Radiation Risk Communication to Patients and Parents:
Translating science into practice-
What to say, what to do

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image gently℠

Cincinnati Children's

Faculty Disclosure Information

Dr. Goske

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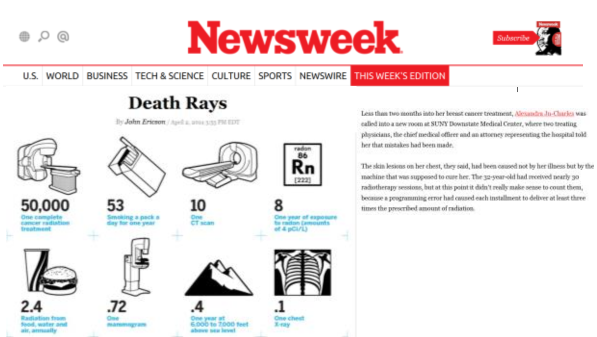
I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation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Death Rays

By *John Ericson*

Less than two months into her breast cancer treatment, Alexandra Jn-Charles was called into a new room at SUNY Downstate Medical Center, where two treating physicians, the chief medical officer and an attorney representing the hospital told her that mistakes had been made.

The skin lesions on her chest, they said, had been caused not by her illness but by the machine that was supposed to cure her. The 32-year-old had received nearly 30 radiotherapy sessions, but at this point it didn't really make sense to count them, because a programming error had caused each installment to deliver at least three times the prescribed amount of radiation.

Effective communication requires

Factual content

Good style of communication

Broder JS, Frush DP. J Am Coll Radiol 2014;11:238-242

Learning objectives
After completing this learning activity, participant should be able to:

- Provide an update on radiation and dose
- Discuss the controversy and potential risks associated with ionizing radiation
- List talking points about radiation risk when speaking to parents
- Discuss Image Gently educational materials as resources for parents and medical imaging professionals

" How safe is a CT scan for my child?"

QUESTIONS

Question 1

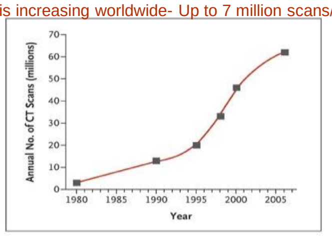
Why is there concern about radiation used in medical imaging?

Why is radiation a "hot topic"?

- use of imaging in early 2000's
  - accuracy and advances in technology contribute to increased use
- emphasis on safety due to medical error
  - government /media attention

Increasing use of CT scans in the United States

Pediatric CT is increasing worldwide- Up to 7 million scans/yr



Brenner DJ, Hall EH. Computed Tomography-An Increasing Source of Radiation Exposure
2007 Vol 357:2277-2284

The NEW ENGLAND JOURNAL of MEDICINE

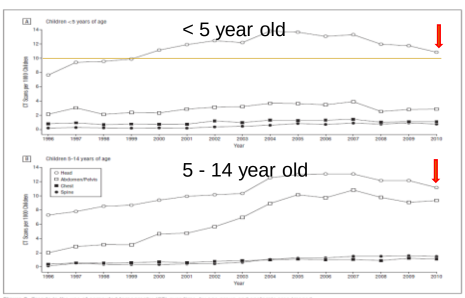


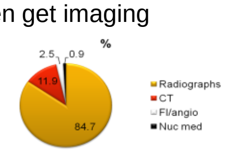
Figure 2. Trends in the use of computed tomography (CT) over time, by age group and anatomic area imaged.

