IMAGE WISELY

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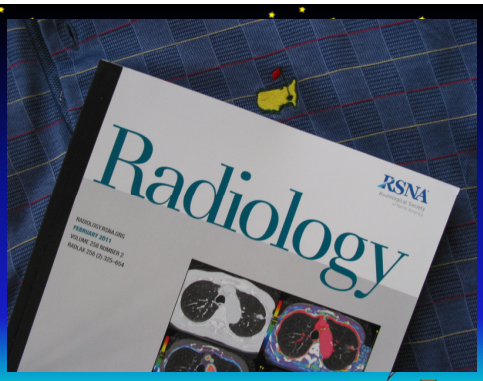
IMAGE WISELY™ Radiation Safety in Adult Medical Imaging

ORGANIZATIONS
PROGRAM INTRODUCTION
RADIATION SOURCES/LEVELS
IMAGING EXAMINATIONS
APPROPRIATENESS
OVERUTILIZATION



ORGANIZATIONS

- American College of Radiology
  www.acr.org
- Radiologic Society of North America
  www.rsna.org
- American Association of Physicists in Medicine
  www.aapm.org
- American Society of Radiologic Technologists
  www.asrt.org

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PROGRAM INTRODUCTION

- Imagewisely.org
- Imaging Physicians/Medical Physicists/Radiologic Technologists
- Equipment Resources
- Patient Medical Imaging Record

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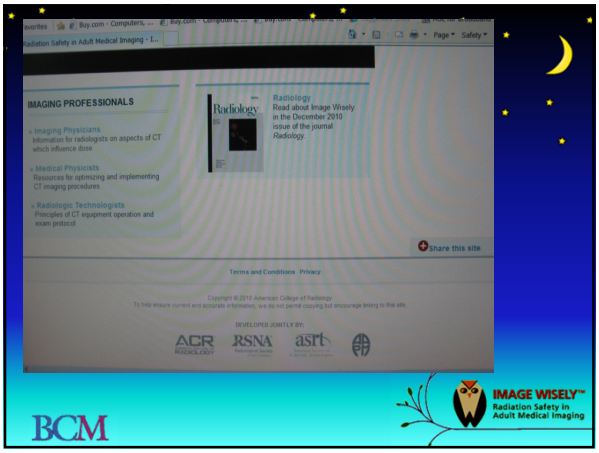
IMAGE WISELY™
Radiation Safety in Adult Medical Imaging
IMAGING PROFESSIONALS
REFERRING PRACTITIONERS
PATIENTS
EQUIPMENT RESOURCES
Take the pledge
2617
PLEDGES TO DATE
ABOUT IMAGE WISELY™
In the News
BCM
IMAGE WISELY™
Radiation Safety in Adult Medical Imaging


IMAGING PROFESSIONALS
Radiology
Read about Image Wisely in the December 2010 issue of the journal Radiology
Imaging Physicians
Information for radiologists on aspects of CT which influence dose
Medical Physicists
Resources for optimizing and implementing CT imaging procedures
Radiologic Technologists
Principles of CT equipment operation and exam protocol
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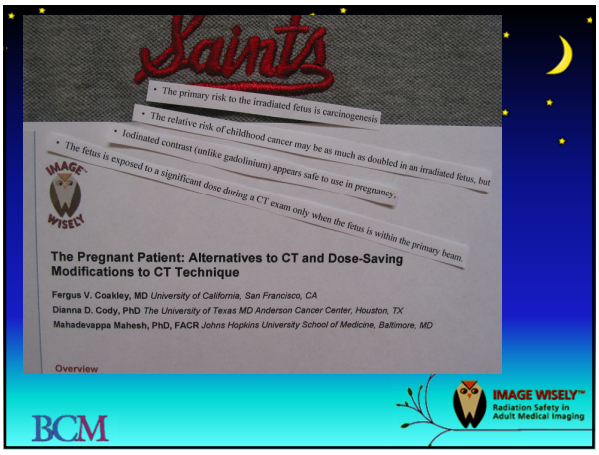
Saints
• The primary risk to the irradiated fetus is carcinogenesis
• The relative risk of childhood cancer may be as much as doubled in an irradiated fetus, but
• Iodinated contrast (unlike gadolinium) appears safe to use in pregnancy.
• The fetus is exposed to a significant dose during a CT exam only when the fetus is within the primary beam.
The Pregnant Patient: Alternatives to CT and Dose-Saving Modifications to CT Technique
Fergus V. Coakley, MD University of California, San Francisco, CA
Dianna D. Cody, PhD The University of Texas MD Anderson Cancer Center, Houston, TX
Mahadevappa Mahesh, PhD, FACR Johns Hopkins University School of Medicine, Baltimore, MD
Overview
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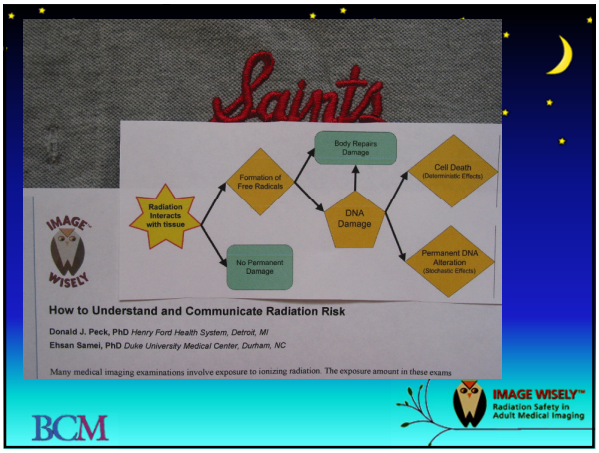
Saints
Radiation Interacts with tissue
Formation of Free Radicals
Body Repairs Damage
DNA Damage
Cell Death (Deterministic Effects)
Permanent DNA Alteration (Stochastic Effects)
No Permanent Damage
How to Understand and Communicate Radiation Risk
Donald J. Peck, PhD Henry Ford Health System, Detroit, 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
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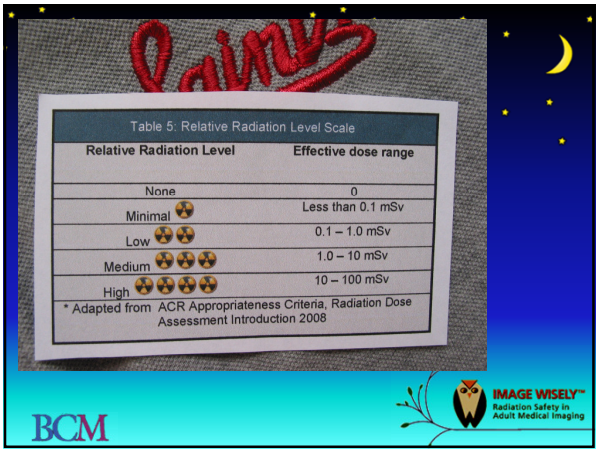
Table 5: Relative Radiation Level Scale
Relative Radiation Level
Effective dose range
None
0
Minimal
Less than 0.1 mSv
Low
0.1 – 1.0 mSv
Medium
1.0 – 10 mSv
High
10 – 100 mSv
* Adapted from ACR Appropriateness Criteria, Radiation Dose Assessment Introduction 2008
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EQUIPMENT RESOURCES

- GE Healthcare
- Hitachi
- Philips
- Siemens
- Toshiba

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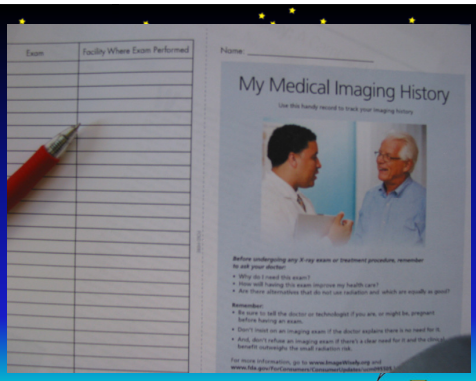

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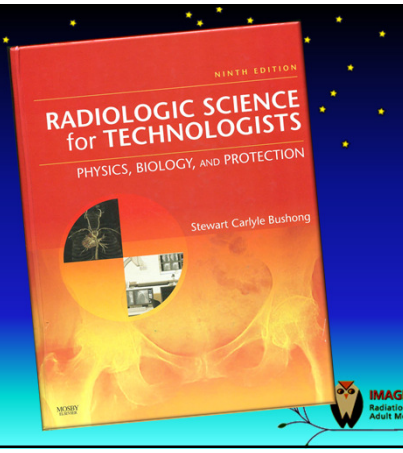

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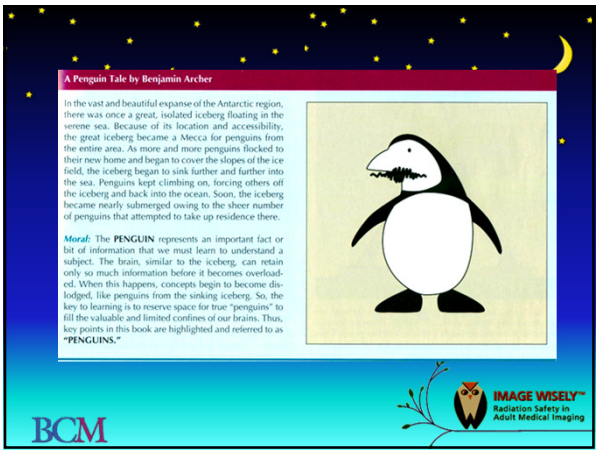
A Penguin Tale by Benjamin Archer
In the vast and beautiful expanse of the Antarctic region, there was once a great, isolated iceberg floating in the serene sea. Because of its location and accessibility, the great iceberg became a Mecca for penguins from the entire area. As more and more penguins flocked to their new home and began to cover the slopes of the ice field, the iceberg began to sink further and further into the sea. Penguins kept climbing on, forcing others off the iceberg and back into the ocean. Soon, the iceberg became nearly submerged owing to the sheer number of penguins that attempted to take up residence there.
Moral: The PENGUIN represents an important fact or bit of information that we must learn to understand a subject. The brain, similar to the iceberg, can retain only so much information before it becomes overloaded. When this happens, concepts begin to become dislodged, like penguins from the sinking iceberg. So, the key to learning is to reserve space for true "penguins" to fill the valuable and limited confines of our brains. Thus, key points in this book are highlighted and referred to as "PENGUINS."
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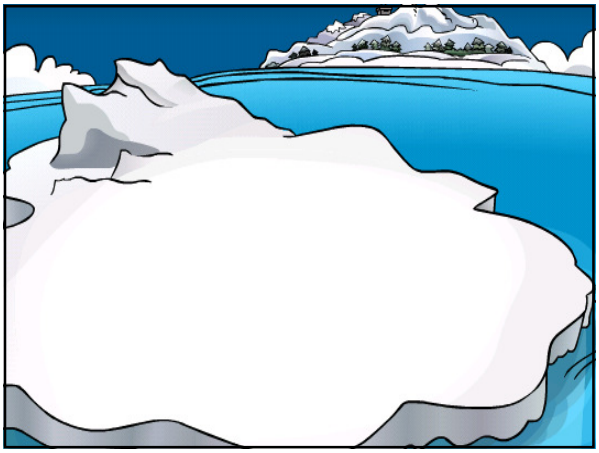
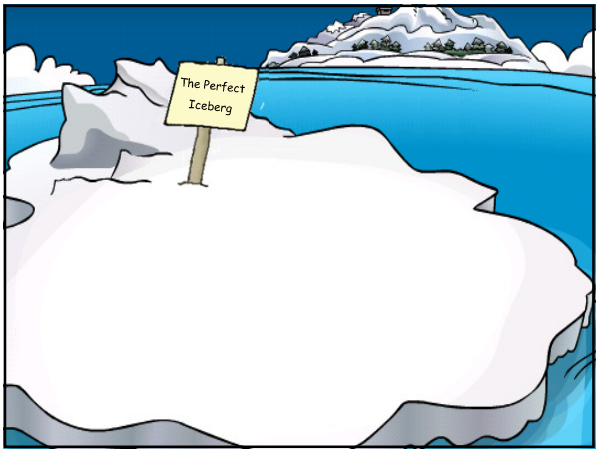
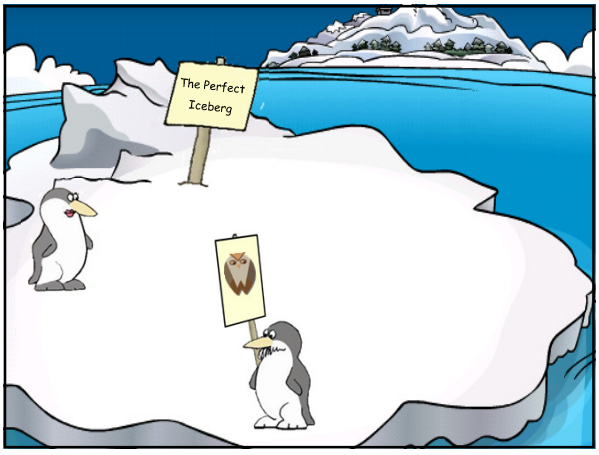
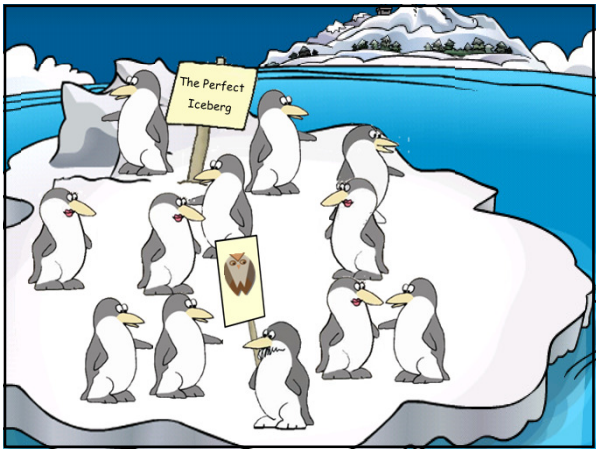
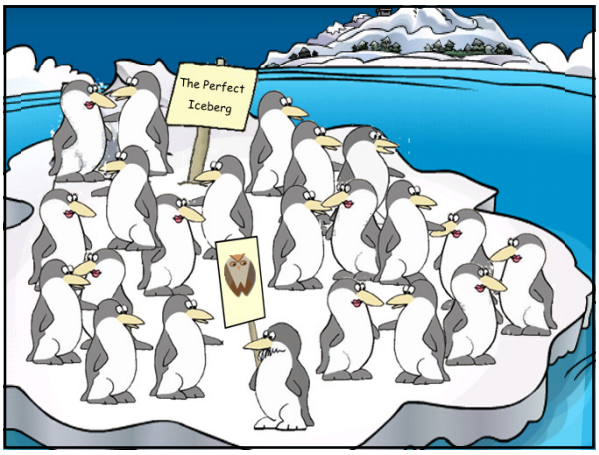


