Ionizing Radiation Exposure of the Population of the United States

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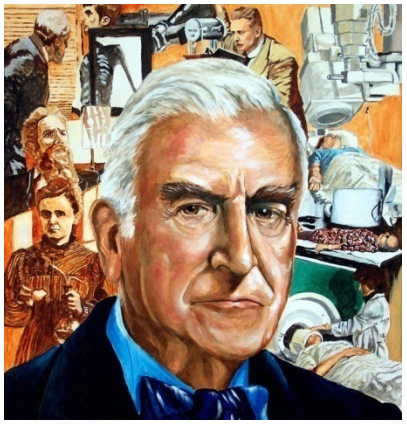
Executive Director

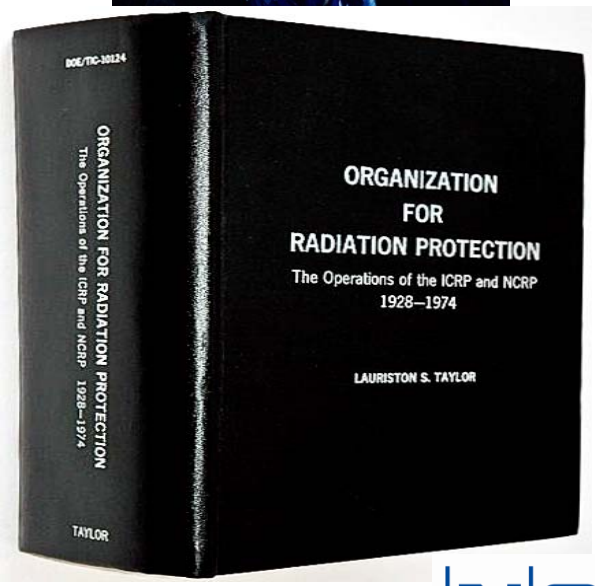
Key Dates in NCRP's History

1929: U.S. Advisory Committee on X-ray and Radium Protection

1946: U.S. National Committee on Radiation Protection

1964: National Council on Radiation Protection and Measurements (NCRP) chartered by U.S. Congress (Public Law 88-376)





NCRP Scientific Authority Since 1929

Key Elements of NCRP's Charter Under U.S. Public Law 88-376

Cornerstones of role in radiation health protection:

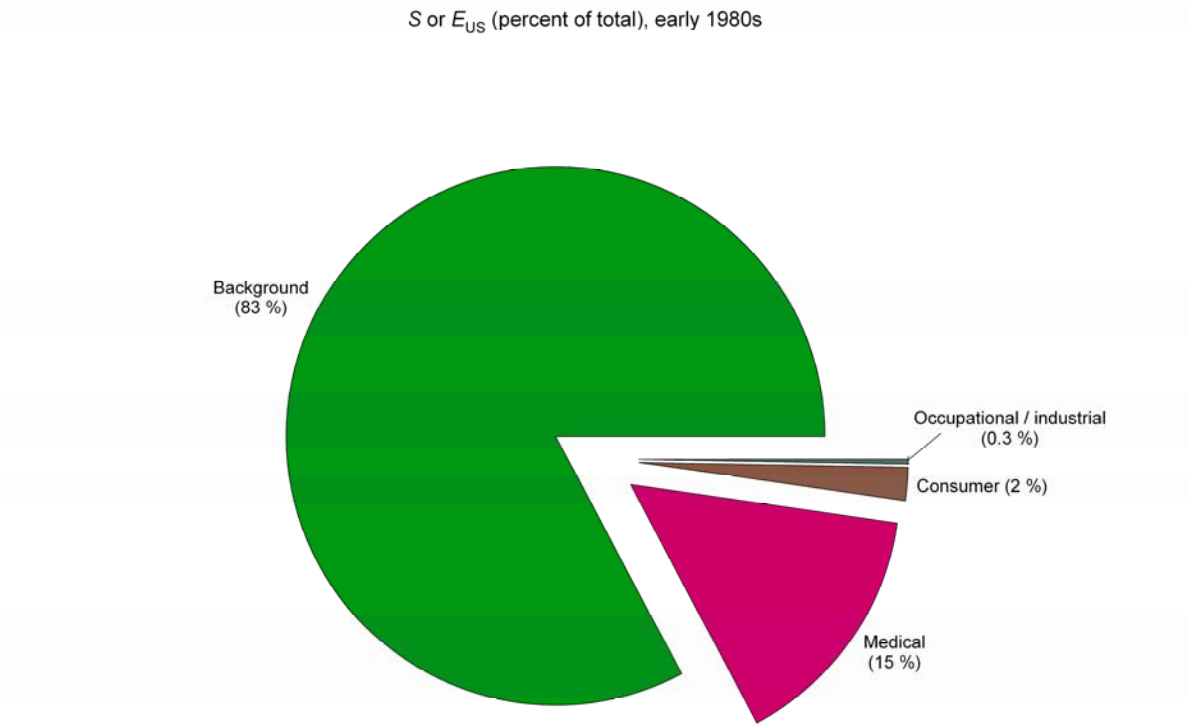
1) *Collect and analyze* information and recommendations in the public interest about:
   a) protection against radiation; and
   b) radiation measurements, quantities and units.
2) *Develop* basic concepts of radiation protection;
3) *Facilitate* effective use of combined resources of organizations concerned with radiation protection; and
4) *Cooperate* with national and international governmental and private organizations; and
5) *Disseminate* the Council's work.