Migliorettti DL et al. The use of Computed TomographyThe in Pediatric and the Associated Radiation Exposure and Estimated Cancer Risk. JAMA Pediatrics 2013

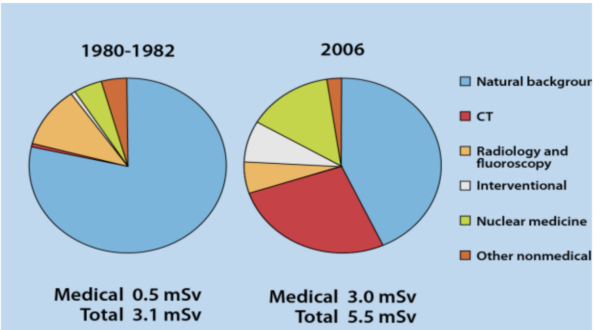
Patterns of use in children

n= 355,088 United Healthcare database

1 in 43 children get imaging



Dorfman AL et al. ARCH PEDIATR ADOLESC MED/VOL 165 (NO. 5), MAY 2011



Question 2

What is the potential harm?

FACT: Radiation in very large doses causes cancer

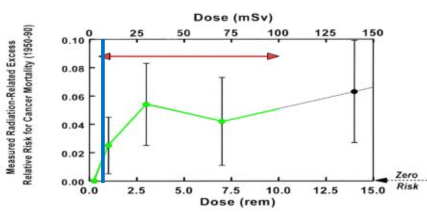
Photo # NH 50603 Torpedo plane takes off from Shokaku to attack Pearl Harbor, 7 December 1941

http://www.history.navy.mil/photos/images/h50000/h50603.jpg

- Are 2-5x more sensitive to radiation for most cancers
- Have a longer life to express those changes…cancer latency is 10-40 years!
- We assume that a large number of CT exams increases risk

Scaife ER, Rollins MD. Seminars in Pediatric Surgery 2010;19:252

Data from the A-bomb survivors expressing the relevant risk for cancer mortality. Relevant dose range for pediatric CT: 6-100 mSv (0.006=0.1 Sv). "There is direct, statistically significant evidence for risk in the dose range from 0 to 0.1 Sv." Reproduced with permission from Springer Verlag[22]



From pediatricradiology.ccf.org Slovis TL. Radiation safety

Two types of radiation effects

High dose → tissue effects (acute)

Lower dose → stochastic effects (delayed)

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Most tissue effects occur at 1 month

Tissue Reactions from Single-Delivery Radiation Dose to Skin of the Neck, Torso, Pelvis, Buttocks, or Arms

Band	Single-Site Acute Skin-Dose Range (Gy)*	NCI Skin Reaction Grade†	Approximate Time of Onset of Effects: Prompt	Early	Midterm	Long Term
A1	0–2	NA	No observable effects expected	No observable effects expected	No observable effects expected	No observable effects expected
A2	2–5	1	Transient erythema	Epilation	Recovery from hair loss	No observable results expected
B	5–10	1–2	Transient erythema	Erythema, epilation	Recovery; at higher doses, prolonged erythema, permanent partial epilation	Recovery; at higher doses, dermal atrophy or induration
C	10–15	2–3	Transient erythema	Erythema, epilation; possible dry or moist desquamation; recovery from desquamation	Prolonged erythema; permanent epilation	Telangiectasia‡; dermal atrophy or induration; skin likely to be weak
D	>15	3–4	Transient erythema; after very high doses, edema and acute ulceration; long-term surgical intervention likely to be required	Erythema, epilation; moist desquamation	Dermal atrophy; secondary ulceration due to failure of moist desquamation to heal; surgical intervention likely to be required; at higher doses, dermal	Telangiectasia‡; dermal atrophy or induration; possible late skin breakdown;wound might be persistent and progress into a deeper lesion;

Radiology. 2010 Feb;254(2):326-41. doi: 10.1148/radiol.2542082312.

Increased attention to risk from medical radiation exposure

Oct 30, 2008 9:19 pm US/Pacific

CBS13 Investigates: Radiation Overexposure

Radiation Overexposure Involving A 2-Year-Old Child

Reporting
Sam Shane

ARCATA (CBS13) — Inside the tiny frame of two-year-old Jacoby Roth no one really knows for sure what's going on.

"I just want him to be ok," says Carrie Roth, Jacoby's mother.

