Increasing role of medical physicist in radiation protection

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Medical Physicist in Radiology

1980's

- Who???
- What can he/she do?
- Radiotherapy
- Nuclear Medicine

2013

- Where is he/she??
- Fluoroscopy in
  - Cardiology
  - Electro-physiology
  - Vascular surgery
  - Urology
  - Gastroenterology
  - Orthopedic surgery
  - ……..

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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

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

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

USA TODAY

Let the hype begin

Super Bowl

The Golden Globes

'Gladiator' wins best drama film

Monday, January 22, 2001

Newsline

CT scans in children linked to cancer later

usatoday.com's new look

Asia stocks mixed overnight

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

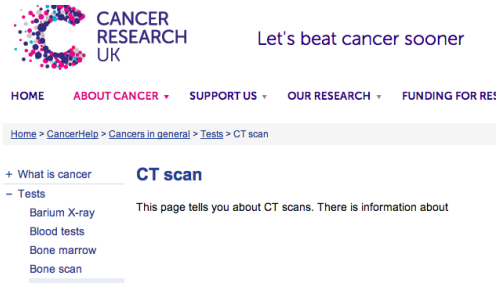
Rehani. Abu Dhabi

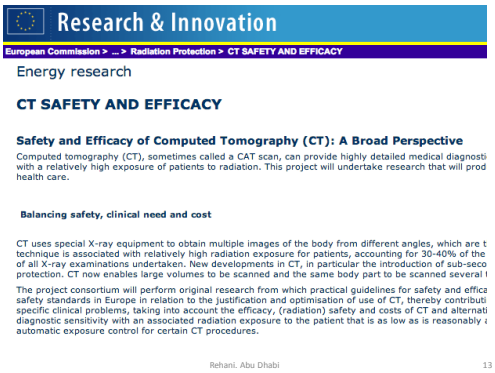
2000s

- **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





CT in News

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

Over-utilization of CT

Radiology

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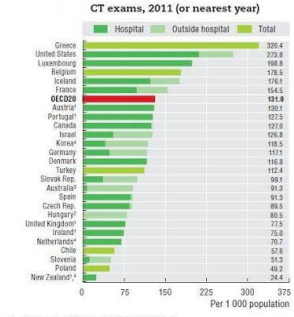
Original Research
Special Reports

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

[1]From 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.), Me College of Wisconsin, 8701 W Watertown Plank Rd, Milwaukee, WI 53226-4801; American Board of Radiology, Tucson, Ariz (G.J.B.); Departm Radiology, University of Colorado, Denver, Colo (J.P.B.); American Board of Radiology Foundation, Tucson, Ariz (J.B.); Department of Radiol



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.

CT in News

1. Higher doses to children (2001)
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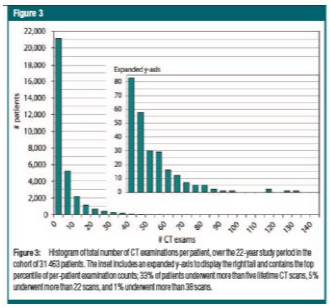
Number of CT Examinations

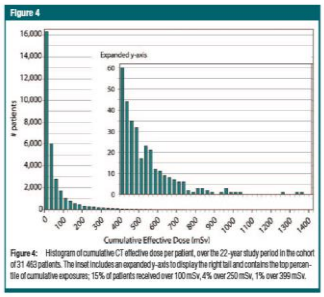


31,500 patients
190,712 CT examinations
22 year period

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

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

Estimated Cumulative Dose



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

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

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**

1972-2007=35 years

CT Machines were most well behaved ones for 35 years

Right or WRONG, accidents drive safety

Take action before forced

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

Another Era started
Patients/parents
Public

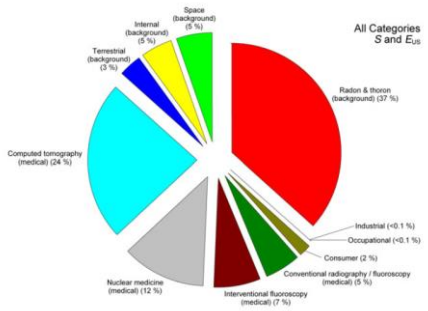
- **The increasing publications in journals,**
- **Recent changes in Safety Standards,**
- **California law,**
- **Increase responsibilities of medical physicists in patient protection.**

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



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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

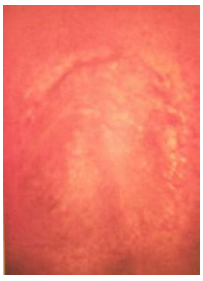
- **Advising on and reviewing**
- **clinical research studies,**
- **delivering teaching and training,**
- **research and development,**
- **radiation protection for new installations,**
- **audit of facilities for regulatory compliance,**
- **review of personal monitoring,**
- **testing protocol development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

Almost a thing of past for staff in medical

Color??

35

But this is IN



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Changing scenario

1980's

- QC/QA

2010's

- Patient dose assessment
- Dose management
  - Actual
  - Training

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Then & Now

1980's

- Regulatory

2010's

- Regulatory requirements
- Work requirements

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Competition

Radiology

- Ultrasound
- Radiography
- CT
- Interventional

Medical Physics

- QC
- Dosimetry
- Safety

Problem: Lack of enough competition

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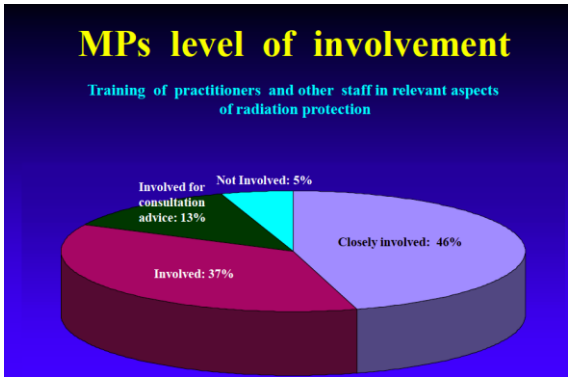
TYPICAL SALARY RANGES FOR MASTERS DEGREES-NO CERTIFICATION

			Primary Income				Total Income			
				Percentiles				Percentiles		
	Number	Median Yrs 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 Proj 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	*	*	*	*	*	*	*	*	*	*
Rad Safety/Health Physics	11	11	116.2				124.4			
Engineering	*	*	*	*	*	*	*	*	*	*
Ultrasound	*	*	*	*	*	*	*	*	*	*
Administrative	*	*	*	*	*	*	*	*	*	*



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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