Outline

- Overview of NCRP Reports on Population Dose in the United States
- Medical Exposures of Patients
  - Computed Tomography
  - Conventional Radiography and Fluoroscopy
  - Interventional Fluoroscopy
  - Nuclear Medicine
- Occupational Exposure from Medical Procedures
- Summary

Overview

NCRP Report No. 93 (1987): Exposure of the U.S. population to ionizing radiation as of the early 1980s.



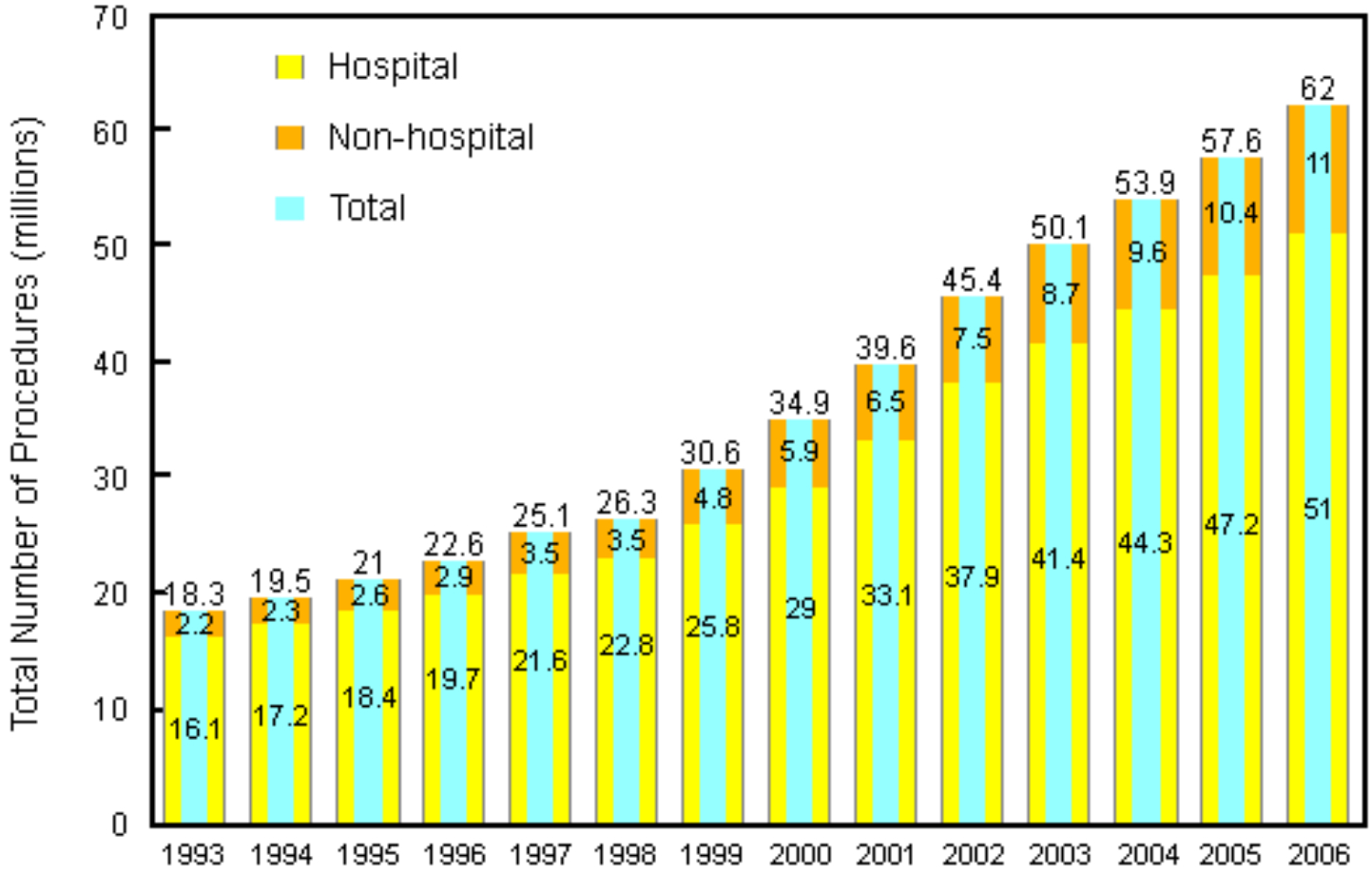
Overview

- NCRP Report No. 160 (2009) Exposure of the U.S. population in 2006
  - Main source of data on the estimates of the number of procedures:
    - commercial market benchmark reports by IMV
    - reports were supplemented by Medicare, Veterans Administration and a Large National Employer Plan.

