

Increasing role of medical physicist in radiation protection

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2

Medical Physicist in Radiology

1980's

- Who???
- What can he/she do?

2013

- Where is he/she??
- Fluoroscopy in
 - Cardiology
 - Electro-physiology
 - Vascular surgery
 - Urology
 - Gastroenterology
 - Orthopedic surgery
 -
- Radiotherapy
- Nuclear Medicine

3

1980's

- Radiation safety was important but was dominated by occupational radiation protection,
- Reached level of good control

How many were concerned about dose monitoring to patients?

- ?????
- Very few



What could happen to patients? No skin injuries.
Theoretical risk of cancer

Rehani_Slovenia

5

1990s: A series skin injuries among patients undergoing interventional procedures



6

1990s

- **Skin injuries in interventional procedures:**
Provided medical physicists new directions to develop expertise in patient dosimetry and dose management.

AJR issue with many articles & Editorial



Brenner, Lee Rogers, Paterson, Donolly, Nickoloff, Haaga

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2000s

- **Cancer risk in children: Provided medical physicists another directions to develop expertise in patient dosimetry and dose management.**
- **Brought radiation risks in public domain and created challenging situations for medical physicists.**

Era on ATTENTION to dose in CT

Manufacturers vying with each other on Radiation Dose

10

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National Cancer Institute
at the National Institutes of Health

We Can Answer Your Questions
1-800-4-CANCER

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NATIONAL CANCER INSTITUTE
FactSheet
In English / En español

Computed Tomography (CT) Scans and Cancer

Key Points

- Computed tomography (CT) is an imaging procedure that uses special x-ray equipment to create a series of detailed pictures, or scans, of areas inside the body. It is also called computerized tomography and computerized axial tomography (CAT) scanning.
- In cancer, CT may be used to help detect abnormal growths; to help diagnose tumors; to provide information about the extent, or stage, of disease; to help in guiding biopsy procedures or in planning treatment; to determine whether a cancer is responding to treatment; and to monitor for recurrence.
- Although CT is an important tool in medicine, it has the potential—like other sources of ionizing radiation—to cause cancer. People should discuss the risks and benefits of CT with their doctors.

1. What is computed tomography?

Computed tomography (CT) is an imaging procedure that uses special x-ray equipment to create detailed pictures, or scans, of areas inside the body. It is also called computerized tomography and computerized axial tomography (CAT).

Reviewed: 07/15/2

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11



Let's beat cancer sooner

HOME ABOUT CANCER SUPPORT US OUR RESEARCH FUNDING FOR RESEARCH

Home > CancerHelp > Cancers in general > Tests > CT scan

+ What is cancer

- Tests

Barium X-ray
Blood tests
Bone marrow
Bone scan

CT scan

This page tells you about CT scans. There is information about

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12

Energy research

CT SAFETY AND EFFICACY

Safety and Efficacy of Computed Tomography (CT): A Broad Perspective

Computed tomography (CT), sometimes called a CAT scan, can provide highly detailed medical diagnosis with a relatively high exposure of patients to radiation. This project will undertake research that will prod health care.

Balancing safety, clinical need and cost

CT uses special X-ray equipment to obtain multiple images of the body from different angles, which are then combined to produce a 3D image. This technique is associated with relatively high radiation exposure for patients, accounting for 30-40% of the of all X-ray examinations undertaken. New developments in CT, in particular the introduction of sub-second protection, CT now enables large volumes to be scanned and the same body part to be scanned several times.

The project consortium will perform original research from which practical guidelines for safety and efficacy standards in Europe in relation to the justification and optimisation of use of CT, thereby contributing to specific clinical problems, taking into account the efficacy, (radiation) safety and costs of CT and alternative diagnostic sensitivity with an associated radiation exposure to the patient that is as low as is reasonably achievable automatic exposure control for certain CT procedures.

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13

FDA U.S. Food and Drug Administration
Protecting and Promoting Your Health

Home Food Drugs Medical Devices Radiation-Emitting Products Vaccines, Blood & Biologics Animal & Veterinary

Radiation-Emitting Products

Home > Radiation-Emitting Products > Radiation-Emitting Products and Procedures > Medical Imaging > Medical X-ray Imaging

Radiation-Emitting Products and Procedures

- Medical Imaging
- Medical X-ray Imaging
- Radiography
- Computed Tomography (CT)**
- Dental Cone-beam Computed Tomography
- Fluoroscopy

Computed Tomography (CT)

- Description
- Uses
- Risks/Benefits
- Information for Patients and Parents
- Information for Health Care Providers
 - Information for the referring physician—exam justification: CT scan
 - Information for the imaging team—optimization
- Information for Industry: CT Manufacturers and Assemblers
- Reporting Problems to the FDA

