



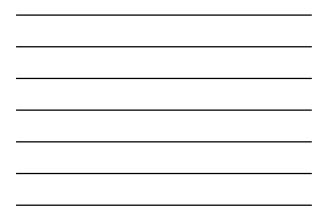
History (jumping ahead a little)

Media attention resurfaces periodically

2004 CT Scan Radiation	n Risks?
2005 2006 2007 Ele Streight Eimes	n CT Scans: A Call for Patient- vitws - occusers 12, 2005 CT Scans: A Radioactive Risk
New Focus on Dargers of CT Scans New Focus on Dargers of CT Scans 20100 Image: Scans 20110 Image: Scans 20111 Ev.Sta ljek films 20112 CT Scans larnsse films 'Lander's Lander Kink, Sta	How Dangerous Are CT Scans? Common International 2000 Push to Curb CT Scans Research and a conting numbers are subjected to radioactive CT scans I = 1000 Minute Scans
2013 2014 2014 2015 2016 Could CT scans cause ca	To Scan or Not to Scan: Largest Study to Date Links Childhood CTs to Increased Cancer Risk to The Market Control CTs of Control Control ConsumerReports International Control Control Control The cancer risk that lurks in your hospital Unnecessary CT scans are for to common in U.S.

History (jumping ahead a little)





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History

▶ 2002

- ACR introduces CT accreditation program
- Voluntary
 - QC and dose measurements with tolerances – Adult and pediatric

ACR

image gently®

- "National" (not state-specific)
- Not the first modality program (BI, US, MR, NM)

2008

- Image Gently launched
 - Alliance to improve safe and effective imaging care of children worldwide
 - Promotes peds specific techniques
 - Voluntary (pledge, no testing requirements)

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History

- 2008 (continued)
 - Medicare* Improvements for Patients and Providers Act (MIPPA) approved
 - All nonhospital suppliers of CT, NM, MR, and PET services must be accredited
 - Physicians and staff maintain training and education
 - Strict standards of performance and safety
 - $-\operatorname{Establish}$ and maintain a QA program
 - Medicare reimbursement of technical component
 - Effective Jan. 1, 2012

*Medicare: A federal health insurance program for people who are 65 or older, certain younger people with disabilities, and people with End-Stage Renal Disease (dialysis or transplant patients).

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History

2009

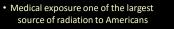
- United Healthcare* mandates accreditation
 - Outpatient CT, MR, PET, NM
 - Required for reimbursement of technical component
 - ACR, IAC (Intersocietal Accreditation Commission) – ACR has dose limits
 - IAC compares dose to reference (but no limits)
 - Sets stage for other insurers

*United Healthcare: Very large insurance provider. Covers 45 million individuals worldwide. Q1 2015 revenue: \$32.6 billion.

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History

- 2009 (continued)
 - NCRP* Report 160: "Ionizing Radiation Exposure of the Population of the United States"



• CT is largest source of medical exposure



*National Council on Radiation Protection and Measurements. Chartered by US congress (1964). Collect, analyze, and disseminate information and recommendations on radiation protection.

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History

▶ 2010

- Image Wisely launched
 Campaign for lowering doses in adult medical imaging
- Radiation Safety in Adult Medical Imaging

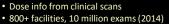
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REGISTRY

▶ 2011

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ACR CT Dose Index Registry opens



- 2012
- AAPM posts scan protocols for selected exams
 - Includes reasonable CTDI-vol ranges
 - 7 protocols to date (2016)
 - Other dose educational tools



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History

2012 (continued)

- CMS* requires CT accreditation for reimbursement
 - MIPPA (2008) takes effect
 - ACR, IAC, and the Joint Commission
 - -JC added in 2010
 - Compare doses to reference (no threshold)
 - Other private insurers also begin to mandate accreditation

*Centers for Medicare & Medicaid Services. Manages Medicare, Medicaid (and other programs). 1 in 3 Americans enrolled in one of these programs.

History

- 2012 (continued)
 - California State law (SB 1237) becomes effective
 Strict CT dose reporting requirements
 - Accreditation mandatory after Jan., 2013
 - Several States have since followed suit
 Requiring accreditation
 - and/or
 - Stricter dose reporting

*Centers for Medicare & Medicaid Services. Manages Medicare, Medicaid (and other programs). 1 in 3 Americans enrolled in one of these programs.