Overview

- NCRP Report No. 160 (2009), cont.
  - Effective doses for procedures were derived by a variety of methods, each of which is described in the respective discussion for the subcategories of medical exposure.
    - CT, data on dose length product and age and body region specific conversion coefficients were utilized;
    - conventional radiography and fluoroscopy, a published survey of effective dose was applied;
    - interventional fluoroscopy, data on *KAP* and protocol specific dose conversion coefficients were utilized; and
    - nuclear medicine, data on dose conversion coefficients expressed as effective dose per unit administered activity were utilized.
  - Data reported as:
    - collective effective dose (S) (person-Sv);
    - and effective dose per individual in the U.S. population (E_{US}) (mSv).

Computed Tomography



Computed Tomography

Category	Effective Dose per Scan (mSv)
Head	2
Chest	7
Abdomen & pelvis	10
Extremity	0.1
Virtual colonography	10
Whole-body screening	10
Calcium scoring	2
Angiography – Head	5
Angiography – Heart	20

Computed Tomography

Categories	Scans (%)	S (person-Sv)	S (%)
Head	28.4	38,044	8.7
Chest	15.9	74,326	17.0
Abdomen/pelvis	31.7	212,538	48.6
Extremity	5.2	515	0.1
Angio – Heart	3.4	46,000	10.5
Angio – Head	3.0	10,000	2.3
Spine	6.2	41,369	9.5
Interventional	3.4	230	0.5
Cardiac	0.5	6,000	1.4
Others	2.5	8,500	2.0

Computed Tomography

Annual Collective Effective Dose (S):

437,500 person-Sv

Conventional Radiography and Fluoroscopy

Examination	Effective Dose (mSv)	No. Exams (1000)	S (person-Sv)	S (%)
Chest	0.1	128,944	12,894	12.8
Breast	0.18 (0.42)	34,500	6,210 (14,490)	6.2
Cervical Spine	0.2	5,800	1,160	1.2
Thoracic Spine	1.0	2,590	2,590	2.6
Lumbar Spine	1.5	11,197	16,796	16.7
Upper GI	6.0	4,044	24,264	24.1
Abdomen	0.7	14,964	10,475	10.4
Barium Enema	8.0	656	5,248	5.2
IVP	3.0	1,180	3,540	3.5
Pelvis & Hip	0.6 – 0.7	19,963	13,156	13.1
Other exams	0.005 – 1.7	58,131	1,613	0.7
Dental	0.005 (0.21)	500,000	2,528 (10,500)	2.8

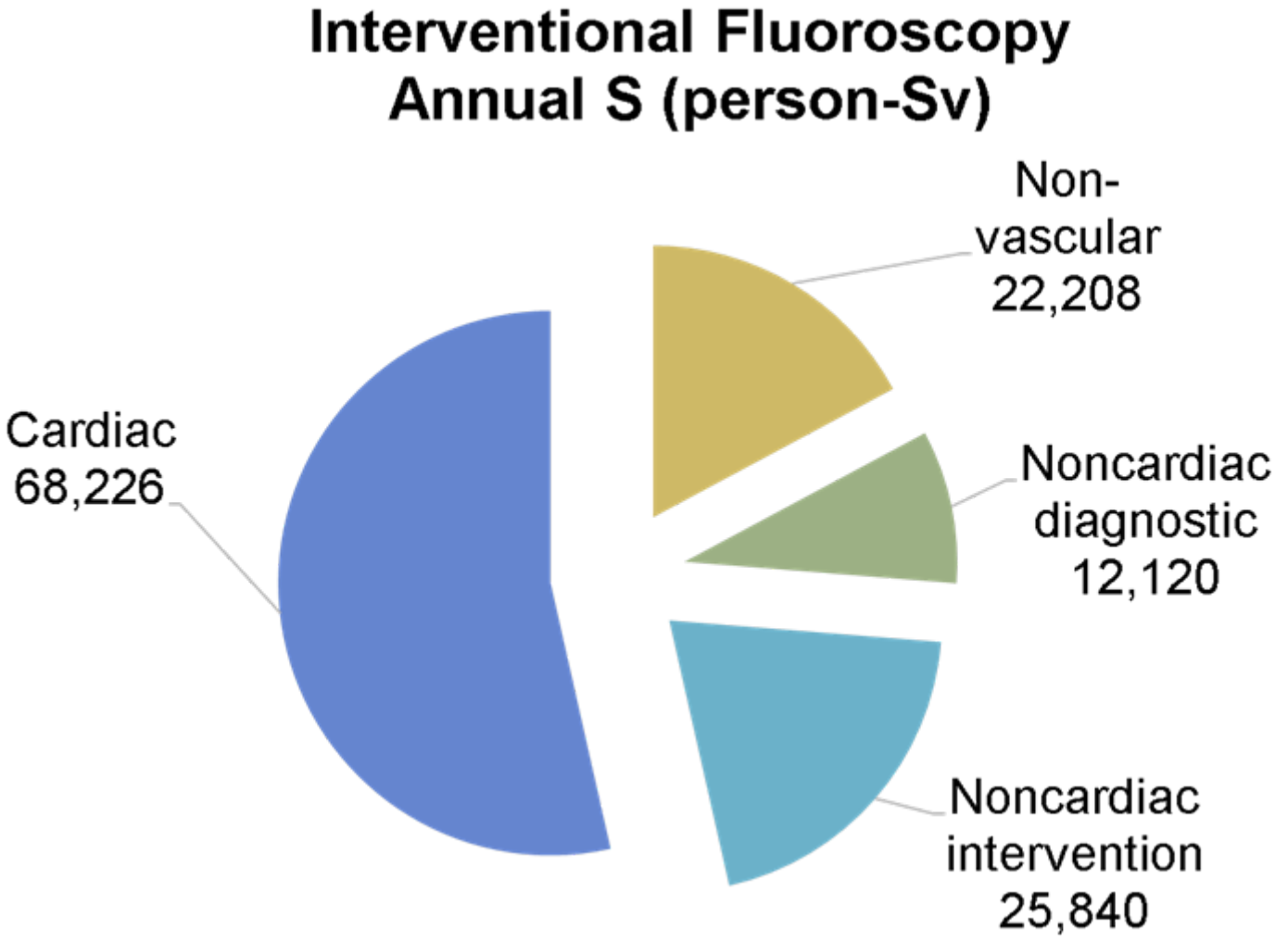
Conventional Radiography and Fluoroscopy

