Top Ten Actions a Physicist Can Take to Improve CT Imaging at Facilities They Support

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Outline

- Introduction/Context
- Funding appropriate physics support
- Top ten ways to support your CT practice (in no particular order)
- Summary/Conclusions

Author's context (bias?)

- Board-certified Diagnostic Medical Physicist
- Residency-trained
- Formerly a CT-orientated clinical physicist
- Currently lone diagnostic physicist at a tertiary-care hospital & clinic system w/ 3 CT scanners, 40K CT's annually
- Also RSO & support Mammo, Nuc Med, PET/CT, Nuc Card, & MRI – all accredited
- Fortunate to think about CT 1-2 hrs per week

CT Practice Context

- Modality accreditation becoming normalized
- Joint Commission expressing formal interest/concern with regard to CT
- Heightened awareness of radiation dose/risk issues
- Increased associated administrative costs
- Many sites seeing flat or decreasing CT exam volumes
- Minimum role of physicist now extending beyond annual site survey

Funding Appropriate Physics Support

- As CT administrative expenses rise & exam volumes potentially fall – how to address funding support?
- Answer: Directly. Lots of good ammunition:
  - The Joint Commission Sentinel Event Alert
  - Accreditation requirements
  - Image Gently / Image Wisely practice guidance
  - Popular/public press/interest in radiation dose/risk
- Reality: The standard of practice for CT has evolved to included more extensive (and costly) involvement by the physicist

Funding Appropriate Physics Support

From


The Joint Commission
Sentinel Event Alert

A complimentary publication of The Joint Commission

Issue 47, August 24, 2011

Radiation risks of diagnostic imaging

(The Joint Commission Sentinel Event Alert Issue 47, August 24, 2011)

As a result of the potential dangers … (CMS) will require the accreditation of facilities providing advanced imaging services in non-hospital, freestanding settings beginning January 1, 2012. In addition, the state of California has mandated that facilities that furnish CT X-ray services become accredited by July 1, 2013. In addition, in May, …(ACR) launched its National Radiology Data Registry (NRDR)…The fee-for-service registry includes a tool that can be used to target specific areas for improving practice.

Objective of the Top Ten List

- Present ideas that promote cost- & time-efficient support practices on the part of the physicist
- Identify a few primary reference sites from which a trove of useful CT tools will flow

#10 Know the stakeholders

- Techs
- Radiologists
- Administrators (departmental & institutional)
- Service engineers
- Vendor sales/technical support
- Referring physicians
- ER staff
- Patients

#9 Require a protocol book/documentation mechanism

- Storing protocols on a scanner is insufficient
- A book (hard or soft copy) is needed w/revision mechanism
- Resulting practice requirement – process to create, modify protocols
- QC requirement – Process to confirm book protocol matches scanner protocol
- Format idea? See Kofler, 2010 CT Dose Summit
  - Spreadsheet, database, or word proc. document formats all plausible

#9 continued: Require a protocol book/documentation mechanism

Example: Excel ss-based protocol. Single workbook per protocol / multiple acquisition phases within worksheet / multiple scanner models within workbook (tabbed)

	GE	GE	GE	GE
Scanner model	**16**	**16**	**16**	**16**
ACQUISTION PHASE	**1**	**2**	**3**	**4**
Protocol	Renal Mass			
revised	9/9/2011			
INDICATIONS	Renal mass evaluation			
PREP	NPO 2 hours prior			
SCOUT	AP & Lateral-Inspiration -S60-S500-kV120, mA 10-Feet first -Supine			
SCAN	Kidneys without	Kidneys w/30 sec delay	Abd/Pelvis w/90 sec delay	Kidneys w/ 3 min Delay
ORAL CONTRAST	None			
IV CONTRAST	None	Ultravist 300	Ultravist 300	Ultravist 300
dose | rate | delay		125cc/2.5cc/sec	125cc/2.5cc/sec	125cc/2.5cc/sec
Scan Instructions	Kidneys without	Kidneys w/30 sec delay	Abd/Pelvis w/90 sec delay	Kidneys w/ 3 min Delay
Scan Type	Helical	Helical	Helical	Helical
Rotation Time	0.8	0.8	0.8	0.8
Rotation Length	Full	Full	Full	Full
Det. Configuration	16	16	16	16
Pitch	1.375:1	1.375:1	1.375:1	1.375:1
Speed (mm/rot)	27.5	27.5	27.5	27.5
kVp	120	120	120	120
SFOV	Large Body	Large Body	Large Body	Large Body
mA	Auto	Auto	Auto	Auto
AutoMA min | max| NI	80/380/14	80/380/14	80/380/14	80/380/14
Breath-hold	Inspiration	Inspiration	Inspiration	Inspiration
Breath-time (s)				
Prep Delay (s)	0	30	Use Repeat series	Use Repeat Series
Min. Retro (mm)	1.25	1.25	1.25	1.25