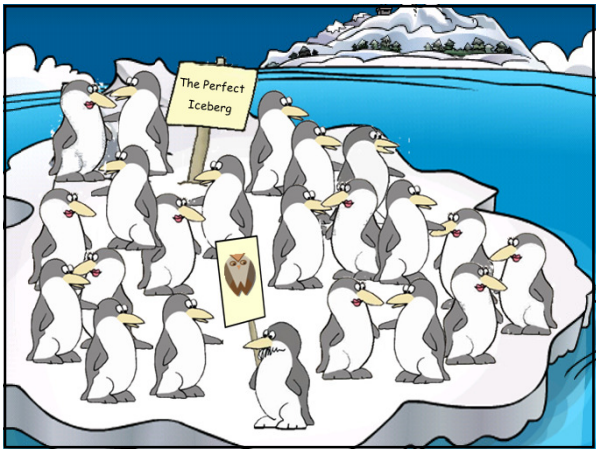

The Perfect Iceberg

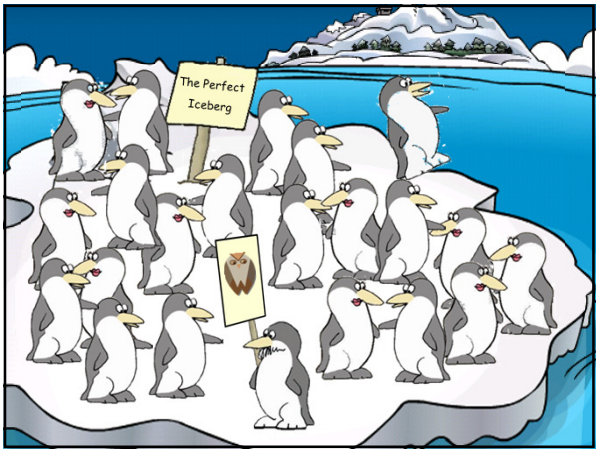

The Perfect
Iceberg


The Perfect
Iceberg

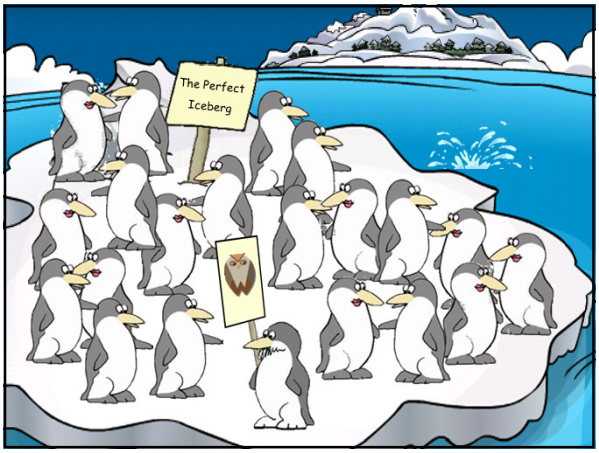

The Perfect
Iceberg

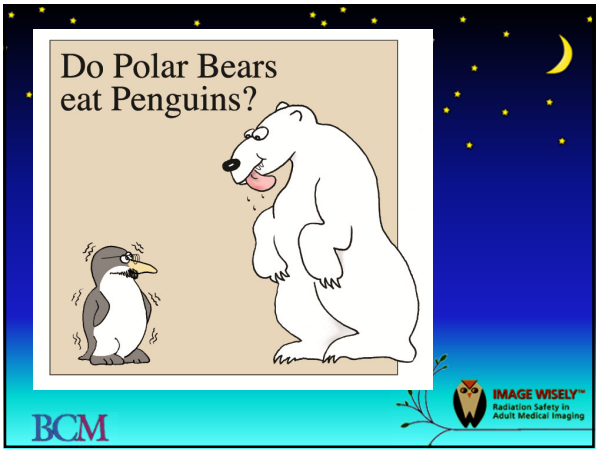

The Perfect
Iceberg


The Perfect
Iceberg


The Perfect
Iceberg


The Perfect Iceberg


The Perfect Iceberg


Do Polar Bears eat Penguins?
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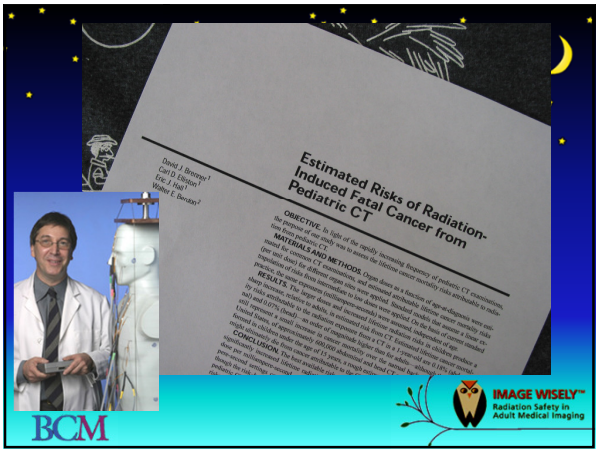
Estimated Risks of Radiation-Induced Fatal Cancer from Pediatric CT
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USA TODAY
Election still splits court
Bush debuts with education push
CT scans in children linked to cancer later
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CT scans in
By Steve Sternberg
USA TODAY
Each year, about 1.6 million children in the USA get CT scans to the head and abdomen — and about 1,500 of those will die later in life of radiation-induced cancer, according to research out today.
What's more, CT or computed tomography scans given to kids are typically calibrated for adults, so children absorb two to six times the radiation needed to produce clear images, a second study shows. These doses are "way bigger than the sorts of doses that people at Three Mile Island were getting."
David Brenner of Columbia says, "Most people got a tenth to a hundredth of the dose of a CT."
Both studies appear in
American Journal of
induced fatal cancer
scans. Until a decade ago,
too long to perform on ch
giving them anesthesia
still. Today's scanners spi
patient in seconds, provi
tions, or "slices," of anat
Doctors use CT scans
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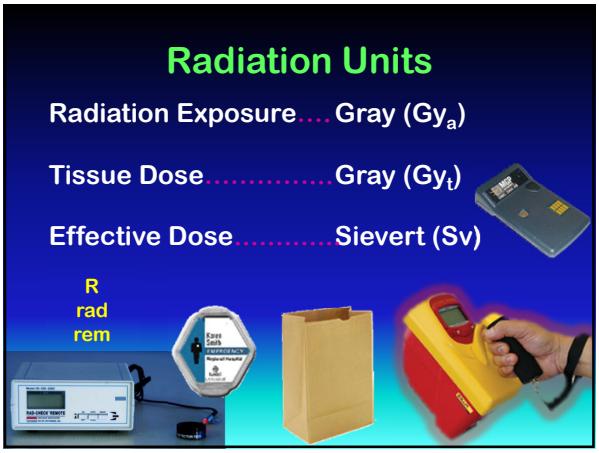
Radiation Units
Radiation Exposure.... Gray (Gy_a)
Tissue Dose..... Gray (Gy_t)
Effective Dose..... Sievert (Sv)
R
rad
rem

Approximate Effective Dose

- Chest X-ray – 0.1 mSv
- Abdomen X-ray – 0.7 mSv
- Chest CT – 7 mSv
- Nuc Med Perfusion Stress – 12 mSv
- Whole Body CT – 30 mSv
- PET/CT – 45 mSv

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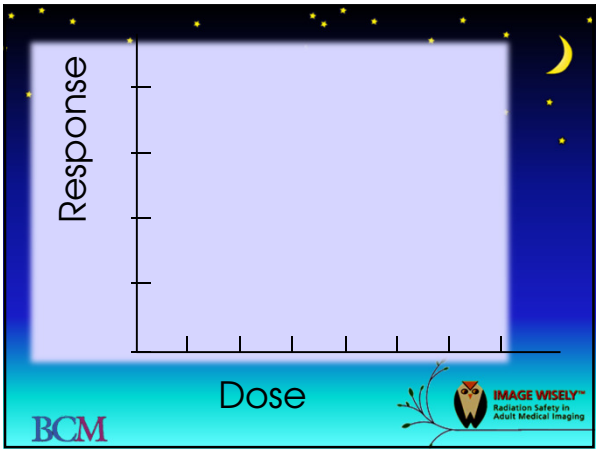

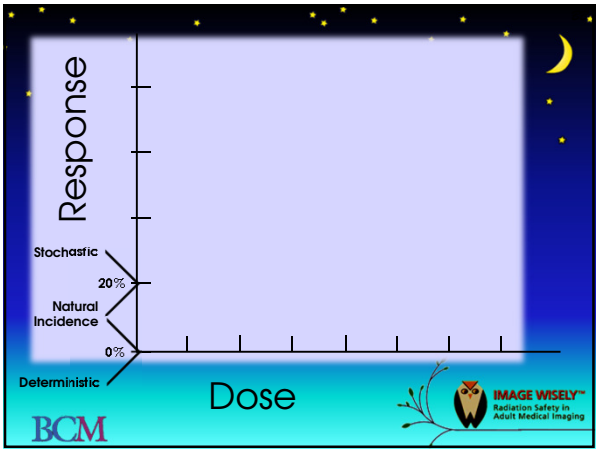

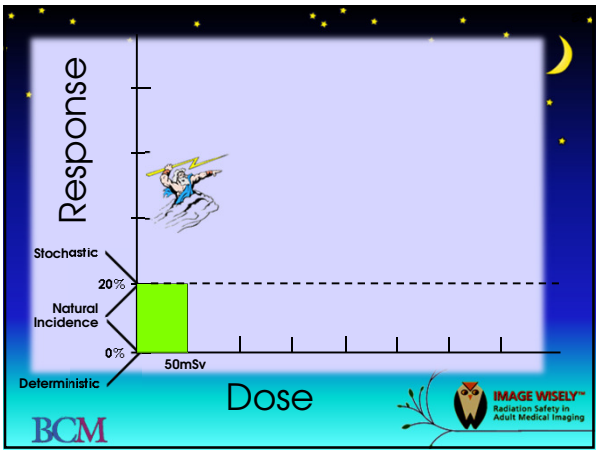
Response
Stochastic
20%
Natural Incidence
0%
50mSv
Deterministic
Dose
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Radiation Safety in Adult Medical Imaging

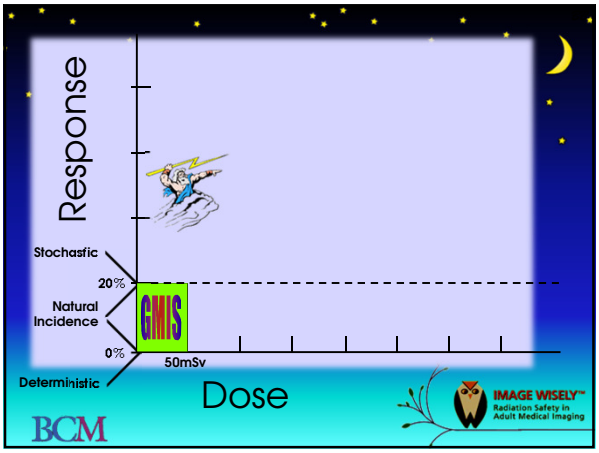
Response
Stochastic
20%
Natural Incidence
GMIS
0%
50mSv
Deterministic
Dose
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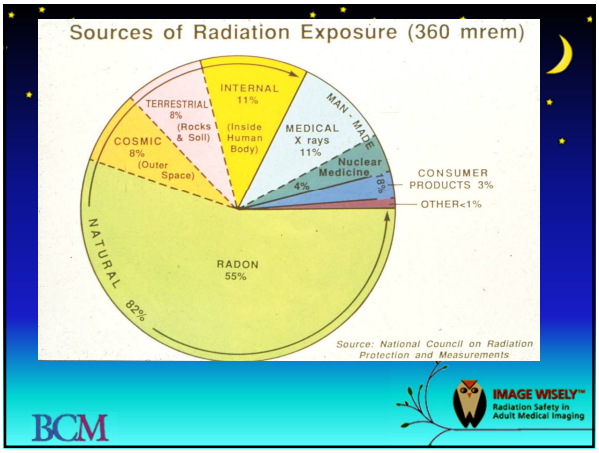
IMAGE WISELY™
Radiation Safety in Adult Medical Imaging


Sources of Radiation Exposure (360 mrem)
INTERNAL 11%
(Inside Human Body)
TERRESTRIAL 8%
(Rocks & Soil)
COSMIC 8%
(Outer Space)
MEDICAL X rays 11%
MAN - MADE
Nuclear Medicine 4%
CONSUMER PRODUCTS 3%
OTHER<1%
RADON 55%
NATURAL 82%
Source: National Council on Radiation Protection and Measurements
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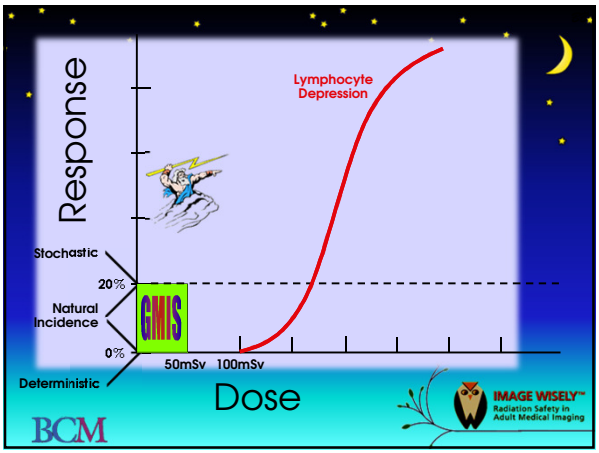
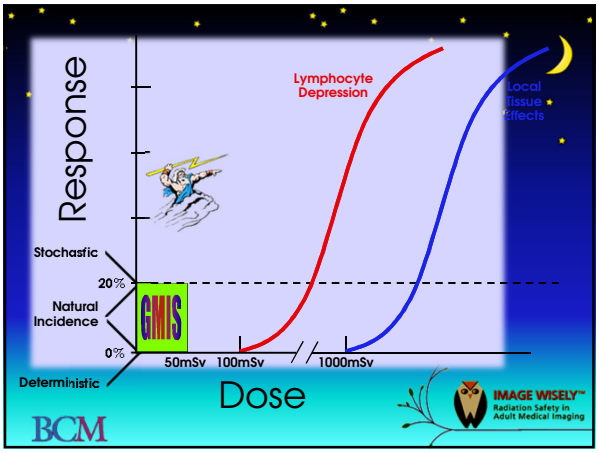