- Annual Collective Effective Dose (S):

100,500 person-Sv

(116,800 person-Sv using ICRP 2007 weighting factors for breast and dental exposures)

Interventional Fluoroscopy



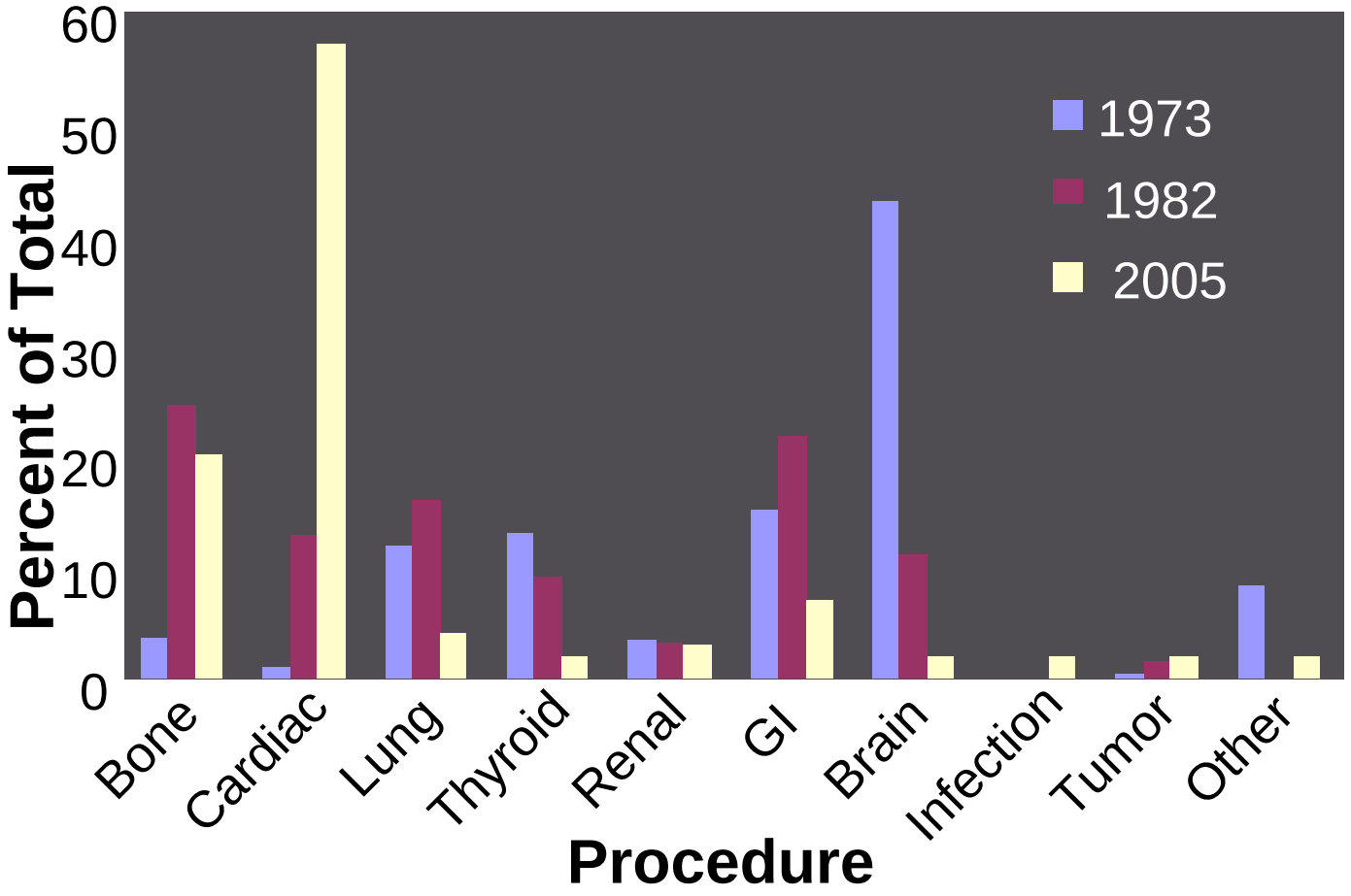
Interventional Fluoroscopy

- Annual Collective Effective Dose (S):