14

CT in News

1. Higher doses to children (2001)
2. Cancer risks from CT (2002-2007)

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15

Over-utilization of CT

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16

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October 2010
Volume 257, Issue 1

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Special Reports

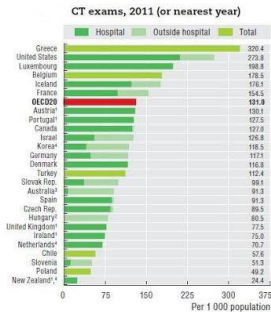
Addressing Overutilization in Medical Imaging

William R. Hendee, PhD, Gary J. Becker, MD, James P. Borgstede, MD, Jennifer Bosma, PhD, William J. Casarella, MD, Beth A. Erickson, MD, C. Douglas Maynard, MD, James H. Thrall, MD, and Paul E. Wallner, DO

¹From the Departments of Radiology (W.R.H.), Radiation Oncology (W.R.H., B.A.E.), Biophysics (W.R.H.), and Population Health (W.R.H.), M College of Wisconsin, 8701 W Watertown Plank Rd, Milwaukee, WI 53226-4801; American Board of Radiology, Tucson, Ariz (G.J.B.); Depart Radiology, University of Colorado, Denver, Colo (J.P.B.); American Board of Radiology Foundation, Tucson, Ariz (J.B.); Department of Radiol

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17



1. Exams outside hospital not included.
2. Exams in hospital not included.
3. Exams on public patients not included.
4. Exams privately-funded not included.

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18

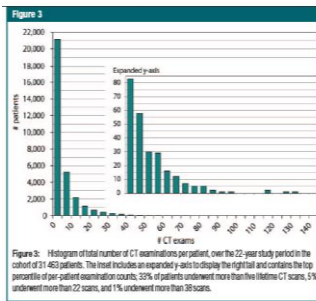
CT in News

1. Higher doses to children (2001)
2. Cancer risks from CT (2002-2007-.....)
3. Over-utilization of CT (2007-.....)

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19

Number of CT Examinations



31,500 patients
190,712 CT examinations
22 year period

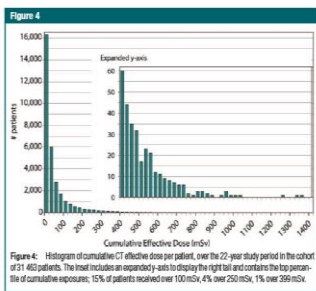
- 33%: ≥ 5 CT exams
- 5%: 22-132 exams

Sodickson et al.
Radiology 251; 175-184,
2009

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20

Estimated Cumulative Dose



- 15%, ED > 100 mSv
- 4%, 250 -1375 mSv
- 1% >399 mSv

Sodickson et al.
Radiology 251; 175-184,
2009

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21

CT in News

1. Higher doses to children (2001)
2. Cancer risks from CT (2002-2007-....)
3. Over-utilization of CT (2007-.....)
4. Individual patient dose ≥ 100 mSv

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22

1972-2007=35 years



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23

**CT Machines were most
well behaved ones for 35
years**



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24

Right or WRONG, accidents drive safety

Take action before forced

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Till skin injuries were
reported, there was
talk about **CT dose
reduction,**
but **no hype or fear**

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26

Another Era started
Patients/parents
Public

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27

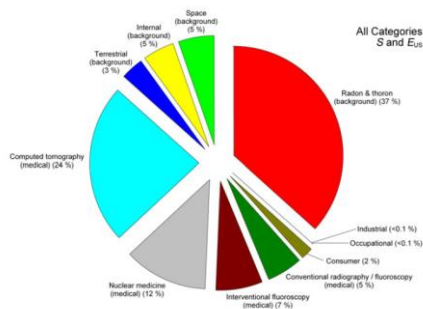
- The increasing publications in journals,
- Recent changes in Safety Standards,
- California law,
- Increase responsibilities of medical physicists in patient protection.

Medical physics
without radiation?

Medical Physicists

- Number of Medical Physicists in the world: ~18 500
- Mean concentration: ~2.7 per million population
- In developed countries: (~15 –20) per million population
- In developing countries: (~0 –5) per million population

Medical exposure: Largest Source



31

Duties and Responsibilities

- Facility design
- Defining the technical specification of the equipment
- Establishing procedures, equipment quality assurance
- Radiological protection of the patient and (often) the workers
- Standards and regulations on radiation safety require MP
- MP Jobs in many countries are created on strength of radiation safety requirements

Core Tasks: Diagnostic Medical Physicist

- QA (on site),
- QA (analysis and reporting),
- Optimisation: troubleshooting protocols flagged by users,
- Optimisation: troubleshooting protocols flagged by dose audit, dose audit/calculation, acceptance/commissioning of systems, acceptance/commissioning of component e.g. x-ray tube/detector,
- Optimisation: setting up exposure protocols, examination of newly installed equipment for the purposes of ensuring the safety features and warning devices operate correctly and there is sufficient protection provided, together with other support/advice

Other activities: Diagnostic Medical Physicist

- Advising on and reviewing
- clinical research studies,
- delivering teaching and training,
- research and development,
- radiation protection for new installations,
- audit of facilities for regulatory compliance,
- review of personal monitoring,
- testing protocol development and management.