Response
Lymphocyte Depression
Stochastic
20%
Natural Incidence
GMIS
0%
Deterministic
50mSv
100mSv
Dose
BCM
IMAGE WISELY™
Radiation Safety in Adult Medical Imaging


Response
Lymphocyte Depression
Local Tissue Effects
Stochastic
20%
Natural Incidence
GMIS
0%
Deterministic
50mSv
100mSv
1000mSv
Dose
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Deterministic

- Non-Linear
- Threshold
- Severity increases with dose

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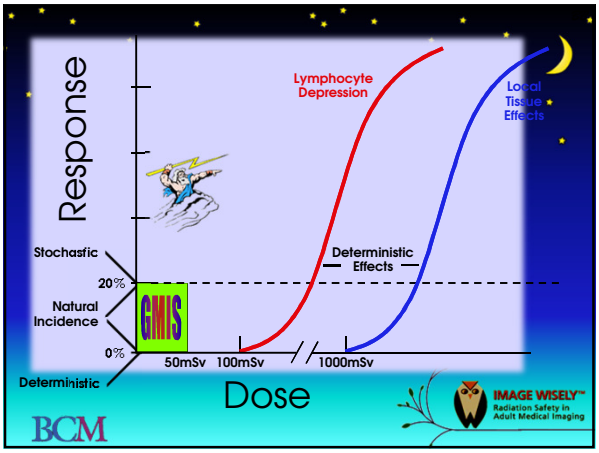

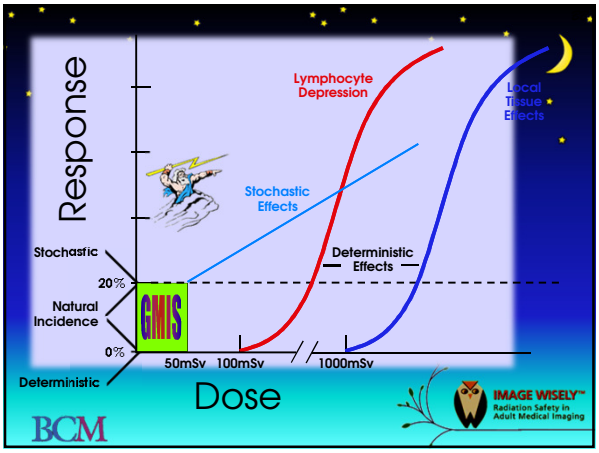

Stochastic

- Linear
- Non-Threshold
- Incidence increases with dose

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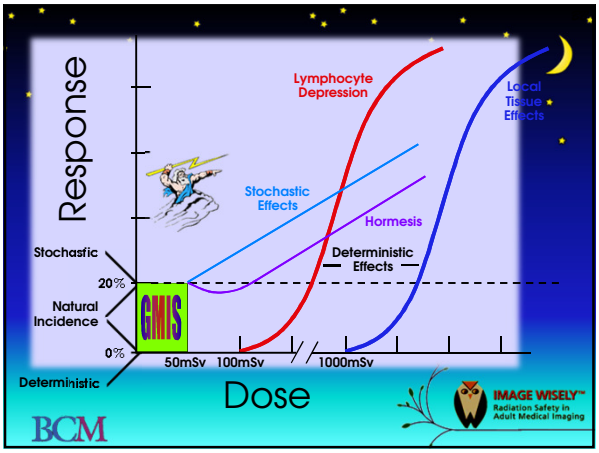

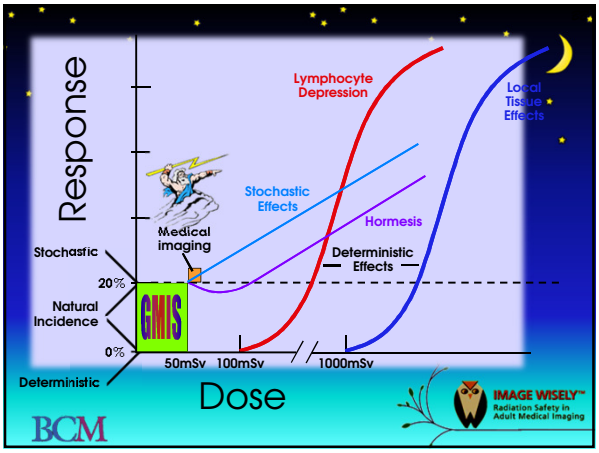

RADIATION SOURCES/LEVELS

- Radon
- Natural Background (GMIS)
- Medical Imaging
- Consumer Products

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IMAGE WISELY™ Radiation Safety in Adult Medical Imaging

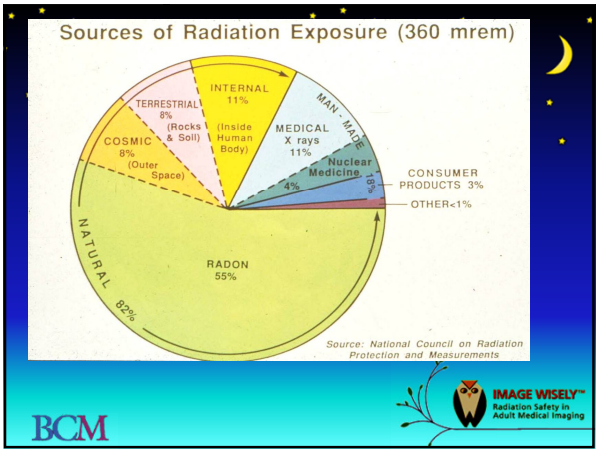

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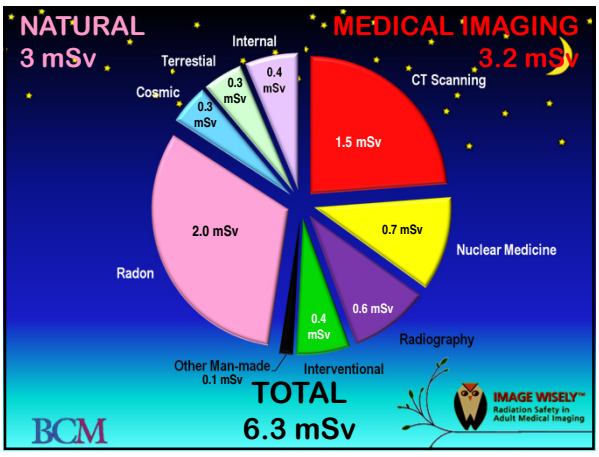
IMAGE WISELY™ Radiation Safety in Adult Medical Imaging



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RADIATION SOURCES/LEVELS

- Radon
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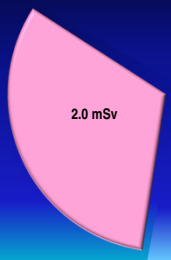
Radon



TOTAL
6.3 mSv

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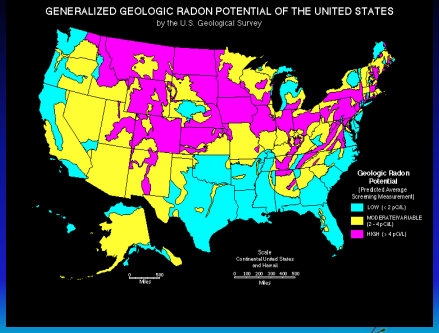

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Radon

- Discovered by Dorn in 1900 during his experiments with radium
- Naturally occurring radioactive gas
- Colorless, odorless & tasteless

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Radon

- 21,000 lung cancer deaths attributable to radon in the US annually
- Radon is the 2nd leading cause of lung cancer, after smoking
- Radon is the 6th leading cause of cancer deaths in the US

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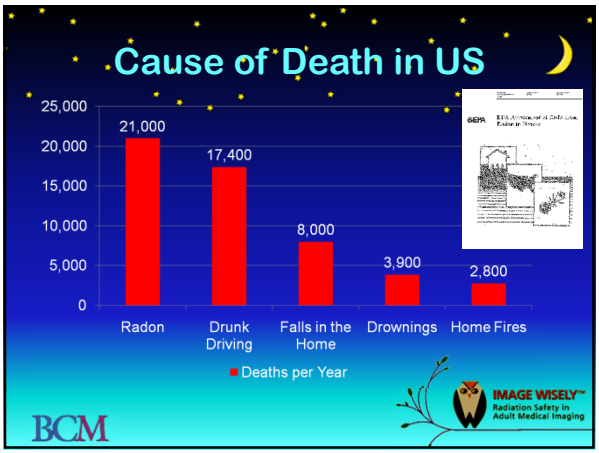
Cause of Death in US
25,000
20,000
15,000
10,000
5,000
0
21,000
17,400
8,000
3,900
2,800
Radon
Drunk Driving
Falls in the Home
Drownings
Home Fires
Deaths per Year
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Radium Water Bath Will Improve Your Health
RECOMMENDED FOR RHEUMATISM, STOMACH TROUBLE
ECZEMA AND OTHER SKIN DISEASES
RADIUM
THE RADIUM BATH HOUSE, CLAREMORE'S FINEST, CLAREMORE, OKLA.
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Invigorating Water

- From 1919 to 1922, the Great Radium Spring Water Company sold bottle water that ostensibly provided some of the same health benefits as radium springs in nearby places like Saratoga Springs, New York
- The water contained dissolved radon

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Is your DRINKING WATER *what it should be?*

This Radium Vitalizer makes your drinking water Radio-Active

Does it Pay?

The following statistics, furnished by that internationally known authority, Dr. Sigmund Sauberman, of Berlin, Germany, on cases under careful observation, will interest the thoughtful in the beneficial, healing and curative powers of radium emanation. This is indisputable evidence of its restorative vir-

Diseases Treated	No. Treated	Cured	Benefitted
Anemia	111	71	40
Ankylosis	52	30	21
Asthma (Bronchial)	37	00	31
Apoplexy	81	00	70
Arterio-Sclerosis	305	00	294
Arthritis "Gout"	125	38	63
Arthritis "Chronic"	218	189	24
Arthritis "Deformans"	691	512	52
Arthritis "Tobacco"	210	137	63
Arthritis "Gonorrheal"	47	30	17
Bronchitis	200	104	57
Cystitis, Chronic (inflammation of bladder)	21	11	00

For full explanation of this list address

NATIONAL RADIUM COMPANY, INC.
[illegible] W. Washington Street
CHICAGO

IMAGE WISELY™ Radiation Safety in Adult Medical Imaging

Radium Glass

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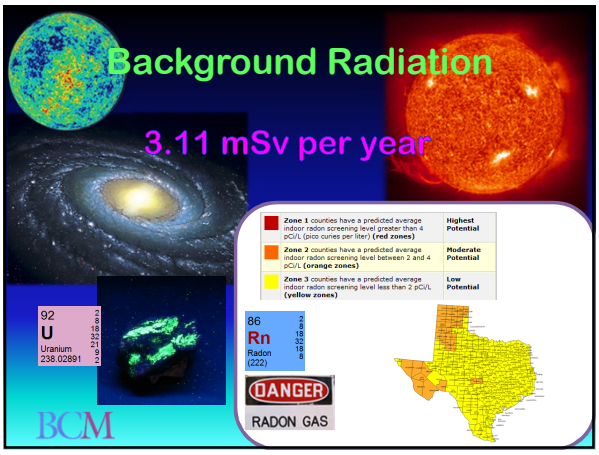
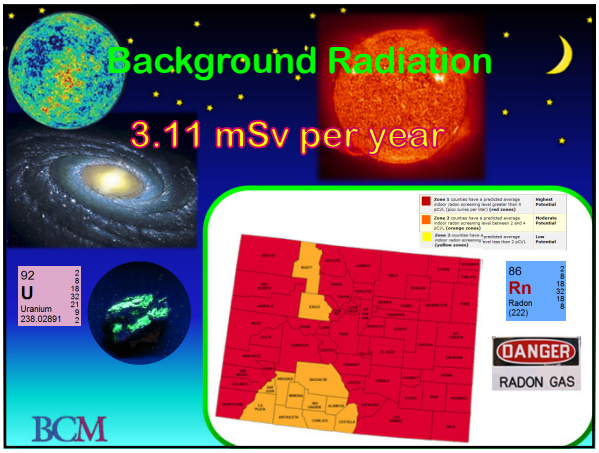

Background Radiation
3.11 mSv per year
Zone 1 counties have a predicted average indoor radon screening level greater than 4 pCi/L (pico curies per liter) (red zones)
Highest Potential
Zone 2 counties have a predicted average indoor radon screening level between 2 and 4 pCi/L (orange zones)
Moderate Potential
Zone 3 counties have a predicted average indoor radon screening level less than 2 pCi/L (yellow zones)
Low Potential
92
U
Uranium
238.02891
86
Rn
Radon
(222)
DANGER
RADON GAS
BCM


Background Radiation
3.11 mSv per year
92
U
Uranium
238.02891
86
Rn
Radon
(222)
DANGER
RADON GAS
BCM