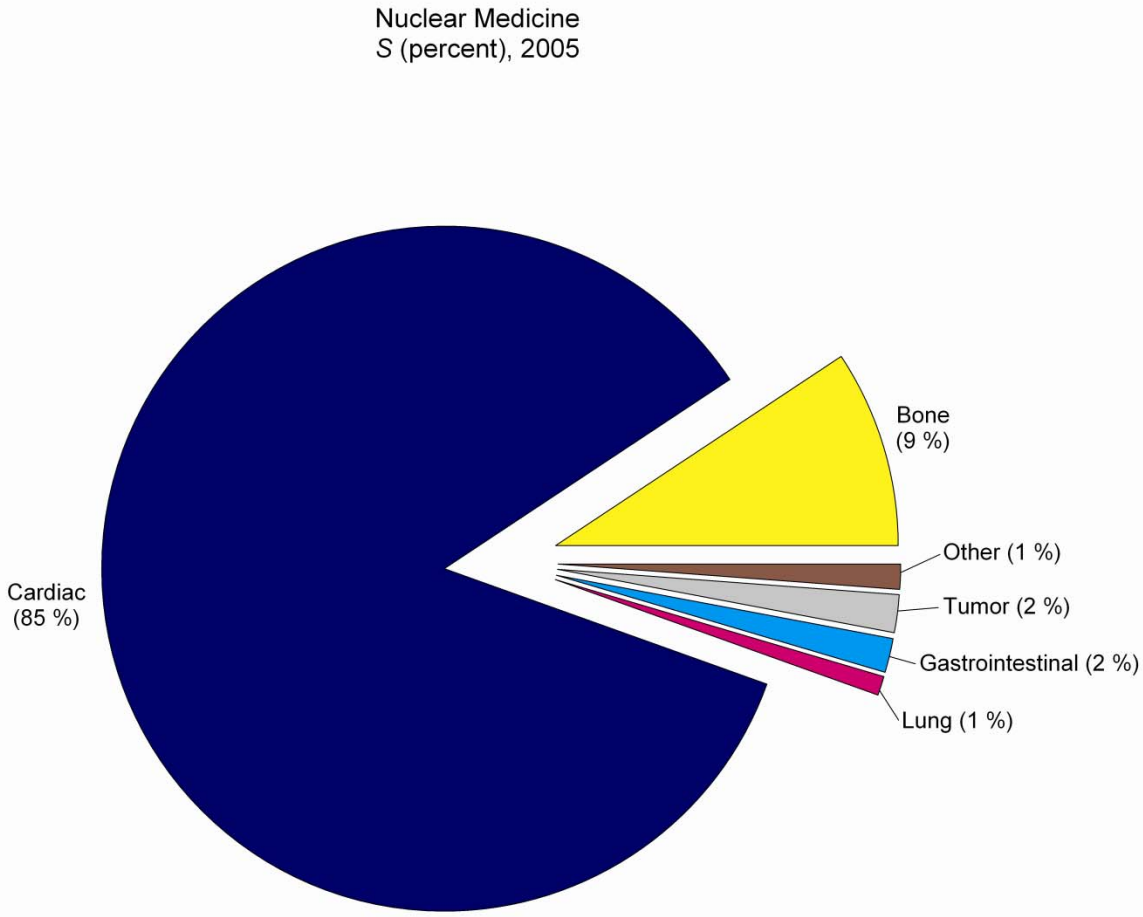
  128,400 person-Sv

Nuclear Medicine

Change in *In Vivo* Diagnostic Nuclear Medicine Procedures



Nuclear Medicine

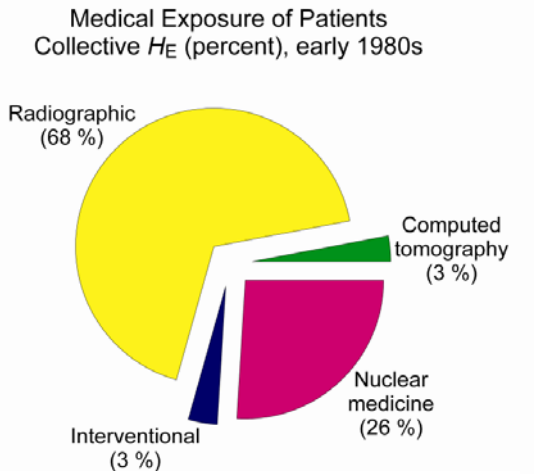


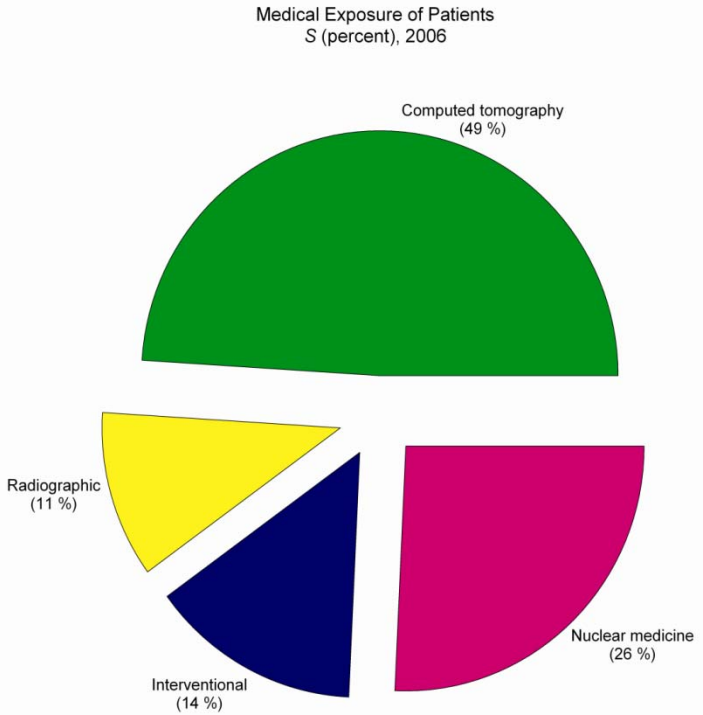
Nuclear Medicine

- Annual Collective Effective Dose (S):