#8 Read and understand the protocols

- Physicist/naïve review helps with specificity, consistency
- Scan parameters should use appropriate terminology, units, & order
- Sufficient information for a trained CT tech (from another site) to conduct the exam?

#7 Know CT dose & risk issues

- No excuse - Too many resources
- Make yourself available for consult with stakeholders - Suggest indirect provision of pt. contact information (ask tech to seek patients contact information and provide back to physicist)
  - Listen first to patient – identify their concerns
  - Be able to discuss CT dose & risk in varying degrees of detail & technicality – spell out units, abbreviations
- Become an institutional resource/expert on dose/risk

#7 continued Know CT dose & risk issues

- Resources
  - Image Wisely : www.imagewisely.org
  - Image Gently : www.imagegently.org
  - AAPM site with CT Dose Summit presentations:

    www.aapm.org/meetings/2010CTS

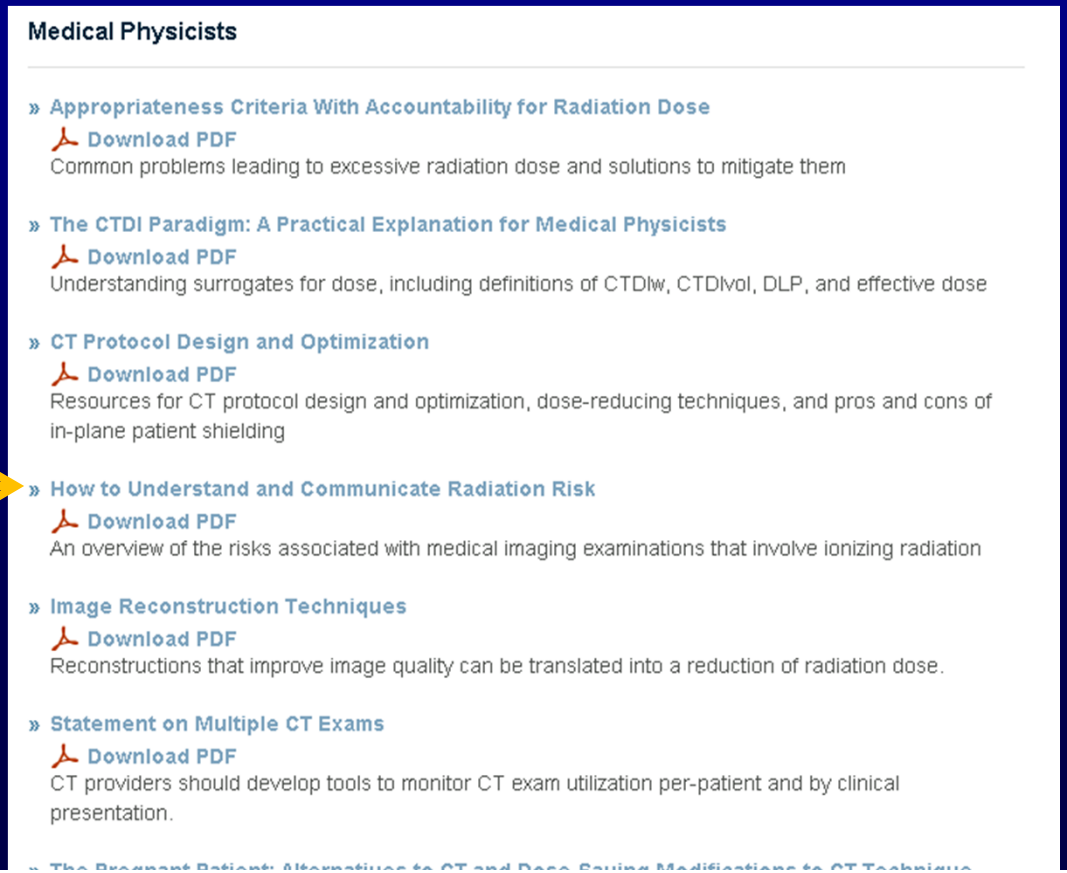
    www.aapm.org/meetings/2011CTS
  - ImpaCT: www.impactscan.org