But Jacoby's mother Carrie, and his father Padre and Jacoby himself may very well live the rest of their lives not knowing.

Figure 1. Radiodermatitis in the right arm of a 7 year old patient. Photograph taken 4 weeks after radiofrequency ablation (taken from Reference 5 with the permission of the British Journal of Radiology).

Vano, E., Arranz, L., Sastre, J. M., Moro, L., Ledo, A., Garate, M. T. and Minguez, I. *Dosimetric and Radiation Protection Considerations based on some Cases of Patient Skin Injuries in Interventional Cardiology.* Br. J. Radiol. **71**, 510–516 (1998).

Tissue effects - Dose dependent with threshold ➔ predictable


THE RADIATION BOOM

After Stroke Scans, Patients Face Serious Health Risks

By WALT BOGDANICH

Published: July 31, 2010

When Alain Reyes's hair suddenly fell out in a freakish band circling his head, he was not the only one worried about his health. His co-workers at a shipping

New York Times July 31, 2010

Stochastic effect

- *Potential* for cancer
- *Potential* for genetic effects
  - *risk* of event occurring is dependent on dose
  - there is assumed to be "no threshold"

image gently℠

From: Slovis T, Frush DP
Medical Radiation and Children
PowerPoint, www.pedrad.org. 2007

Question 3

What are relative radiation doses for common imaging exams?

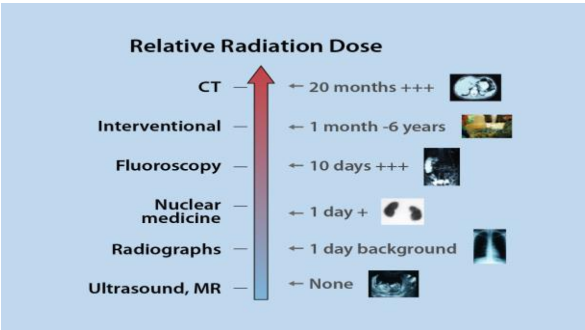
Trillions..

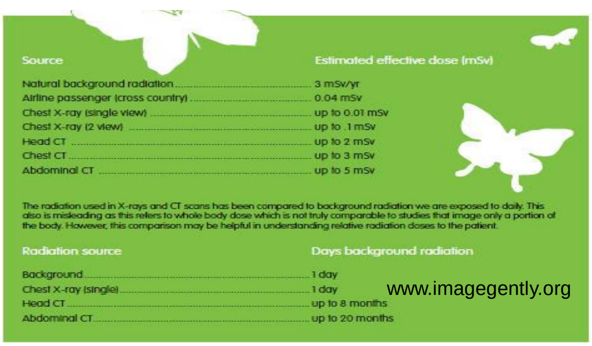
Some facts

- A single **gray** is a **large dose** of radiation
- Most **medical doses** are **milliGray** (mGy)
- Sieverts are a similar measure but with a weighting factor for type of radiation and tissue affected. It is used in risk estimates.
- Background radiation is 3 mSv/year

More facts

- Up to 0.1 mGy for 2 view chest radiograph
- 5.0 mGy CT abdomen for 5 year old
- 10-20.0 mGy for adult- size CT abdomen





Source	Estimated effective dose (mSv)
Natural background radiation	3 mSv/yr
Airline passenger (cross country)	0.04 mSv
Chest X-ray (single view)	up to 0.01 mSv
Chest X-ray (2 view)	up to .1 mSv
Head CT	up to 2 mSv
Chest CT	up to 3 mSv
Abdominal CT	up to 5 mSv

The radiation used in X-rays and CT scans has been compared to background radiation we are exposed to daily. This also is misleading as this refers to whole body dose which is not truly comparable to studies that image only a portion of the body. However, this comparison may be helpful in understanding relative radiation doses to the patient.

Radiation source	Days background radiation
Background	1 day
Chest X-ray (single)	1 day
Head CT	up to 8 months
Abdominal CT	up to 20 months

www.imagegently.org

Question 4

Can radiation be measured ?