220,500 person-Sv

Comparison of Medical Exposures of Patients





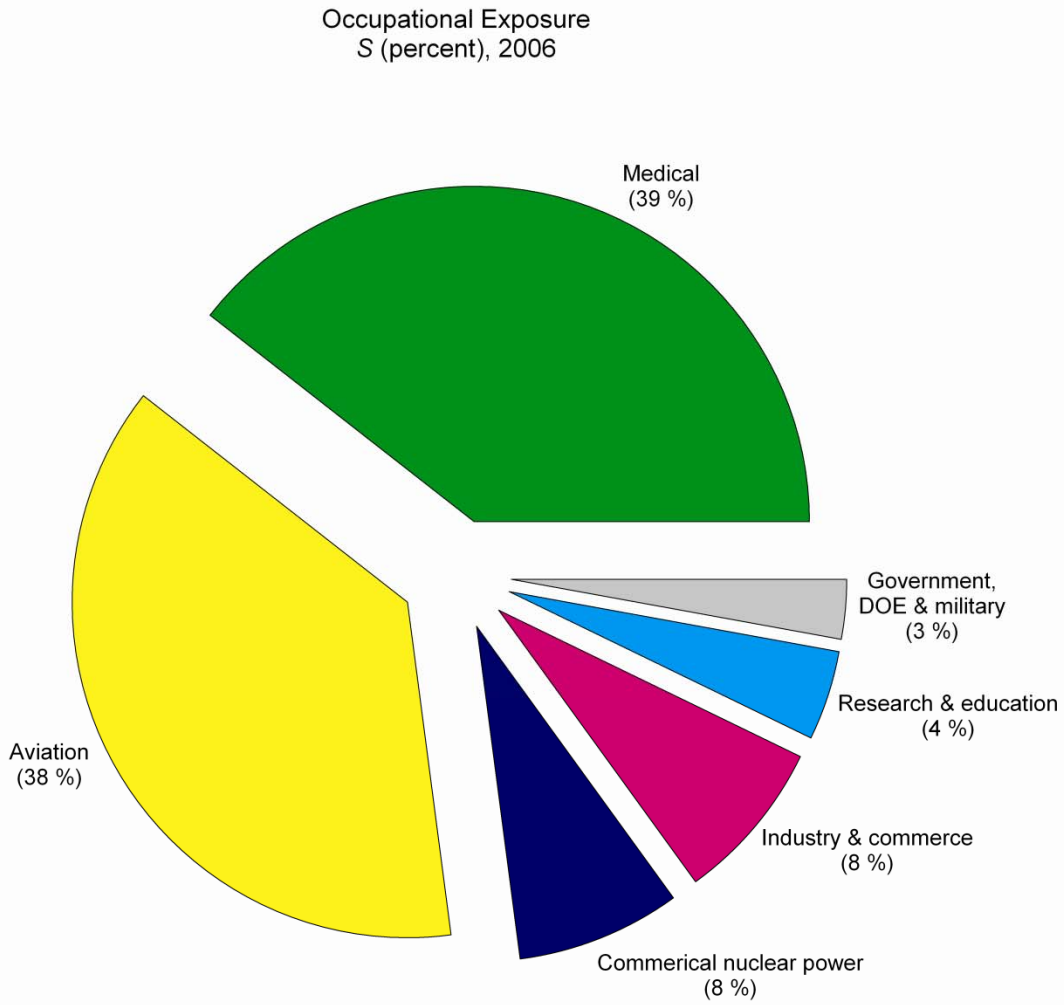
Occupational Exposure

- Six subcategories grouped by the nature of employment and associated type of source:
  - **medical;**
  - aviation;
  - commercial nuclear power;
  - industry and commerce;
  - education and research; and
  - government, DOE and military.

Medical

Numbers of Workers and Doses	2003	2004	2005	2006
Monitored workers	1,957,088	2,220,861	2,352,976	2,519,693
Workers with recordable dose	690,661	735,400	693,941	735,347
