduction in dose.
Results: Abdomen-Pelvis ED (ICRP103)

Abdomen-Pelvis mean $E_{103}$ was 17 mSv in 2010 and 11 mSv in 2012, a 35% reduction in dose.
Results: Abdomen-Pelvis CTDIvol

Abdomen-Pelvis mean CTDIvol was 13.15 mGy in 2010 and 9.12 mGy in 2012, a 31% reduction in dose.
Results: Abdomen-Pelvis SSDE

Abdomen-Pelvis mean SSDE was 17.05 mGy in 2010 and 10.75 mGy in 2012, a 37% reduction in dose.
CTDIvol vs. SSDE Abdomen-Pelvis

2010 SSDE

2010 CTDIvol

2012 SSDE

2012 CTDIvol
When describing the distribution in the doses used at this facility, the results were largely unchanged whether SSDE or CTDIvol was used as the measure:

median CTDIvol 7 mGy-cm and median SSDE 8 mGy-cm
Conclusions

- NQF measure is a useful and practical method for assessing CT doses
  - An individual can manually collect data in less than four workdays
  - Open source software can be used to assess dose
  - Dose metric software can be used to assess dose
- Facilities will be able to:
  - Assess successful dose reduction efforts
  - Compare their radiation dose distributions to national distributions
  - Assess temporal trends
- Greater dose awareness and potential for decreased doses
FACILITIES CAN UPLOAD THEIR DATA DURING THE FIRST 3 DAYS OF OUR VIRTUAL MEETING:

THE UNIVERSITY OF CALIFORNIA, SAN FRANCISCO WILL OFFER A VIRTUAL SYMPOSIUM IN RADIATION SAFETY FOR CT MAY 8-10, 2013

GO TO: HTTP://RORL.RADIOLOGY.UCSF.EDU
EMAIL: RORL@UCSF.EDU
OR CALL: (415) 502-1370 FOR MORE INFORMATION

RADIATION SAFETY IN CT
References


   http://www.qualityforum.org/MeasureDetails.aspx?actid=0&SubmissionId=221#k=0739

4. Size Specific Dose Estimate (SSDE) AAPM Task Group 204
   http://www.aapm.org/pubs/reports/rpt_204.pdf