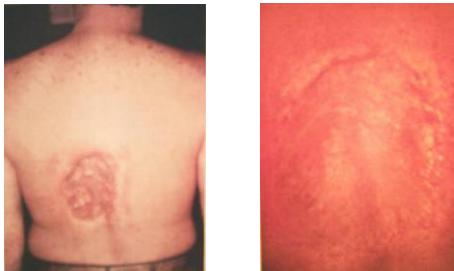
Almost a thing of past for staff in
medical



Color??

35

But this is IN



36 36

Changing scenario

1980's

- QC/QA



2010's

- Patient dose assessment
- Dose management
 - Actual
 - Training



37

Then & Now

1980's

- Regulatory



2010's

- Regulatory requirements
- Work requirements



38

Competition

Radiology

- Ultrasound
- Radiography
- CT
- Interventional



Medical Physics

- QC
- Dosimetry
- Safety



Problem: Lack of enough competition

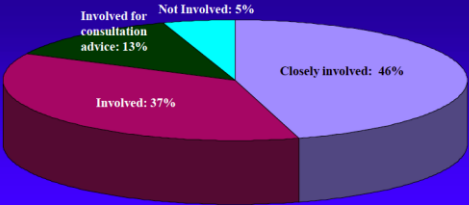
39

TYPICAL SALARY RANGES FOR MASTERS DEGREES-NO CERTIFICATION

	Median Yrs		Primary Income					Total Income				
	Number	Exper	Average	20th	Median	80th		Average	20th	Median	80th	
Overall	264	4	125.8	96.0	120.0	150.0		128.4	96.0	120.0	150.0	
Sex												
Male	184	4	129.8	100.0	120.0	160.0		132.8	100.0	122.8	160.0	
Female	80	4	116.6	87.0	115.0	134.6		118.3	87.0	115.0	136.5	
Type of Position												
Primarily Clinical	226	4	124.2	95.4	120.0	144.6		126.1	95.4	120.0	147.1	
Primarily Academic	*	*	*	*	*	*		*	*	*	*	
Primarily Administrative	7	18	157.9					184.7				
Primarily Regulatory & Standards	11	12	128.9					128.9				
Primarily Prof. Res. Dev. & Mgmt	10	8	126.0					126.0				
Primarily Application Specialist	*	*	*	*	*	*		*	*	*	*	
Primary Employment												
Private or Community Hospital	75	4	135.0	110.0	130.0	161.2		140.1	110.0	131.0	163.6	
Government Hospital	8	4	109.1					109.1				
Med School or Univ Hospital	39	4	115.4	95.0	116.0	130.0		119.6	95.0	120.0	140.0	
College or University	*	*	*	*	*	*		*	*	*	*	
Government (non-hospital)	*	*	*	*	*	*		*	*	*	*	
Medical Physics Service Group	58	4	108.6	90.0	107.7	130.0		109.0	90.0	107.7	130.0	
Medical (physician's) Group	17	6	152.5	111.2	130.5	203.7		157.2	112.5	130.5	226.0	
Industrial or Commercial Firm	15	12	131.4	115.4	130.0	163.4		131.4	115.4	130.0	163.4	
Cancer Center	39	4	125.6	94.5	120.2	155.0		126.5	94.5	120.2	155.0	
Primary Discipline												
Radiation Oncology	191	4	128.9	105.5	120.8	150.0		130.9	105.5	123.0	150.6	
Diagnostic Radiology	53	4	112.7	75.0	110.8	130.2		116.0	75.0	111.0	137.5	
Nuclear Medicine	*	*	*	*	*	*		*	*	*	*	
Magnetic Resonance	*	*	*	*	*	*		*	*	*	*	
Radiation Health Physics	11	11	116.2					124.4				
Engineering	*	*	*	*	*	*		*	*	*	*	
Ultrasound	*	*	*	*	*	*		*	*	*	*	
Administrative	*	*	*	*	*	*		*	*	*	*	

MPs level of involvement

Training of practitioners and other staff in relevant aspects of radiation protection



Medical Physicists in Radiation Protection



Future

- In coming years medical radiation protection may emerge as a specialty
- Already IAEA has a separate RPOP Unit
- Challenge to deal with

Thank You



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