Collective effective dose (person-Sv)	508	559	546	549
Average effective dose (mSv)	0.74	0.76	0.79	0.75

Population Dose (person-Sv) from Occupational Exposure



Radiation Exposures to U.S. Population in 2006

Exposure Category	S (person-Sv)	E_{US} (mSv)
Background	933,000	3.11
Medical	899,000	3.00
Consumer, etc.	39,000	0.13
Industrial, etc.	1,000	0.003
Occupational	1,400	0.005

Radiation Exposure to U.S. Population in 2006

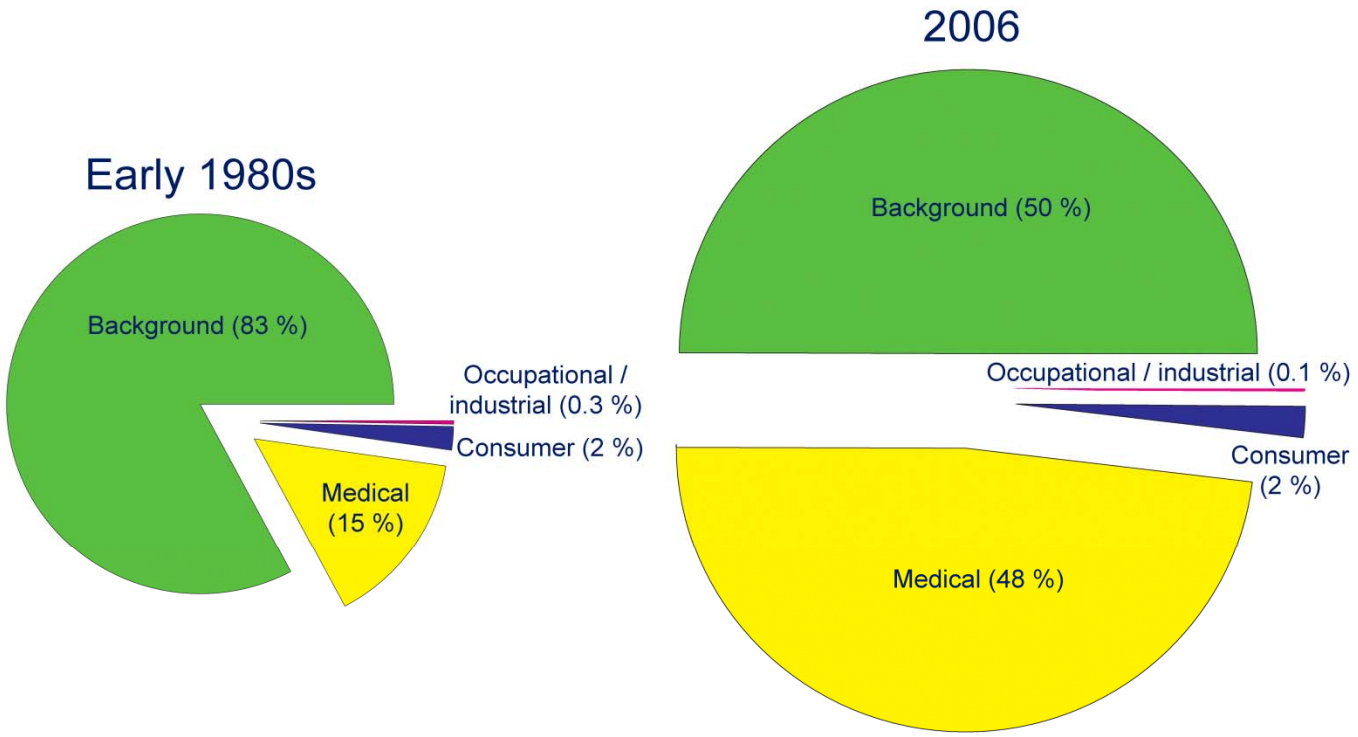
- Annual Collective Effective Dose (S):