FULL DISCLOSURE ….

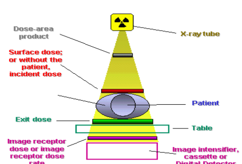
WE HAVE NOT BEEN ABLE TO EASILY MEASURE THE RADIATION DOSE OUR PATIENTS RECEIVE !

"The determination of ionizing radiation dose to a living human from an x-ray exam is very complex….."

JACR 2007 May 4(5) 272

"Can't measure dose… can only estimate dose."

Courtesy of **Priscilla Butler, MS Physicist**



Can radiation be accurately and easily measured at the time of the exam ?

YES	NO
• Nuclear Medicine	• Digital Radiographs
• Fluoroscopy * Requires Kapmeter	• Fluoroscopy No Kapmeter
• CT SSDE estimate- not on manufacturers' equipment	

Question 5

Does radiation cause cancer?

RISK

TABLE 6
Lifetime Risk of Death from Everyday Activities in United States (*69*)

Activity	Lifetime risk
Assault	214
Accident while riding in car	304
Accident as pedestrian	652
Choking	894
Accidental poisoning	1,030
Drowning	1,127
Exposure to fire or smoke	1,181
Cancer from ^{18}F-FDG PET scan (10-y-old)	1,515
Falling down stairs	2,024
Cancer from ^{99m}Tc-MDP bone scan (10-y-old)	2,560
Cancer from ^{18}F-FDG PET scan (40-y-old)	2,700
All forces of nature	3,190
Accident while riding bike	4,734
Cancer from ^{99m}Tc-MDP bone scan (40-y-old)	4,760
Accidental firearms discharge	6,333
Accident while riding in plane	7,058
Falling off ladder or scaffolding	10,606
Hit by lightning	84,388

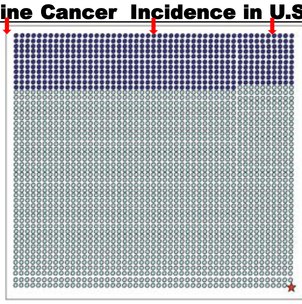
Compressed mortality: 1999–2007. CDC WONDER Web site. Available at: http://wonder.cdc.gov/cmf-icd10.html. Accessed May 26, 2011.

What is the baseline lifetime cancer occurrence in the U.S. population ?

a. 20%
b. 40% ←
c. 60%
d. 80%

Baseline risk of death is 20%

Baseline Cancer Incidence in U.S. = 40%



Baseline incidence of death from cancer in U.S. = 20%

1 in 2,500 risk

1 in 550

THE JOURNAL OF NUCLEAR MEDICINE • Vol. 52 • No. 8 • August 2011

Radiation exposure from CT scans in childhood and subsequent risk of leukaemia and brain tumours: a retrospective cohort study

Mark S Pearce, Jane A Salotti, Mark P Little, Kieran McHugh, Choonsik Lee, Kwang Pyo Kim, Nicola L Howe, Cecile M Ronckers, Preetha Rajaraman, Sir Alan W Craft, Louise Parker, Amy Berrington de González

Summary

Background Although CT scans are very useful clinically, potential cancer risks exist from associated ionising radiation, in particular for children who are more radiosensitive than adults. We aimed to assess the excess risk of leukaemia and brain tumours after CT scans in a cohort of children and young adults.

Methods In our retrospective cohort study, we included patients without previous cancer diagnoses who were first examined with CT in National Health Service (NHS) centres in England, Wales, or Scotland (Great Britain) between 1985 and 2002, when they were younger than 22 years of age. We obtained data for cancer incidence, mortality, and loss to follow-up from the NHS Central Registry from Jan 1, 1985, to Dec 31, 2008. We estimated absorbed brain and red bone marrow doses per CT scan in mGy and assessed excess incidence of leukaemia and brain tumours cancer with Poisson relative risk models. To avoid inclusion of CT scans related to cancer diagnosis, follow-up for leukaemia began 2 years after the first CT and for brain tumours 5 years after the first CT.