#7 continued Know CT dose & risk issues

- Resources

  Example: Image Wisely (imagewisely.org)

  Home > Imaging Professionals > Medical Physicists >



Medical Physicists

» **Appropriateness Criteria With Accountability for Radiation Dose**
Download PDF
Common problems leading to excessive radiation dose and solutions to mitigate them

» **The CTDI Paradigm: A Practical Explanation for Medical Physicists**
Download PDF
Understanding surrogates for dose, including definitions of CTDIw, CTDIvol, DLP, and effective dose

» **CT Protocol Design and Optimization**
Download PDF
Resources for CT protocol design and optimization, dose-reducing techniques, and pros and cons of in-plane patient shielding

» **How to Understand and Communicate Radiation Risk**
Download PDF
An overview of the risks associated with medical imaging examinations that involve ionizing radiation

» **Image Reconstruction Techniques**
Download PDF
Reconstructions that improve image quality can be translated into a reduction of radiation dose.

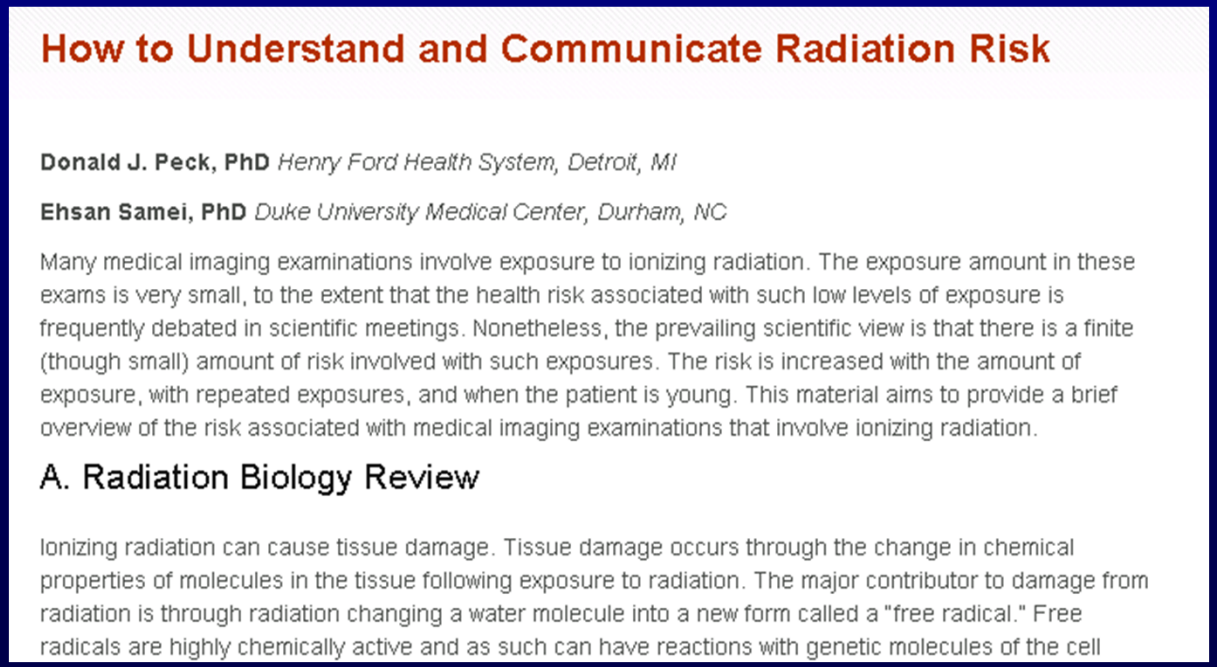
» **Statement on Multiple CT Exams**
Download PDF
CT providers should develop tools to monitor CT exam utilization per-patient and by clinical presentation.