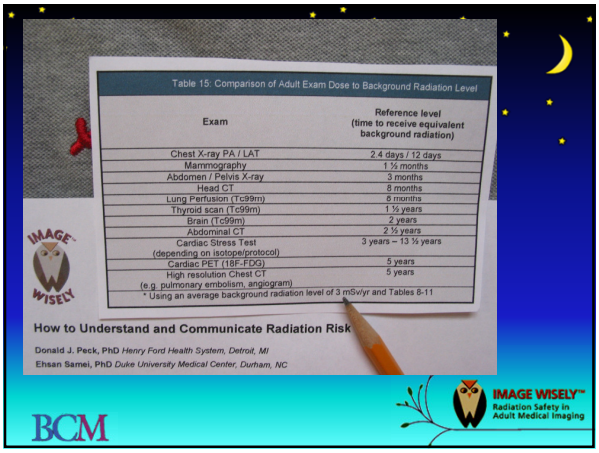
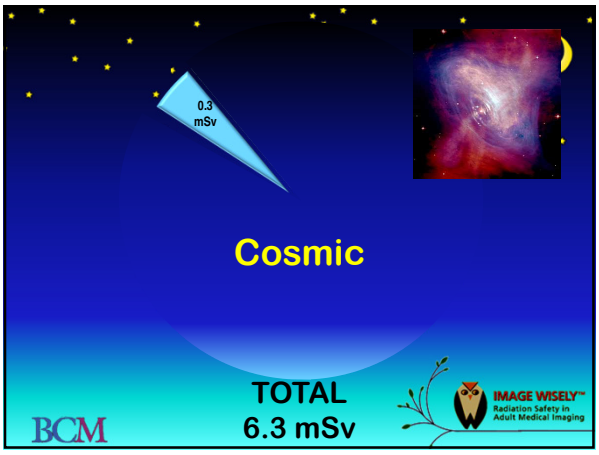


Table 15: Comparison of Adult Exam Dose to Background Radiation Level
Exam
Reference level (time to receive equivalent background radiation)
Chest X-ray PA / LAT
2.4 days / 12 days
Mammography
1 ½ months
Abdomen / Pelvis X-ray
3 months
Head CT
8 months
Lung Perfusion (Tc99m)
8 months
Thyroid scan (Tc99m)
1 ½ years
Brain (Tc99m)
2 years
Abdominal CT
2 ½ years
Cardiac Stress Test (depending on isotope/protocol)
3 years – 13 ½ years
Cardiac PET (18F-FDG)
5 years
High resolution Chest CT (e.g. pulmonary embolism, angiogram)
5 years
* Using an average background radiation level of 3 mSv/yr and Tables 8-11
IMAGE WISELY
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
BCM
IMAGE WISELY™
Radiation Safety in Adult Medical Imaging


0.3
mSv
Cosmic
TOTAL
6.3 mSv
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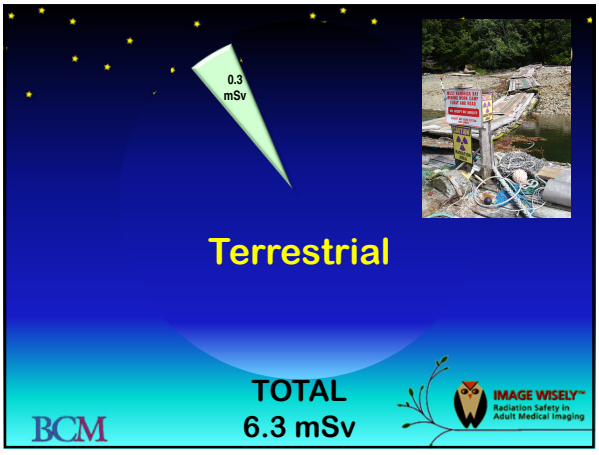
Adult Medical Imaging


0.3
mSv
Terrestrial
TOTAL
6.3 mSv
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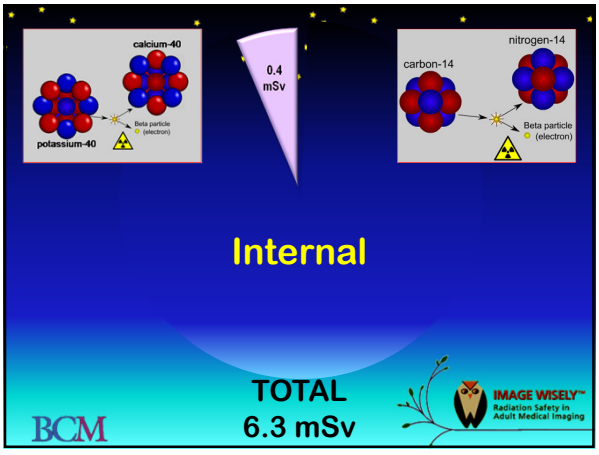
Adult Medical Imaging


calcium-40
potassium-40
Beta particle
(electron)
0.4
mSv
carbon-14
nitrogen-14
Beta particle
(electron)
Internal
TOTAL
6.3 mSv
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RADIATION SOURCES/LEVELS

- Radon
- Natural Background (GMIS)
- Consumer Products
- Medical Imaging

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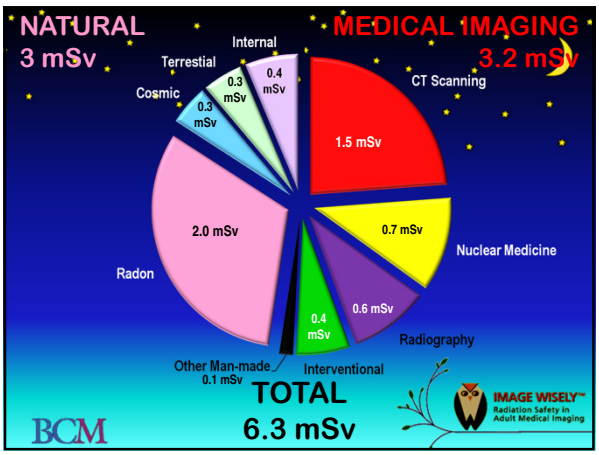

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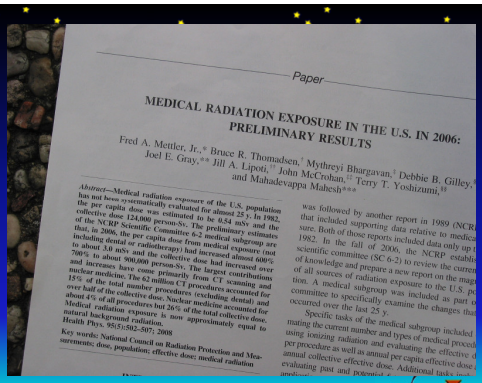

Paper

MEDICAL RADIATION EXPOSURE IN THE U.S. IN 2006: PRELIMINARY RESULTS

Fred A. Mettler, Jr.,* Bruce R. Thomadsen,† Mythreyi Bhargavan,‡ Debbie B. Gilley,§ Joel E. Gray,** Jill A. Lipoti,†† John McCrohan,‡‡ Terry T. Yoshizumi,§§ and Mahadevappa Mahesh***

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Number of Procedures (2006)

- Radiography – 293 million
- Computed Tomography – 67 million
- Nuclear Medicine – 18 million
- Interventional – 17 million
- Radiotherapy – 1 million

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IMAGING EXAMINATIONS

- Computed Tomography
- Radiography
- Fluoroscopy
- Nuclear Medicine

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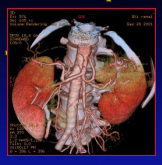

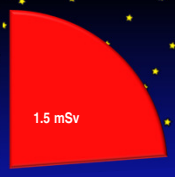

Computed Tomography

TOTAL
6.3 mSv

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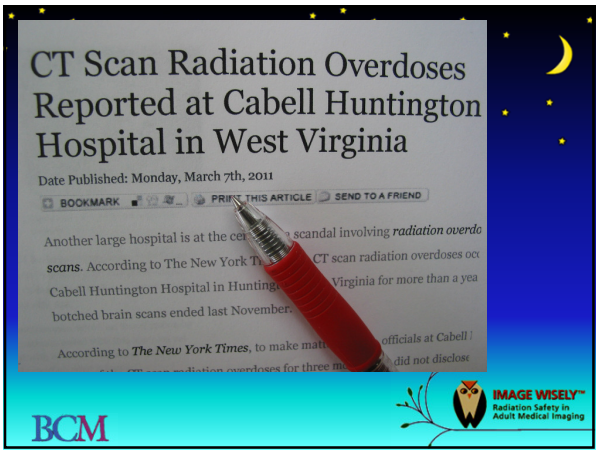
CT Scan Radiation Overdoses Reported at Cabell Huntington Hospital in West Virginia
Date Published: Monday, March 7th, 2011
BOOKMARK
PRINT THIS ARTICLE
SEND TO A FRIEND
Another large hospital is at the ce
scandal involving radiation overdo
scans. According to The New York T
CT scan radiation overdoses occ
Cabell Huntington Hospital in Hunting
Virginia for more than a yea
botched brain scans ended last November.
According to The New York Times, to make matt
officials at Cabell
did not disclose
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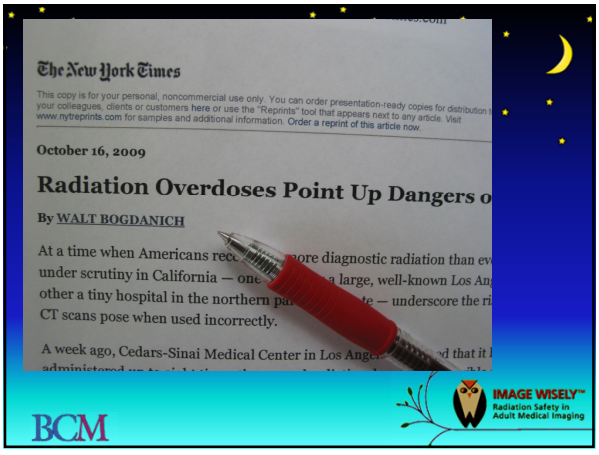
The New York Times
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October 16, 2009
Radiation Overdoses Point Up Dangers o
By WALT BOGDANICH
At a time when Americans rec
ore diagnostic radiation than ev
under scrutiny in California — one
a large, well-known Los An
other a tiny hospital in the northern pa
te — underscore the ri
CT scans pose when used incorrectly.
A week ago, Cedars-Sinai Medical Center in Los Ange
d that it
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Radiation worries prompt FDA to regulate medical scanners
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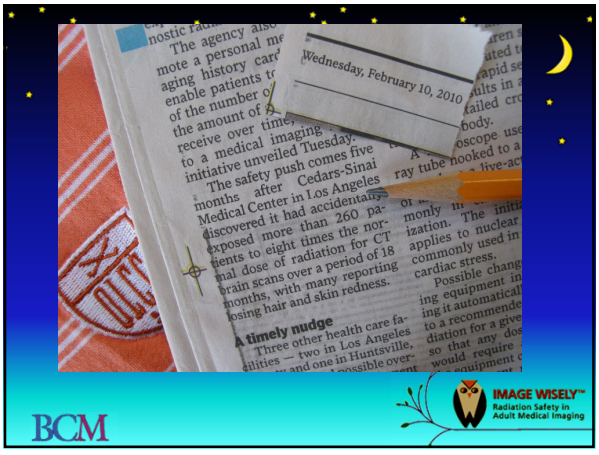
Wednesday, February 10, 2010
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IMAGE WISELY™
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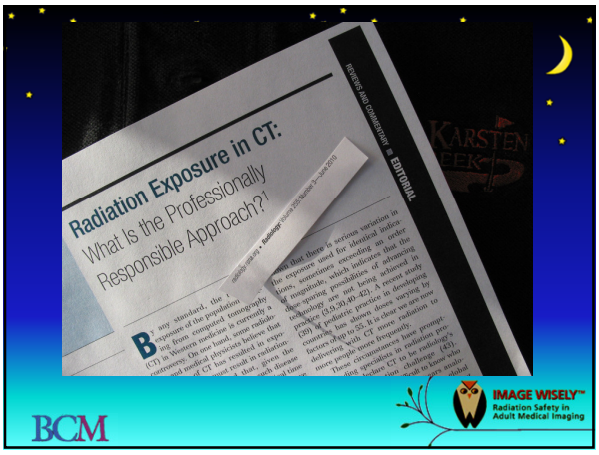
Radiation Exposure in CT:
What Is the Professionally Responsible Approach?
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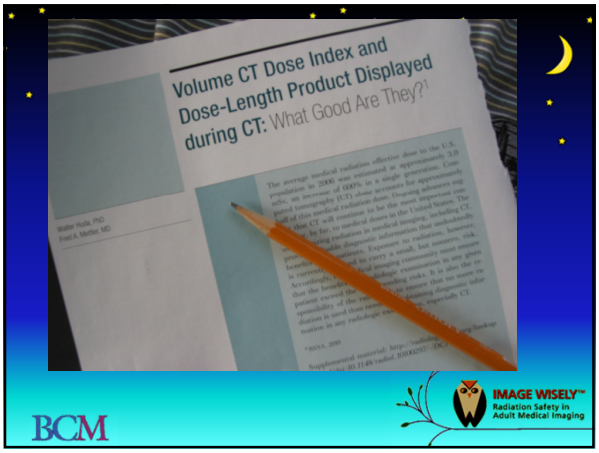
Radiation Safety in Adult Medical Imaging


Volume CT Dose Index and Dose-Length Product Displayed during CT: What Good Are They?
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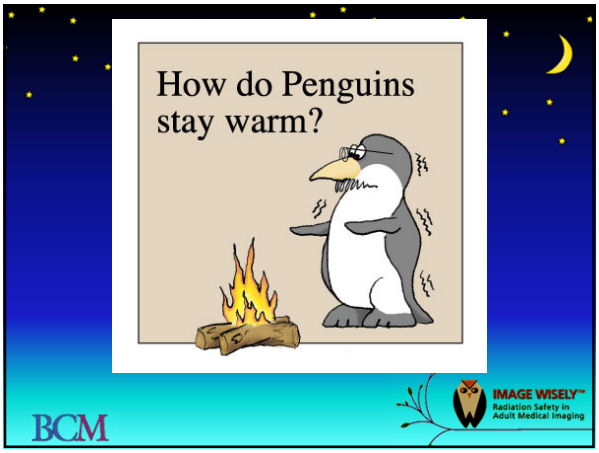
Radiation Safety in Adult Medical Imaging


How do Penguins stay warm?
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CT DOSIMETRY

- $CTDI_w$ = 1/3 center + 2/3periphery(mGy)
- $CTDI_{vol}$ = $CTDI_w$/pitch
- DLP = CTDI x scan length (mGy-cm)
- E = $\sum (D_t + W_t)$ (mSv)
- E = CTDI x W_t (mSv)
- E = CTDI x $CF_{age/exam}$ (mSv)