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History ► 2013

- NEMA Standard XR-29 developed
 - DICOM Radiation Dose Structured Report – Recording more detailed dose info
 - CT Dose Check (Notifications and Alerts)
 - Automatic Exposure Control (AEC)
 - Pediatric and Adult Reference Protocols — Pre-loaded in scanners

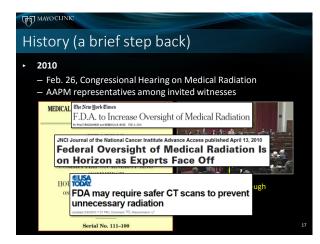
*National Electrical Manufactures Association. "The authoritative representative of the collective interests of the electrical and medical imaging industries." (Vision statement, NEMA.org)

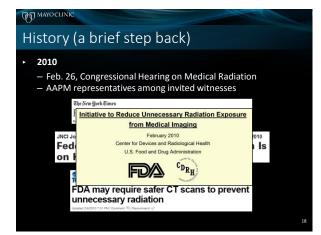
тямиосимс History (a brief step back)

2009-2011 (multiple sites)

After Stroke Scans, Patients Face Serie	ous Health Risks				
Dymet 1012000 Double, 1 milling 1 free Double Dymet 10200000	Doctors 'Shocked' by Radiation Overexposure at				
When Alain Reyer's hair suddenly fell out in a freakish hard o his head, he was not the only one worried about his health. H	"Codare-Sinai				
workers at a shipping company avoid west Virgi	inia Hospital Overradiated Brain Scan				
	Records Show				
what h physics Published; March 5, 20					
received a track at a hospital in	autor a second sec				
EDA Identifies	FDA Identifies More CT Scan Problems with Dangerous Radiation Levels				
	er 8th, 2009 • No Comments				
Huntsville Hospital Responds To Cases Of Radiatio					
Joseph Medical Overe	exposure Through CT Scans				
dozens more at a	Anber Stuet V441T Reporter				
pet off an investig	6 64 p.m. CS7, December 5, 2009 ⊠ E-mail				
Administration it yet lightly regula	Chan Be the first of your friends to like this.				
Hat has in patients who received excessive radiatic	2 00000				
provide a final re					







History (a brief step back)



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History

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History

▶ 2014

- Congress passes Protecting Access to Medicare Act, among other things, includes...
 - Scanners must meet NEMA Standard XR-29 — Reduced reimbursement for non-compliance
 - » 5% by 2016, 15% by 2017
 - May require scanner upgrade (or new scanner)
 » Not necessarily free or inexpensive
 - Applies to Medicare outpatients
 BRILLIANT!

2

WANNOCLINIC History So here we are... No laws directly related to CT dose Laws affecting reimbursement for government insurance CT scanner dose features CT Accreditation Some states laws require... CT Accreditation Stricter CT dose reporting Private insurance companies mandating CT accreditation

- Resources and encouragement from many professional
- organizations for CT dose optimization



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One thing to think about...

State laws

- Proposals drafted with (hopefully) input from physicists
- Public vetting/feedback process
- Can "Shut you down" (warnings, fines, more likely)
- ► ACR accreditation
 - Rules determined by small committee of mostly physicists
 - No open vetting/feedback process
 - Can't "shut you down" if you don't comply but...
 - Other consequences (from insurers and/or State)
- The Joint Commission
 - Consult with physicists (1 physicist now employed)
 - Open feedback period
 - Can't "shut you down" if you don't comply

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Motivation

Does the question "Does CT dose REALLY matter?" REALLY matter in the US?

CT dose only REALLY matters if don't want...

- Patients to think you don't care about giving them cancer! (Perception)
- To operate illegally (at least in some states)! (Politics)
- To lose money and go out of business! (Money)

Is this bad?

Mayoclinic Motivation

CT dose only **REALLY** matters if don't want...

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Motivation

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- To operate illegally (at least in some states)! (Politics)
- To lose money and go out of business! (Money)

Is this bad?

Not as long as emphasis is on the importance of a diagnostic CT exam. Too low of dose is as bad, or worse, than too high of dose!

What happened to the science consideration?

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Motivation

What happened to the science consideration?

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Motivation

What happened to the science consideration?

It's there, just not as relevant anymore!

- Risks will most likely always be in question
- Public perception not likely to change much (any time soon)
- "Goal" has been defined—less dose

We must be active in all CT dose-related discussions with regulators and accreditors (and others) to maintain a checks-and-balance in the clinical, practical, and safety aspects of any proposals

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US Dose Reduction/Optimization in CT

Standard List

- Limit scan range to only what is needed
- Technique charts (when AEC not available)
- Automatic Exposure Control (AEC)
 Different implementations by vendor

 Some more effective with AEC technique charts
- Reduce technique in small steps
- Auto-kV
 - · Best with small patients with contrast agent

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US Dose Reduction/Optimization in CT

Standard List (continued)

- Tailored exams for specific indications
 e.g. follow-up renal stone
- Reduced dose phases for multi-phase exams
 - Or eliminate phases if possibleDual Energy virtual non-contrast
- Iterative Reconstruction
- De-noising software
- Other scanner featuresDynamic collimation, etc.

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Towards the Future

- Continued reduction as US ratchets down doses
 - Practice improvements
 Continued implementation of standard techniques
 - Technology improvementsDetectors, processing, etc.
 - Updating of current dose thresholds/references to reflect decreasing doses
 Need to be cautious regulations and requirements don't
 - spiral (or helical?) beyond reason.
- More regulations? Convergence?