#7 continued Know CT dose & risk issues

- Resources

  Example: Image Wisely (imagewisely.org)

  Home > Imaging Professionals > Medical Physicists > How



How to Understand and Communicate Radiation Risk

Donald J. Peck, PhD *Henry Ford Health System, Detroit, MI*

Ehsan Samei, PhD *Duke University Medical Center, Durham, NC*

Many medical imaging examinations involve exposure to ionizing radiation. The exposure amount in these exams is very small, to the extent that the health risk associated with such low levels of exposure is frequently debated in scientific meetings. Nonetheless, the prevailing scientific view is that there is a finite (though small) amount of risk involved with such exposures. The risk is increased with the amount of exposure, with repeated exposures, and when the patient is young. This material aims to provide a brief overview of the risk associated with medical imaging examinations that involve ionizing radiation.

A. Radiation Biology Review

Ionizing radiation can cause tissue damage. Tissue damage occurs through the change in chemical properties of molecules in the tissue following exposure to radiation. The major contributor to damage from radiation is through radiation changing a water molecule into a new form called a "free radical." Free radicals are highly chemically active and as such can have reactions with genetic molecules of the cell

#6 Review the CT training curriculum for techs

- Most state CT regulations require that technologists receive CT-specific and site-specific training
- The physicist (staff or consultant) is well-suited to facilitate the creation/upkeep of CT-specific & site-specific content
- CT-specific content areas? Check the ARRT CT Certification website:

  www.arrt.org/Certification/Computed-Tomography

- Site-specific content? State regulations, Local qc procedures, vendor-specific features/capabilities (i.e. how does CT dose-modulation work?, etc.)

#5 Be expert in accreditation issues

From the "ACR CT Accreditation FAQ's"

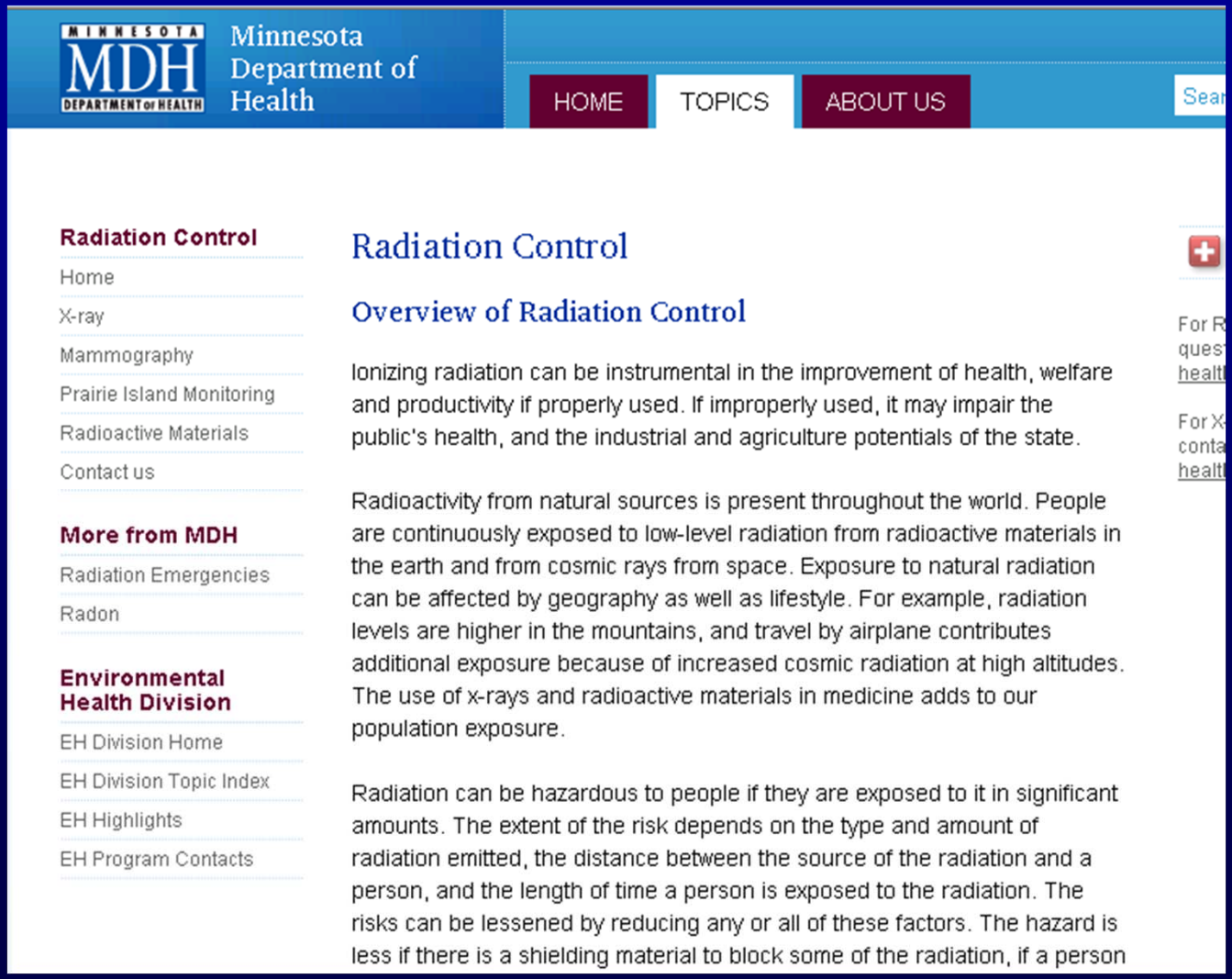
Q. My facility has never applied for accreditation before, and would like to become ACR Accredited for Computed Tomography. How do we get started?