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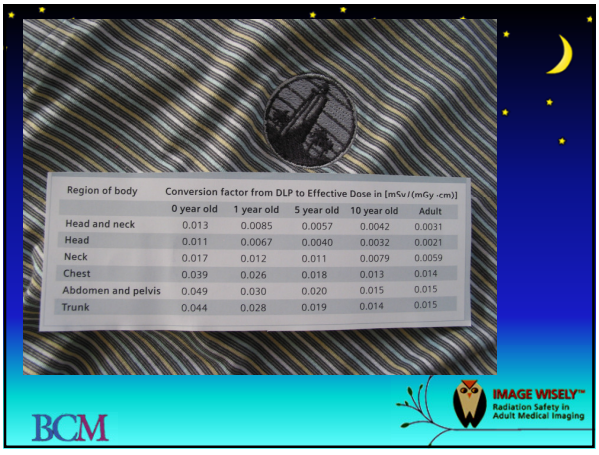

Region of body	Conversion factor from DLP to Effective Dose in [mSv/(mGy -cm)]				
	0 year old	1 year old	5 year old	10 year old	Adult
Head and neck	0.013	0.0085	0.0057	0.0042	0.0031
Head	0.011	0.0067	0.0040	0.0032	0.0021
Neck	0.017	0.012	0.011	0.0079	0.0059
Chest	0.039	0.026	0.018	0.013	0.014
Abdomen and pelvis	0.049	0.030	0.020	0.015	0.015
Trunk	0.044	0.028	0.019	0.014	0.015

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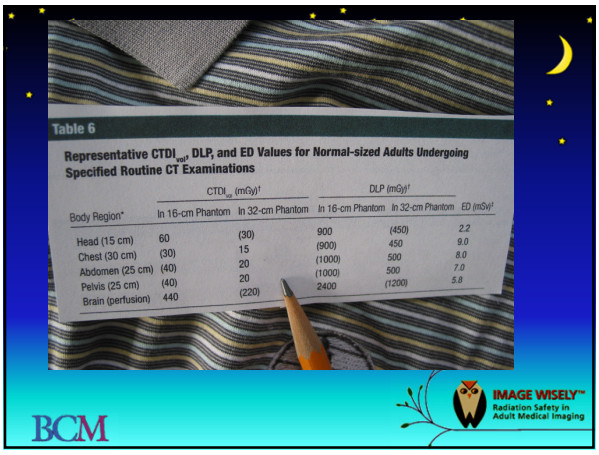
Table 6
Representative CTDI vol, DLP, and ED Values for Normal-sized Adults Undergoing Specified Routine CT Examinations
Body Region*
CTDI vol (mGy)†
In 16-cm Phantom
In 32-cm Phantom
DLP (mGy)†
In 16-cm Phantom
In 32-cm Phantom
ED (mSv)†
Head (15 cm) 60 (30) 900 (450) 2.2
Chest (30 cm) (30) 15 (900) 450 9.0
Abdomen (25 cm) (40) 20 (1000) 500 8.0
Pelvis (25 cm) (40) 20 (1000) 500 7.0
Brain (perfusion) 440 (220) 2400 (1200) 5.8
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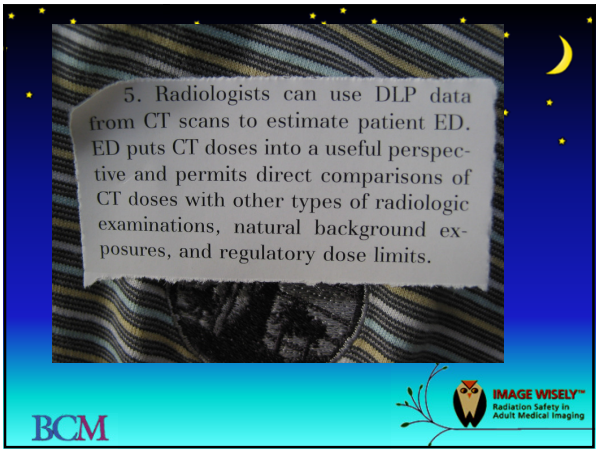
5. Radiologists can use DLP data from CT scans to estimate patient ED. ED puts CT doses into a useful perspective and permits direct comparisons of CT doses with other types of radiologic examinations, natural background exposures, and regulatory dose limits.
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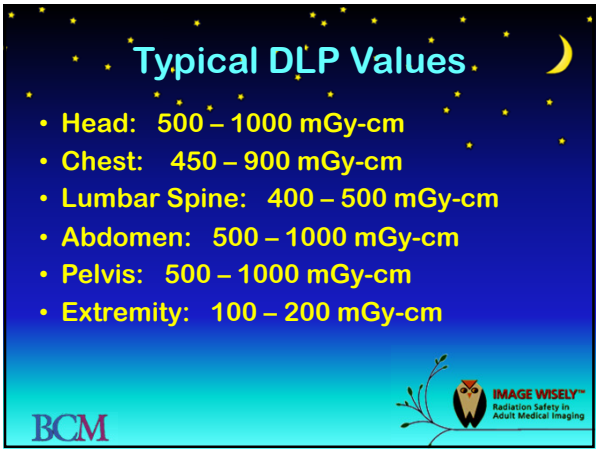
Typical DLP Values
• Head: 500 – 1000 mGy-cm
• Chest: 450 – 900 mGy-cm
• Lumbar Spine: 400 – 500 mGy-cm
• Abdomen: 500 – 1000 mGy-cm
• Pelvis: 500 – 1000 mGy-cm
• Extremity: 100 – 200 mGy-cm
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Diagnostic Report

This computed tomography (CT) study of the head registered a dose length product (DLP) of 725 mGy-cm which results in an approximate effective dose of 1.5 mSv

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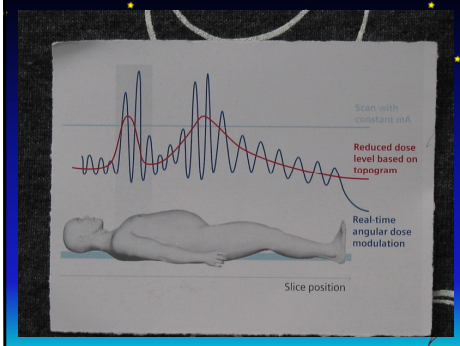

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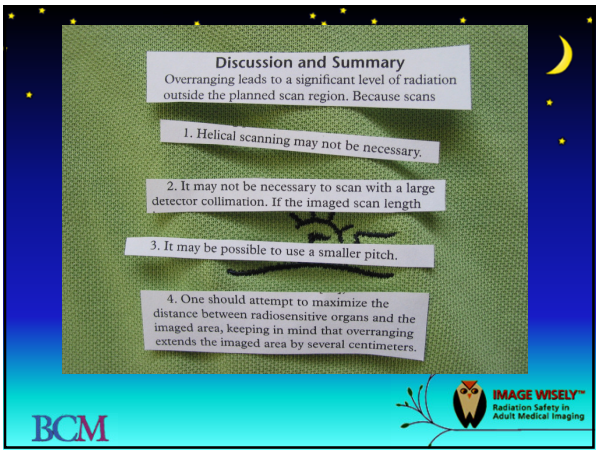
Discussion and Summary
Overranging leads to a significant level of radiation outside the planned scan region. Because scans
1. Helical scanning may not be necessary.
2. It may not be necessary to scan with a large detector collimation. If the imaged scan length
3. It may be possible to use a smaller pitch.
4. One should attempt to maximize the distance between radiosensitive organs and the imaged area, keeping in mind that overranging extends the imaged area by several centimeters.
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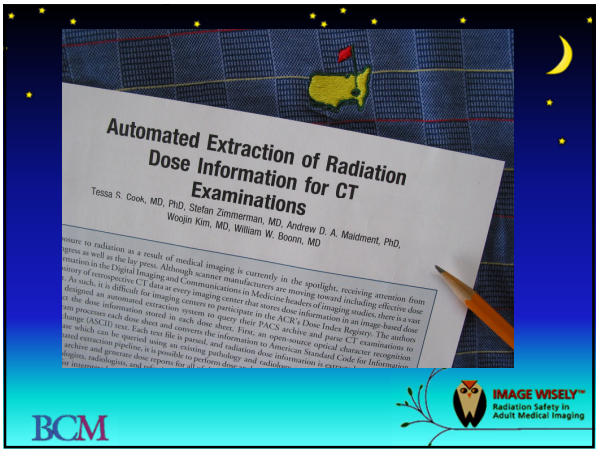
Automated Extraction of Radiation Dose Information for CT Examinations
Tessa S. Cook, MD, PhD, Stefan Zimmerman, MD, Andrew D. A. Maidment, PhD, Woojin Kim, MD, William W. Boonn, MD
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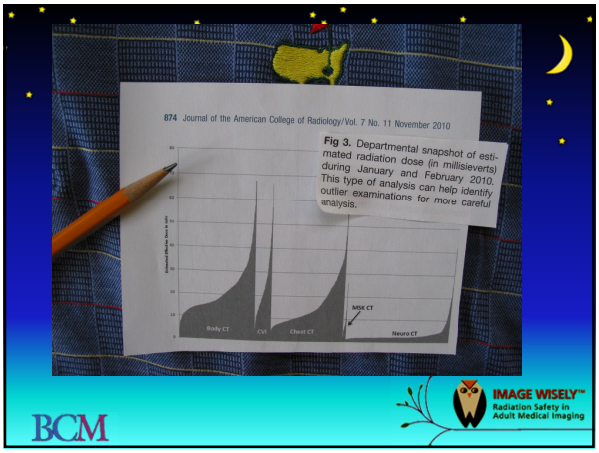
Radiation Safety in Adult Medical Imaging


874 Journal of the American College of Radiology/Vol. 7 No. 11 November 2010
Fig 3. Departmental snapshot of estimated radiation dose (in millisieverts) during January and February 2010. This type of analysis can help identify outlier examinations for more careful analysis.
Body CT
CT
Chest CT
MSK CT
Neuro CT
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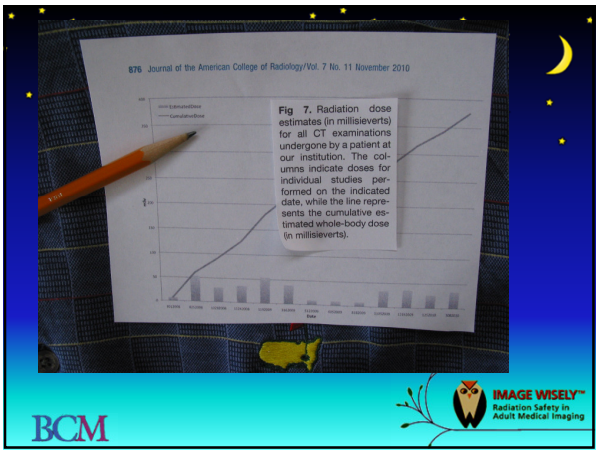
876 Journal of the American College of Radiology/Vol. 7 No. 11 November 2010
Fig 7. Radiation dose estimates (in millisieverts) for all CT examinations undergone by a patient at our institution. The columns indicate doses for individual studies performed on the indicated date, while the line represents the cumulative estimated whole-body dose (in millisieverts).
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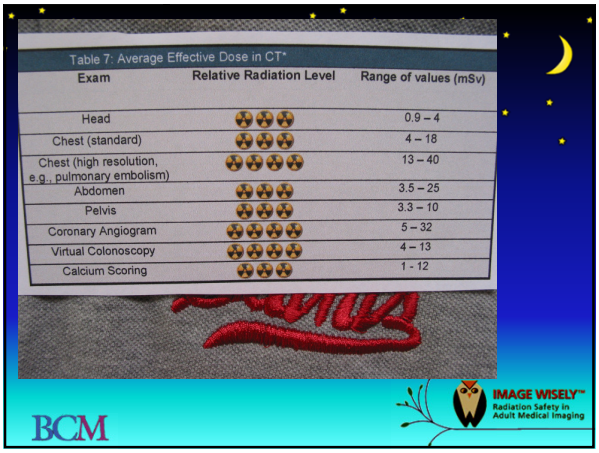
Table 7: Average Effective Dose in CT*
Exam
Relative Radiation Level
Range of values (mSv)
Head
0.9 – 4
Chest (standard)
4 – 18
Chest (high resolution, e.g., pulmonary embolism)
13 – 40
Abdomen
3.5 – 25
Pelvis
3.3 – 10
Coronary Angiogram
5 – 32
Virtual Colonoscopy
4 – 13
Calcium Scoring
1 - 12
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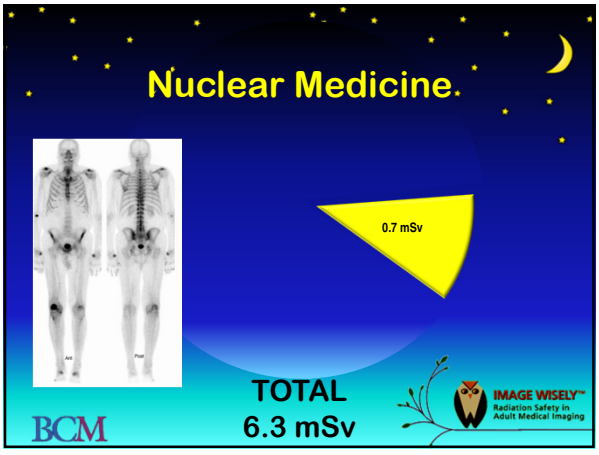
Radiation Safety in Adult Medical Imaging


Nuclear Medicine.
0.7 mSv
TOTAL
6.3 mSv
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- Administered Radiopharmaceutical Dose
- Critical Organ Radiation Dose
- Whole Body Radiaion Dose
- Effective Dose

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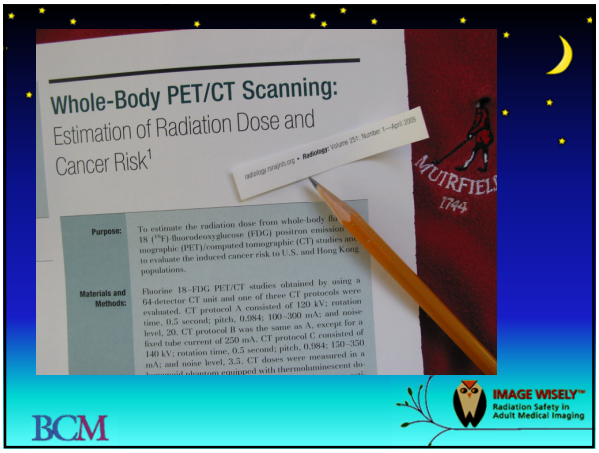