Findings During follow-up, 74 of 178 604 patients were diagnosed with leukaemia and 135 of 176 587 patients were diagnosed with brain tumours. We noted a positive association between radiation dose from CT scans and leukaemia (excess relative risk [ERR] per mGy 0·036, 95% CI 0·005–0·120; p=0·0097) and brain tumours (0·023, 0·010–0·049; p<0·0001). Compared with patients who received a dose of less than 5 mGy, the relative risk of leukaemia for patients who received a cumulative dose of at least 30 mGy (mean dose 51·13 mGy) was 3·18 (95% CI 1·46–6·94) and the relative risk of brain cancer for patients who received a cumulative dose of 50–74 mGy (mean dose 60·42 mGy) was 2·82 (1·33–6·03).

Interpretation Use of CT scans in children to deliver cumulative doses of about 50 mGy might almost triple the risk of leukaemia and doses of about 60 mGy might triple the risk of brain cancer. Because these cancers are relatively rare, the cumulative absolute risks are small: in the 10 years after the first scan for patients younger than 10 years, one excess case of leukaemia and one excess case of brain tumour per 10 000 head CT scans is estimated to occur. Nevertheless, although benefits might outweigh the small absolute risks, radiation doses from CT scans should be kept as low as possible and alternative procedures, which do not involve ionising radiation, should be considered if appropriate.

Funding US National Cancer Institute and UK Department of Health.

Published Online June 7, 2012 DOI:10.1016/S0140-6736(12)60815-0

See Online/Commer DOI:10.1016/S0140-6736(12)60897-6

See Online/Perspect DOI:10.1016/S0140-6736(12)60915-5

Cancer risk in 680 000 people exposed to computed tomography scans in childhood or adolescence: data linkage study of 11 million Australians

OPEN ACCESS

John D Mathews *epidemiologist*, Anna V Forsythe *research officer*, Zoe Brady *medical physicist*, Martin W Butler *data analyst*, Stacy K Goergen *radiologist*, Graham B Byrnes *statistician*, Graham G Giles *epidemiologist*, Anthony B Wallace *medical physicist*, Philip R Anderson *epidemiologist*, Tenniel A Guiver *data analyst*, Paul McGale *statistician*, Timothy M Cain *radiologist*, James G Dowty *research fellow*, Adrian C Bickerstaffe *computer scientist*, Sarah C Darby *statistician*

lymphoid). The absolute excess incidence rate for all cancers combined was 9.38 per 100 000 person years at risk, as of 31 December 2007. The average effective radiation dose per scan was estimated as 4.5 mSv.

Conclusions The increased incidence of cancer after CT scan exposure in this cohort was mostly due to irradiation. Because the cancer excess was still continuing at the end of follow-up, the eventual lifetime risk from CT scans cannot yet be determined. Radiation doses from contemporary CT scans are likely to be lower than those in 1985-2005, but some increase in cancer risk is still likely from current scans. Future CT scans should be limited to situations where there is a definite clinical indication, with every scan optimised to provide a diagnostic CT image at the lowest possible radiation dose.

Since cancer incidence is very low, this increased risk translates into 6 extra cancers over 10 years for every 10,000 children who had a CT scan

Computed tomography in is associated with small ir

Zosia Kmietowicz

BMJ

Computed tomography in children and young people has a small but significant effect on their risk of developing cancer, a large population based study has found.

Overall the study found that the chance of developing cancer was 24% higher among children and teenagers who had undergone computed tomography than among those who had not. But because the incidence of cancer in early life is very low this increased risk translated into only an extra six cancers over 10 years for every 10 000 young people who underwent computed tomography. Had they not had any scans, 39 cases of cancer would have been expected in this group.[1]

BMJ 2013;346:f2360 doi: 10.1136/bmj.f2360 (Published 22 May 2013)

Editorial

CT radiation risks coming into clearer focus

BMJ 2013;346doi: http://dx.doi.org/10.1136/bmj.f3102(Published 21 May 2013)
Cite this as: BMJ 2013;346:f3102

"The finding that will probably dominate media headlines is that exposure to CT in childhood increased the incidence of cancer by 24%. However, it is important to recognize that the baseline incidence of cancer in a general pediatric population is extremely small, so that a 24% increase makes this risk just slightly less small."