A. Start by reading the following documents, available on the ACR website:

- The Diagnostic Modality Accreditation Program Overview
- The ACR CT Accreditation Program Requirements
- The ACR CT Accreditation Clinical Image Quality Guide
- The ACR CT Accreditation Testing Instructions
- The ACR CT Accreditation Phantom Testing Instructions
- The ACR CT Accreditation Toolkit for Site Visits (FZ addition to list)

Details of accreditation programs vary among modalities,
→ read the CT-specific documents

#4 Know your state regs & participate in their development



#3 Know your scanners

- Who uses them & refers to them
  - Radiology, inpt vs outpt, Cardiology, ER (Trauma Center), ICU's, in-network vs. out of network referral
- What manufacturer (interface), features
- Where are they located
- When were they installed, anticipated end of life, replacement plans
- How are they utilized – general purpose, specialized practice, interventional, quantitative CT, …

#2 Know & empower your radiologist colleagues

From *The ACR CT Accreditation Program Requirements*

In addition, all physicians interpreting CT examinations must:

- Have completed an accredited diagnostic radiology residency or 80 hours of documented, relevant classroom instruction including diagnostic radiology and radiation safety physics. Otherwise, physicians must demonstrate training in the principles of radiation protection, the hazards of radiation exposure to both patients and radiological personnel, and appropriate monitoring requirements.
- Be thoroughly acquainted with the many morphologic and pathophysiologic manifestations and artifacts demonstrated on computed tomography. Additionally, supervising physicians should have appropriate knowledge of alternative imaging methods.
- Be knowledgeable of patient preparation, and training in the recognition/treatment of adverse effects of contrast materials[8] for these studies.
- Be responsible for reviewing all indications for the examination; specifying the use, dosage, and rate of administration of contrast agents[8], specifying the imaging technique, including appropriate windowing and leveling; interpreting images; generating written reports; and maintaining the quality of both the images and interpretations.
- Be familiar with the meaning and importance to the practice of CT of: total radiation dose to the patient, exposure factors, conscious sedation principles that are performed in the practice, and post-processing techniques and image manipulation on work stations.

#1 Fiercely resist the urge to do original work

- ***Certain present company excepted!***
- With accreditation, voluntary best-standards, regulatory scrutiny, & general public radiation risk concern…

  Resources multiply:

  Image Gently, Image Wisely, CT Dose Summit presentations, ACR accreditation guidance,…
- We need high-quality, comprehensive resources
  - ➔ Support "Centers of Excellence" = Productive Clinical Research Sites & utilize their work-product with appropriate acknowledgement
  - ➔ When original work is appropriate, endeavor to share it
- Using available resources = Time & cost efficiency

Reference Sites

- Image Wisely : www.imagewisely.org
- Image Gently : www.imagegently.org
- AAPM site with CT Dose Summit presentations:

  www.aapm.org/meetings/2010CTS

  www.aapm.org/meetings/2011CTS
- ImPACT:

  www.impactscan.org
- ACR Accreditation Resources:

  www.acr.org
- *The Joint Commission Sentinel Event Alert*, Issue 47, August 24, 2011

Summary/Conclusions

- Necessity, frequency, & cost of physics support likely increasing
- Seek efficiency by utilizing available, high quality resources
- Know your people, scanners, & stakeholders