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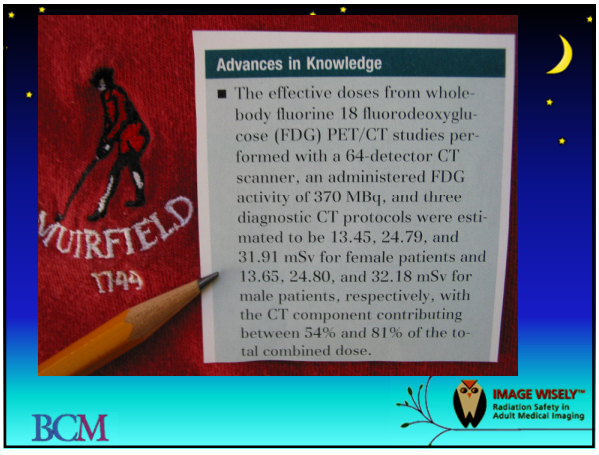

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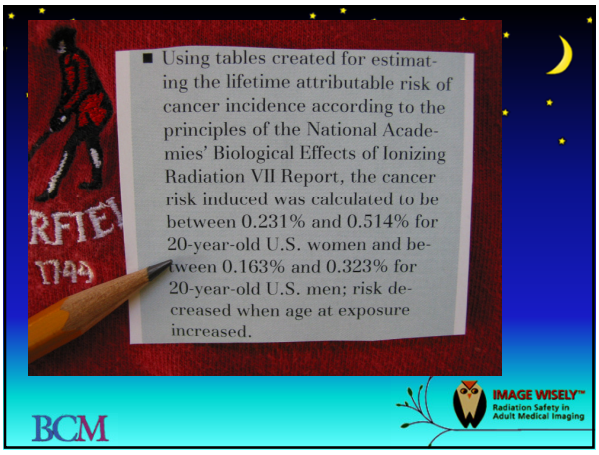
IMAGE WISELY™ Radiation Safety in Adult Medical Imaging


■ Using tables created for estimating the lifetime attributable risk of cancer incidence according to the principles of the National Academies' Biological Effects of Ionizing Radiation VII Report, the cancer risk induced was calculated to be between 0.231% and 0.514% for 20-year-old U.S. women and between 0.163% and 0.323% for 20-year-old U.S. men; risk decreased when age at exposure increased.
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Radiation Safety in Adult Medical Imaging

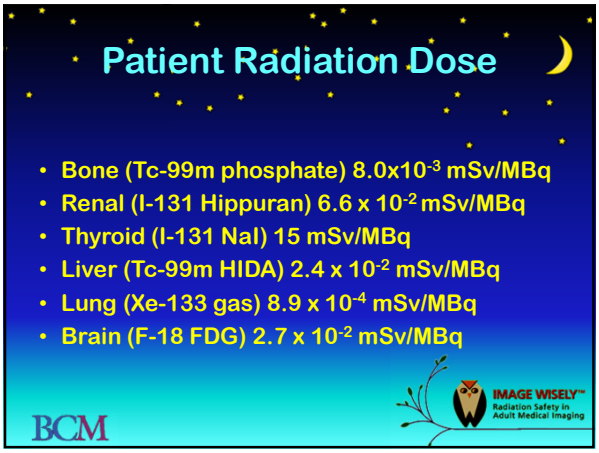
Patient Radiation Dose
• Bone (Tc-99m phosphate) 8.0x10-3 mSv/MBq
• Renal (I-131 Hippuran) 6.6 x 10-2 mSv/MBq
• Thyroid (I-131 NaI) 15 mSv/MBq
• Liver (Tc-99m HIDA) 2.4 x 10-2 mSv/MBq
• Lung (Xe-133 gas) 8.9 x 10-4 mSv/MBq
• Brain (F-18 FDG) 2.7 x 10-2 mSv/MBq
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IMAGE WISELY™
Radiation Safety in Adult Medical Imaging

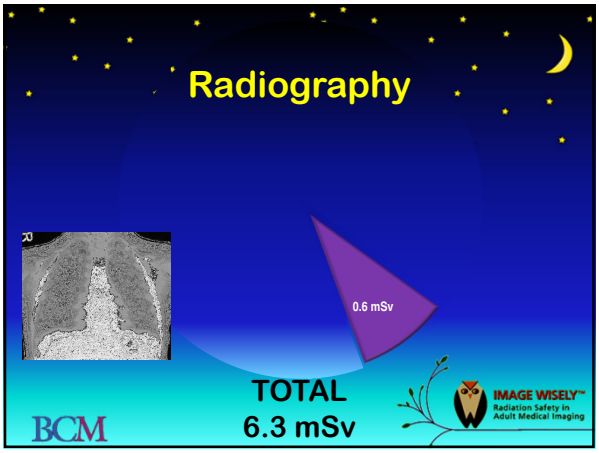
Radiography
0.6 mSv
TOTAL
6.3 mSv
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IMAGE WISELY™
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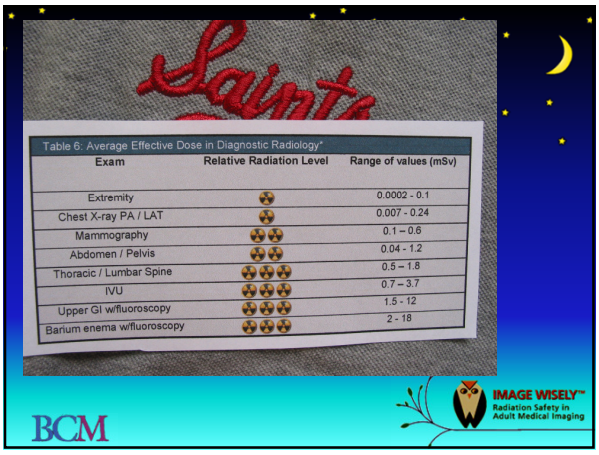
Table 6: Average Effective Dose in Diagnostic Radiology*
Exam
Relative Radiation Level
Range of values (mSv)
Extremity
0.0002 - 0.1
Chest X-ray PA / LAT
0.007 - 0.24
Mammography
0.1 – 0.6
Abdomen / Pelvis
0.04 - 1.2
Thoracic / Lumbar Spine
0.5 – 1.8
IVU
0.7 – 3.7
Upper GI w/fluoroscopy
1.5 - 12
Barium enema w/fluoroscopy
2 - 18
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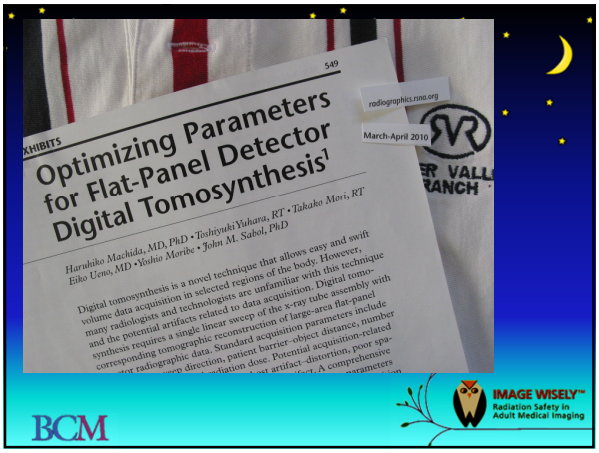
IMAGE WISELY™
Radiation Safety in Adult Medical Imaging


549
EXHIBITS
Optimizing Parameters for Flat-Panel Detector Digital Tomosynthesis
radiographics.rsna.org
March-April 2010
Haruhiko Machida, MD, PhD • Toshiyuki Yuhara, RT • Takako Mori, RT
Eiko Ueno, MD • Yoshio Moribe • John M. Sabol, PhD
Digital tomosynthesis is a novel technique that allows easy and swift volume data acquisition in selected regions of the body. However, many radiologists and technologists are unfamiliar with this technique and the potential artifacts related to data acquisition. Digital tomosynthesis requires a single linear sweep of the x-ray tube assembly with corresponding tomographic reconstruction of large-area flat-panel
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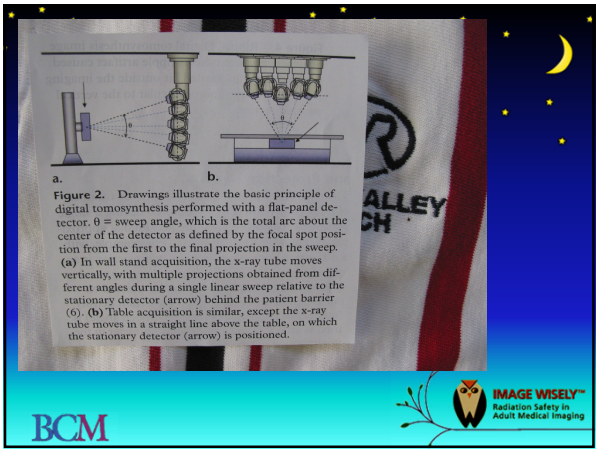
a.
b.
Figure 2. Drawings illustrate the basic principle of digital tomosynthesis performed with a flat-panel detector. θ = sweep angle, which is the total arc about the center of the detector as defined by the focal spot position from the first to the final projection in the sweep. (a) In wall stand acquisition, the x-ray tube moves vertically, with multiple projections obtained from different angles during a single linear sweep relative to the stationary detector (arrow) behind the patient barrier (6). (b) Table acquisition is similar, except the x-ray tube moves in a straight line above the table, on which the stationary detector (arrow) is positioned.
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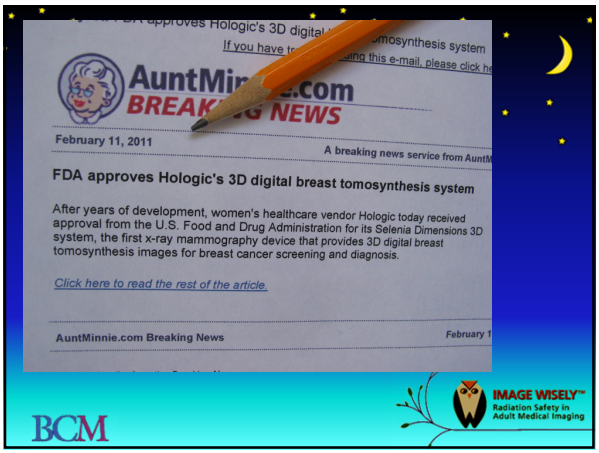
February 11, 2011
A breaking news service from AuntM
FDA approves Hologic's 3D digital breast tomosynthesis system
After years of development, women's healthcare vendor Hologic today received approval from the U.S. Food and Drug Administration for its Selenia Dimensions 3D system, the first x-ray mammography device that provides 3D digital breast tomosynthesis images for breast cancer screening and diagnosis.
Click here to read the rest of the article.
AuntMinnie.com Breaking News
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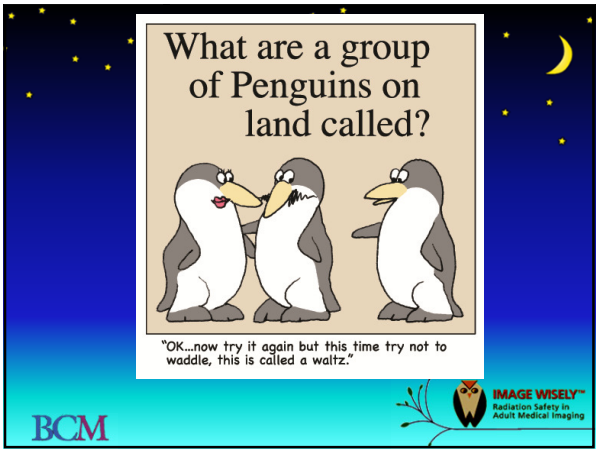
What are a group of Penguins on land called?
"OK...now try it again but this time try not to waddle, this is called a waltz."
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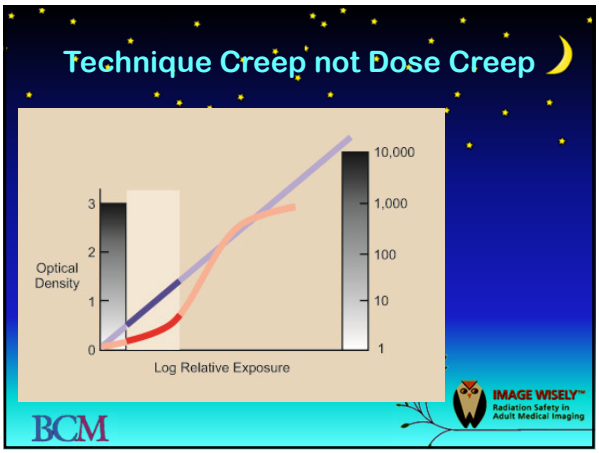
Technique Creep not Dose Creep
Optical Density
3
2
1
0
10,000
1,000
100
10
1
Log Relative Exposure
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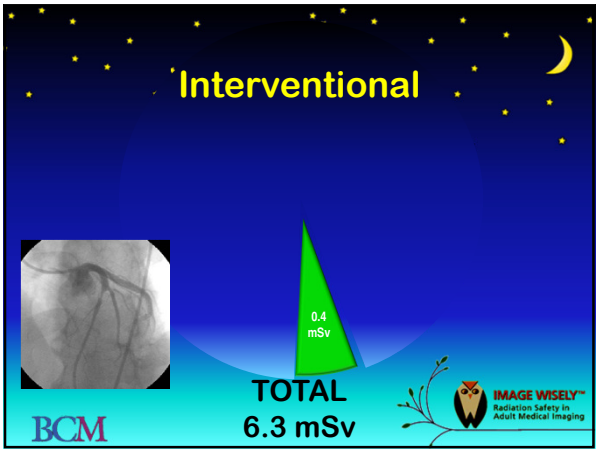
Interventional
0.4 mSv
TOTAL
6.3 mSv
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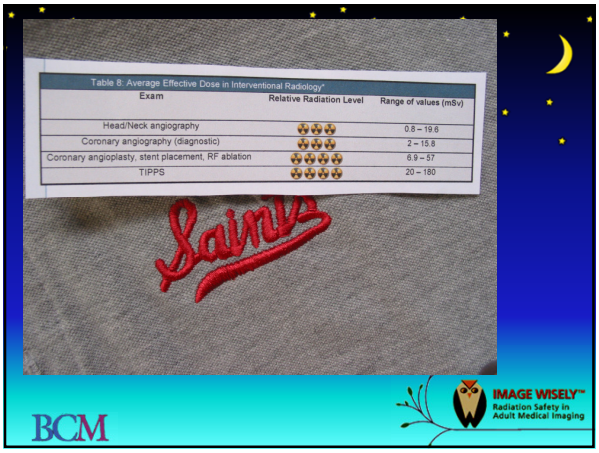
Table 8: Average Effective Dose in Interventional Radiology*
Exam
Relative Radiation Level
Range of values (mSv)
Head/Neck angiography
0.8 – 19.6
Coronary angiography (diagnostic)
2 – 15.8
Coronary angioplasty, stent placement, RF ablation
6.9 – 57
TIPPS
20 – 180
Saints
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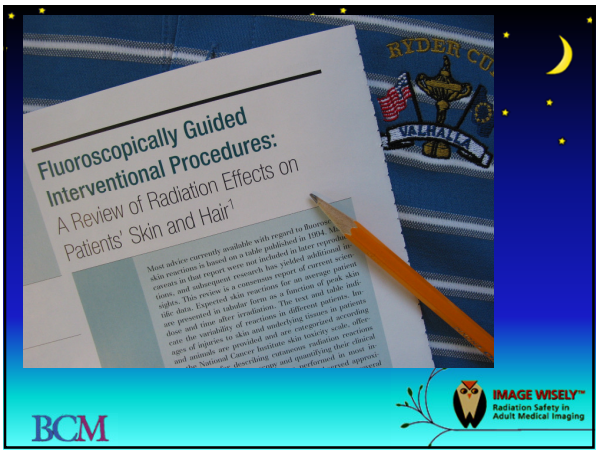
Fluoroscopically Guided Interventional Procedures:
A Review of Radiation Effects on Patients' Skin and Hair[1]
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Figure 1
Figure 1: Radiation injury in a 60-year-old woman subsequent to successful neurointerventional procedure for the treatment of acute stroke. Estimated fluoroscopy time was more than 70 minutes; 43 imaging series were performed during course of the procedure. The head was not shaved. Note focal epilation on scalp and skin injury on neck but not on scalp. No dose estimates were available for this
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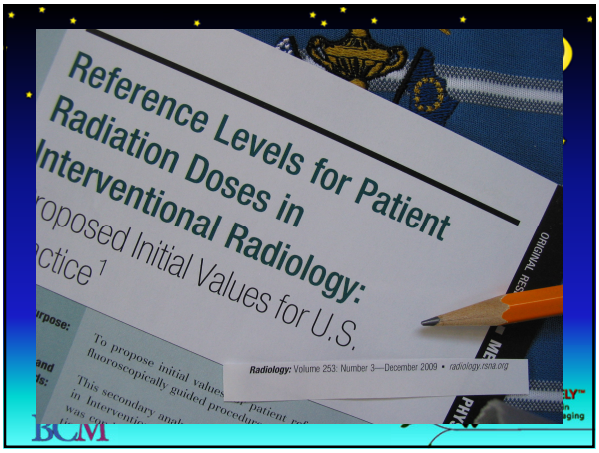
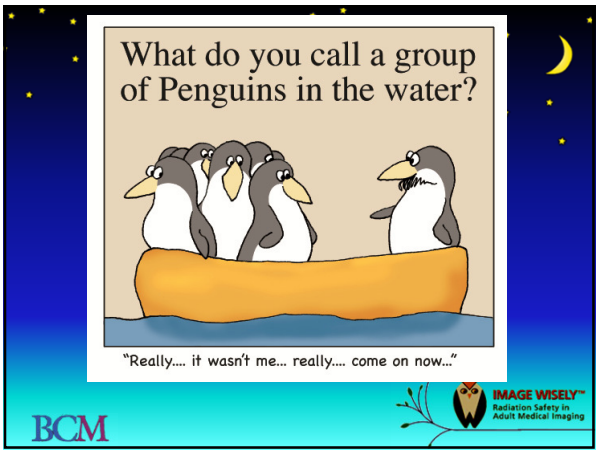