1,870,000 person-Sv

Effective dose per individual in the U.S. population (E_{US}):

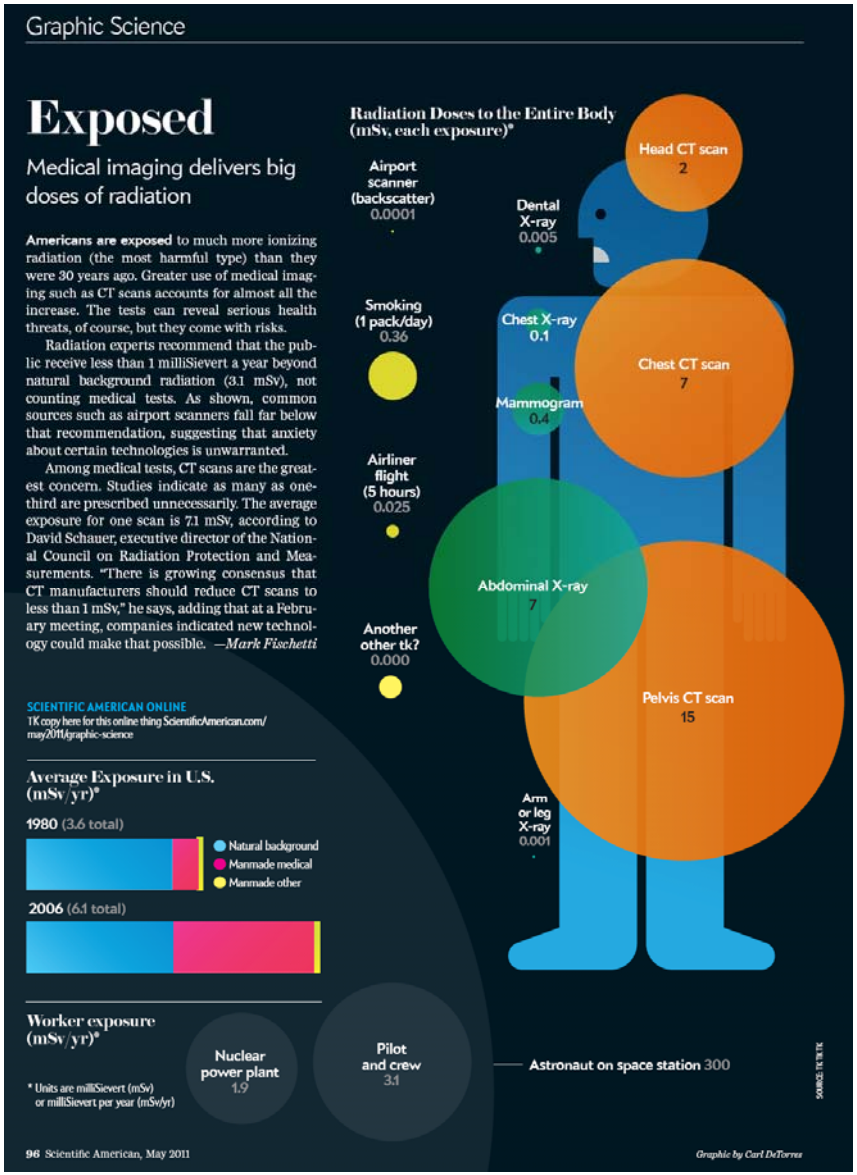
6.2 mSv

NCRP Report No. 160, *Ionizing Radiation Exposure of the Population of the United States*



	Early 1980s	2006
Collective effective dose (person-Sv)	835,000	1,870,000
Effective dose per individual in the U.S. population (mSv)	3.6	6.2

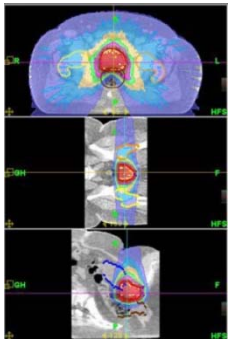
Informing a Wider Audience
(Scientific American – May 2011)

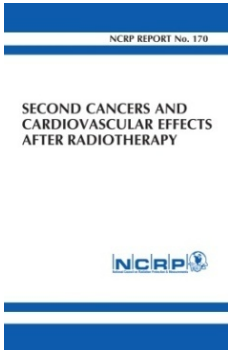


Recent NCRP Publications
Reports (2010 & 2011)

- **170: *Second Primary Cancers and Cardiovascular Effects After Radiation Therapy***

  -L.B. Travis, Chair
  J.D. Boice, Jr., Vice Chair





- **168: *Radiation Dose Management for Fluoroscopically-Guided Interventional Medical Procedures***

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