Reference Levels for Patient Radiation Doses in Interventional Radiology:
roposed Initial Values for U.S.
ctice 1
Radiology: Volume 253: Number 3—December 2009 • radiology.rsna.org
BCM


What do you call a group of Penguins in the water?
"Really.... it wasn't me... really.... come on now..."
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Advice to Patients
• < 2 Gy: No need to inform
• 2-5 Gy: Advise erythema possible
• 5-10 Gy: Self-examination. Return if necessary
• 10-15 Gy: Medical follow-up
• > 15 Gy: Medical follow-up essential
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ORGANIZATIONS
PROGRAM INTRODUCTION
RADIATION SOURCES/LEVELS
IMAGING EXAMINATIONS
APPROPRIATENESS
OVERUTILIZATION

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Table 5: Relative Radiation Level Scale

Relative Radiation Level	Effective dose range
None	0
Minimal ☢	Less than 0.1 mSv
Low ☢☢	0.1 – 1.0 mSv
Medium ☢☢☢	1.0 – 10 mSv
High ☢☢☢☢	10 – 100 mSv

* Adapted from ACR Appropriateness Criteria, Radiation Dose Assessment Introduction 2008

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Increasing the Appropriateness of Outpatient Imaging: Effects of a Barrier to Ordering Low-Yield Examinations[1]
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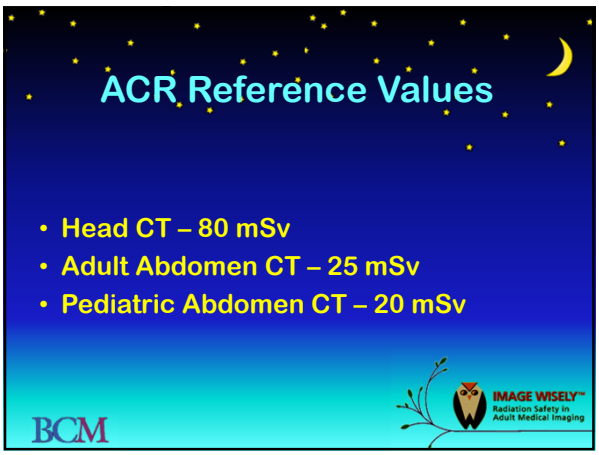
ACR Reference Values
• Head CT – 80 mSv
• Adult Abdomen CT – 25 mSv
• Pediatric Abdomen CT – 20 mSv
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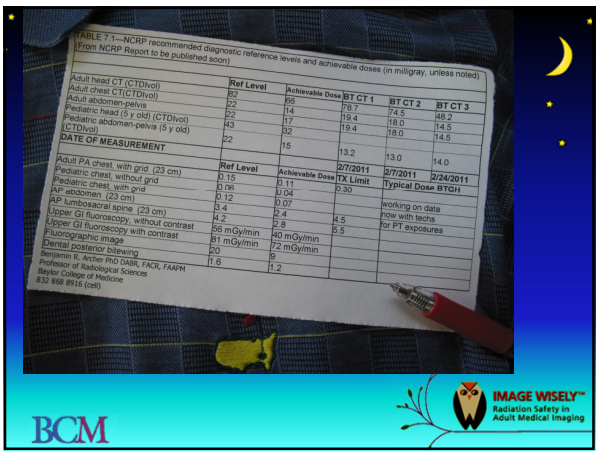
TABLE 7.1—NCRP recommended diagnostic reference levels and achievable doses (in milligray, unless noted)
From NCRP Report to be published soon)
Adult head CT (CTDIvol)
Adult chest CT(CTDIvol)
Adult abdomen-pelvis
Pediatric head (5 y old) (CTDIvol)
Pediatric abdomen-pelvis (5 y old) (CTDIvol)
DATE OF MEASUREMENT
Adult PA chest, with grid (23 cm)
Pediatric chest, without grid
Pediatric chest, with grid
AP abdomen (23 cm)
AP lumbosacral spine (23 cm)
Upper GI fluoroscopy, without contrast
Upper GI fluoroscopy with contrast
Fluorographic image
Dental posterior bitewing
Benjamin R. Archer PhD DABR, FACR, FAAPM
Professor of Radiological Sciences
Baylor College of Medicine
832 868 8916 (cell)
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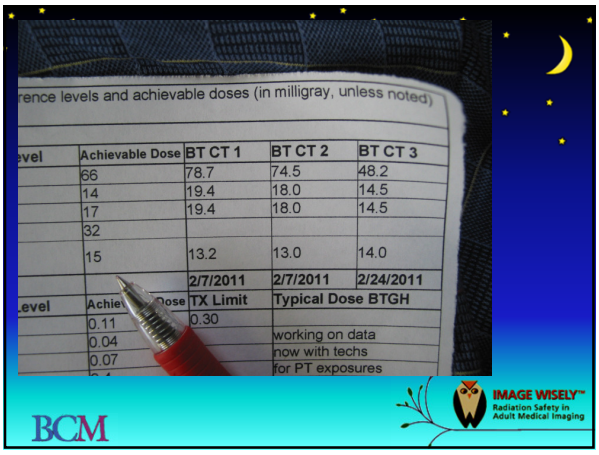
rence levels and achievable doses (in milligray, unless noted)
Achievable Dose
BT CT 1
BT CT 2
BT CT 3
66
78.7
74.5
48.2
14
19.4
18.0
14.5
17
19.4
18.0
14.5
32
15
13.2
13.0
14.0
2/7/2011
2/7/2011
2/24/2011
TX Limit
Typical Dose BTGH
0.30
0.11
0.04
working on data
now with techs
0.07
for PT exposures
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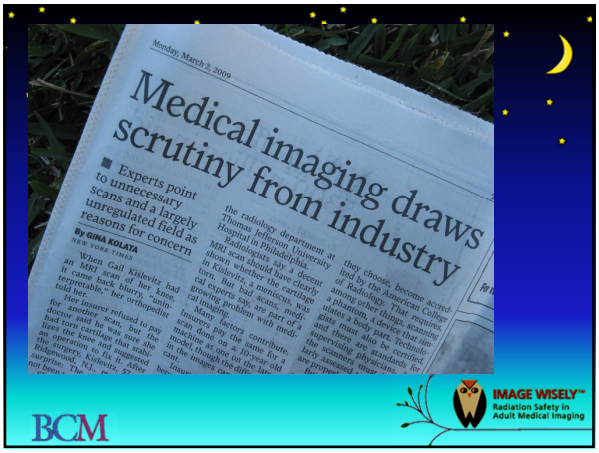
Monday, March 2, 2009
Medical imaging draws scrutiny from industry
Experts point to unnecessary scans and a largely unregulated field as reasons for concern
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MONDAY, MAY 2, 2005
© 2005 Dow Jones
Own Image
MRI and CT Centers Offer Doctors Way to Profit on Scans
Physicians Pay a Flat Fee For Procedures, Then Bill Insurers—at Higher Rate
Navigating Legal Landscape
By David Armstrong
Medical imaging such as MRI and CT scanning is one of health care's fastest-growing sectors. Last October, an owner of imaging centers told doctors how they could get in on the boom.
At a meeting of cardiologists, neuroto-
It's a federal crime for health-care providers to compensate doctors for referrals, or for doctors to receive such compensation, when Medicare or Medicaid patients are involved. Such a ban, called an anti-kickback law, extends to all other types of patients, too, under 36 state statutes, including one in California. Some lawyers say the doctors' almost
Some doctor groups have imaging facilities. Labeled "self-facilities, the deals allow doctors to say MRI or CT scan was done in their own offices and permit the doctors themselves
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6A · THURSDAY, SEPTEMBER 10, 2009 · USA TODAY
File photo by Ron Edmonds, AP
curity card during his 1993 health care speech before Congress.
Health care: Then and now
Aside from annual State of the Union messages, presidents rarely speak to joint sessions of Congress. On Sept. 22, 1993, President Clinton spoke on the topic of health
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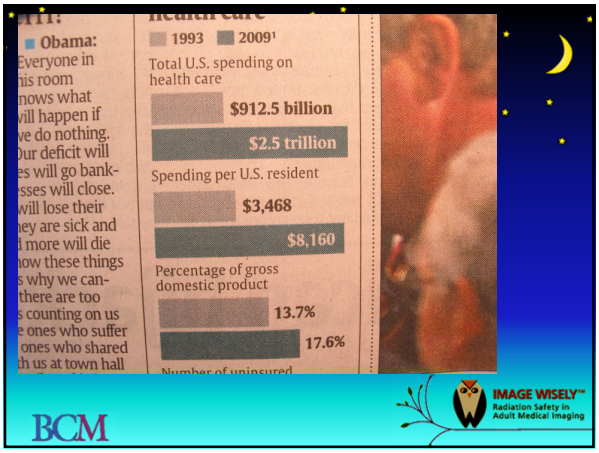
Obama:
Everyone in his room knows what will happen if we do nothing. Our deficit will es will go bank-sses will close. will lose their ey are sick and more will die ow these things s why we can-there are too s counting on us e ones who suffer ones who shared th us at town hall
1993
2009¹
Total U.S. spending on health care
$912.5 billion
$2.5 trillion
Spending per U.S. resident
$3,468
$8,160
Percentage of gross domestic product
13.7%
17.6%
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- Inflation……3%/yr
- Healthcare……9%/yr
- Medical Imaging……18%/yr

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CT, MRI, and PET has ballooned to $100 billion/year

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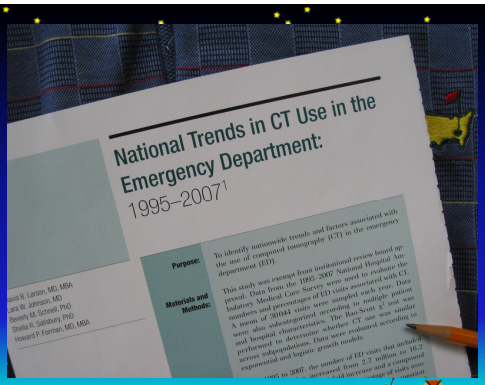
National Trends in CT Use in the Emergency Department: 1995–2007[1]

Purpose:

Materials and Methods:

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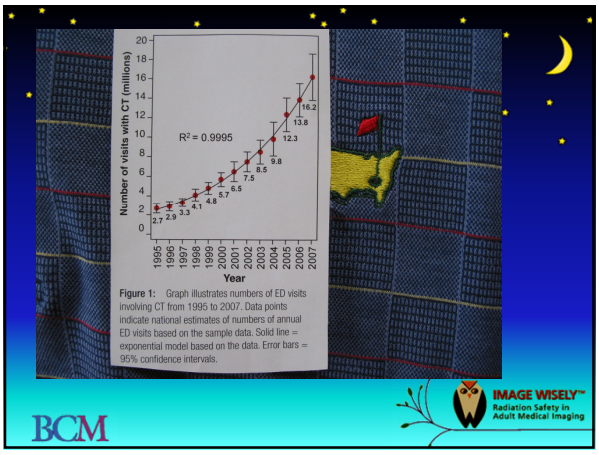
Number of visits with CT (millions)
Year
$R^2 = 0.9995$
2.7
2.9
3.3
4.1
4.8
5.7
6.5
7.5
8.5
9.8
12.3
13.8
16.2
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Figure 1: Graph illustrates numbers of ED visits involving CT from 1995 to 2007. Data points indicate national estimates of numbers of annual ED visits based on the sample data. Solid line = exponential model based on the data. Error bars = 95% confidence intervals.
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Ownership or Leasing of CT Scanners by Nonradiologist Physicians: A Rapidly Growing Trend That Raises Concern About Self-Referral
David C. Levin, MD
Vijay M. Rao, MD
Andrea J. Frangos, MS
Purpose:
Methods and Materials:
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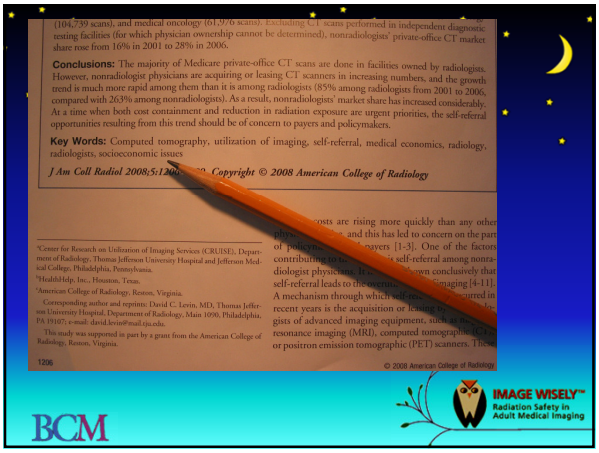
Conclusions:
Key Words:
Copyright © 2008 American College of Radiology
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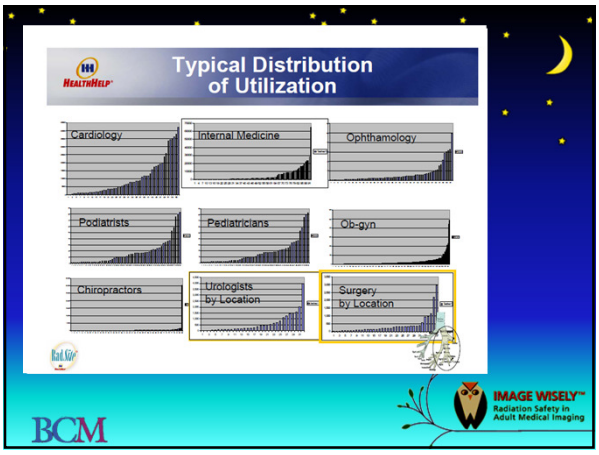
Typical Distribution of Utilization
Cardiology
Internal Medicine
Ophthamology
Podiatrists
Pediatricians
Ob-gyn
Chiropractors
Urologists by Location
Surgery by Location
BCM
IMAGE WISELY™
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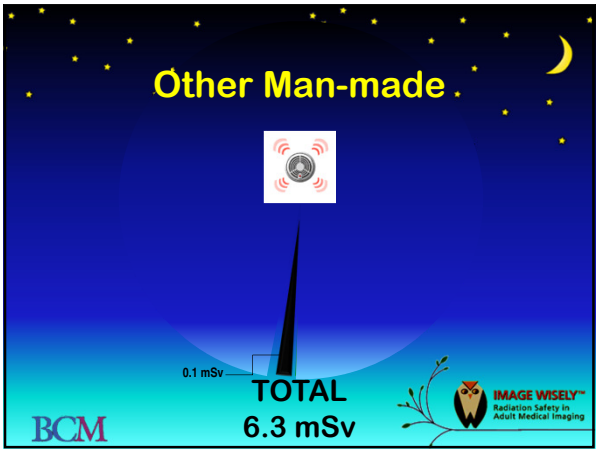
Other Man-made
0.1 mSv
TOTAL
6.3 mSv
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What do you call the area where Penguins nest?
For Sale
"Curb appeal... it's all about curb appeal!"
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IMAGE WISELY™
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CONSUMER RADIATION SOURCES

- Smoke Detectors
- Camp Lanterns
- Microwave Leak Detectors
- Airport Scanners

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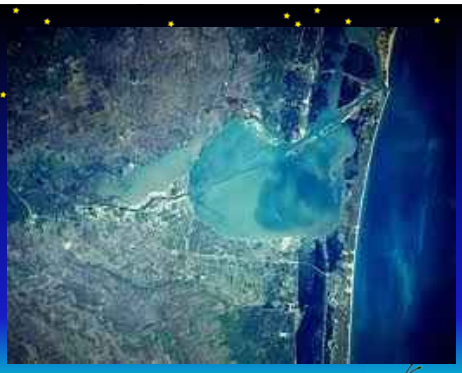

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IMAGE WISELY™ Radiation Safety in Adult Medical Imaging


Kidde
SMOKE AND CARBON MONOXIDE ALARM
BCM
IMAGE WISELY™
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MD Anderson Cancer Center
South Campus
Research Building 3
The University of Texas Health Science Center at Houston
1881 East Rd
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CONSUMER RADIATION SOURCES

- Smoke Detectors
- Camp Lanterns
- Microwave Leak Detectors
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CONSUMER RADIATION SOURCES

- Smoke Detectors
- Camp Lanterns
- Microwave Leak Detectors
- Airport Scanners

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The DETECTO CARD
Microwave Oven RADIATION LEAKAGE INDICATOR CARD (REUSABLE)
SLAMMING THE OVEN DOOR
DIRT OR FOOD PARTICLES
BASIC WEAR AND TEAR
COOK WITH CONFIDENCE!
The DETECTO CARD
MICROWAVE OVEN RADIATION LEAKAGE INDICATOR (REUSABLE)
SENSOR
enzone
Check for Microwave Leakage Every Week
Laboratory Tested for Accuracy
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Be On Guard For Microwave Oven Radiation Leakage!
MICRO ALERT
Doubles as a refrigerator magnet!
Only $4.95
Order #NN2
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"How do you know your microwave oven isn't functioning properly? Maybe your microwave oven leak detector isn't functioning properly."
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CONSUMER RADIATION SOURCES

- Smoke Detectors
- Camp Lanterns
- Microwave Leak Detectors
- Airport Scanners

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AIRPORT SCANNERS

- Hall Effect Metal Detectors (0 uSv)
- Millimeter Wave Scanners (0 uSv)
- Backscatter x-ray scanners (0.1 uSv)

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TSA defends safety of scanners
Radiation expert outlines differences in machines
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IMAGE WISELY™
Radiation Safety in Adult Medical Imaging

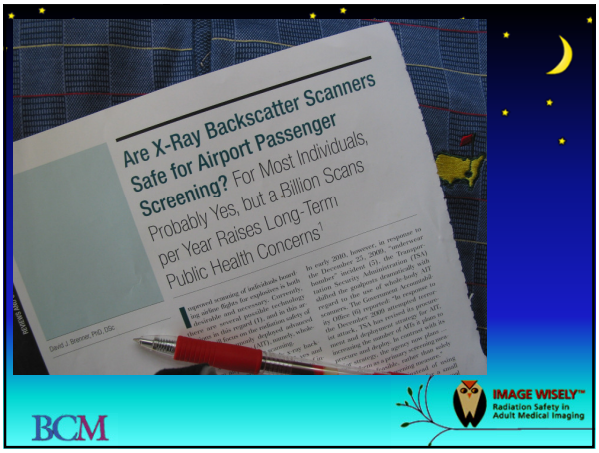
Are X-Ray Backscatter Scanners Safe for Airport Passenger Screening? For Most Individuals, Probably Yes, but a Billion Scans per Year Raises Long-Term Public Health Concerns
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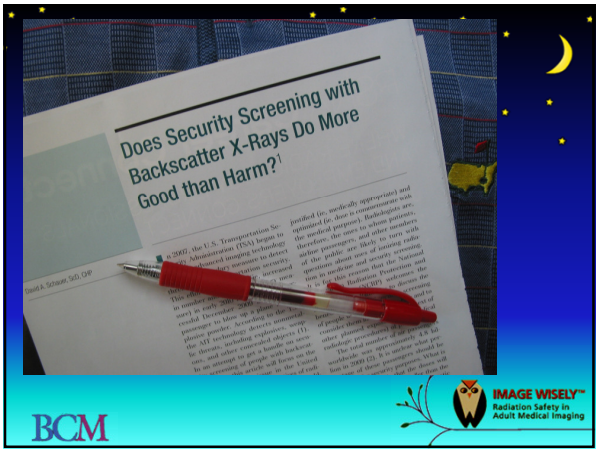
IMAGE WISELY™
Radiation Safety in Adult Medical Imaging


Does Security Screening with Backscatter X-Rays Do More Good than Harm?
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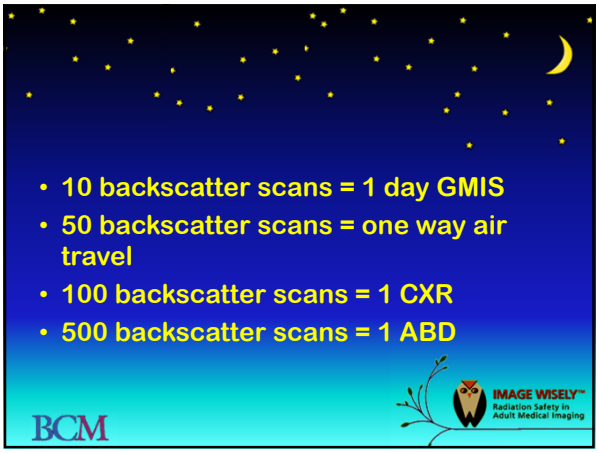
• 10 backscatter scans = 1 day GMIS
• 50 backscatter scans = one way air travel
• 100 backscatter scans = 1 CXR
• 500 backscatter scans = 1 ABD
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IMAGE WISELY™
Radiation Safety in Adult Medical Imaging


'Inexcusable' delay on TSA body-scanner safety reports
Agency: No ill effects for the 15M screened
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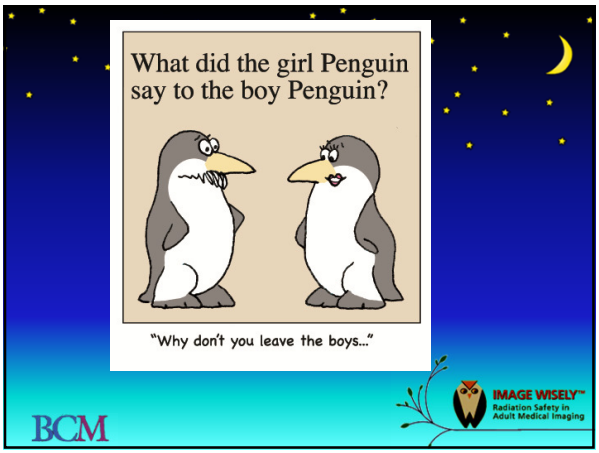
IMAGE WISELY™
Radiation Safety in Adult Medical Imaging


What did the girl Penguin say to the boy Penguin?
"Why don't you leave the boys..."
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WADDLE OVER TO MY RAFT AND I'LL ROOK YOU
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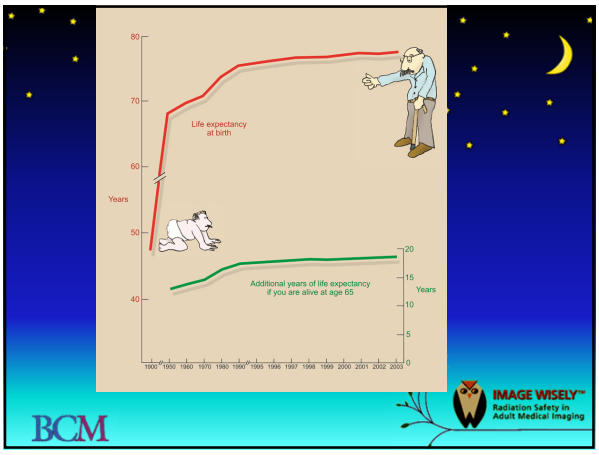
Life expectancy at birth
Years
Additional years of life expectancy if you are alive at age 65
Years
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IMAGE WISELY™
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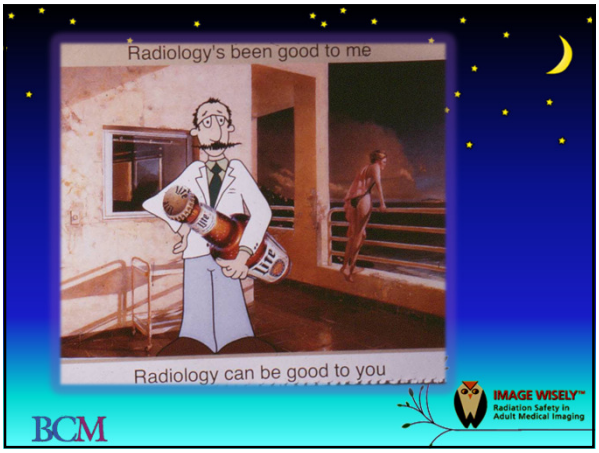
Radiology's been good to me
Radiology can be good to you
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