Sodickson A. BMJ2013;346:f3102

ARTICLE

ONLINE FIRST

The Use of Computed Tomography in Pediatrics and the Associated Radiation Exposure and Estimated Cancer Risk

Diana L. Miglioretti, PhD; Eric Johnson, MS; Andrew Williams, PhD; Robert T. Greenlee, PhD, MPH; Sheila Weinmann, PhD, MPH; Leif I. Solberg, MD; Heather Spencer Feigelson, PhD, MPH; Douglas Roblin, PhD; Michael J. Flynn, PhD; Nicholas Vanneman, MA; Rebecca Smith-Bindman, MD

Importance: Increased use of computed tomography (CT) in pediatrics raises concerns about cancer risk from exposure to ionizing radiation.

Objectives: To quantify trends in the use of CT in pediatrics and the associated radiation exposure and cancer risk.

Design: Retrospective observational study.

Setting: Seven US health care systems.

Participants: The use of CT was evaluated for children younger than 15 years of age from 1996 to 2010, including 4 857 736 child-years of observation. Radiation doses were calculated for 744 CT scans performed between 2001 and 2011.

Main Outcomes and Measures: Rates of CT use, organ and effective doses, and projected lifetime attributable risks of cancer.

Results: The use of CT doubled for children younger than 5 years of age and tripled for children 5 to 14 years of age between 1996 and 2005, remained stable between 2006 and 2007, and then began to decline. Effective doses varied from 0.03 to 69.2 mSv per scan. An effective dose of 20 mSv or higher was delivered by 14% to 25% of abdomen/pelvis scans, 6% to 14% of spine scans, and 3% to 8% of chest scans. Projected lifetime attributable risks of solid cancer were higher for younger patients and girls than for older patients and boys, and they were also higher for patients who underwent CT scans of the abdomen/pelvis or spine than for patients who underwent other types of CT scans. For girls, a radiation-induced solid cancer is projected to result from every 300 to 390 abdomen/pelvis scans, 330 to 480 chest scans, and 270 to 800 spine scans, depending on age. The risk of leukemia was highest from head scans for children younger than 5 years of age at a rate of 1.9 cases per 10 000 CT scans. Nationally, 4 million pediatric CT scans of the head, abdomen/pelvis, chest, or spine performed each year are projected to cause 4870 future cancers. Reducing the highest 25% of doses to the median might prevent 43% of these cancers.

Conclusions and Relevance: The increased use of CT in pediatrics, combined with the wide variability in radiation doses, has resulted in many children receiving a high-dose examination. Dose-reduction strategies targeted to the highest quartile of doses could dramatically reduce the number of radiation-induced cancers.

JAMA Pediatr.
Published online June 10, 2013.
doi:10.1001/jamapediatrics.2013.311

BMJ 2013;346:f2360 doi: 10.1136/bmj.f2360 (Published 22 May 2013)

Image Gently "universal protocols"

We estimated the potential impact of lowering the top 25% of doses to the median, which could be achieved by implementing standardized pediatric CT protocols, such as those found on the Image Gently website,[38] and other guidelines for ensuring that doses are "as low as reasonably achievable."[39,40] We found that 43% of the projected future cancers associated with pediatric CT might be prevented.

Image Gently universal protocols developed by Keith Strauss,
Cincinnati Children's Hospital,
medical imaging physicist

Radiology

ORIGINAL RESEARCH ■ SPECIAL REPORT

Managing Radiation Use in Medical Imaging: A Multifaceted

Hedvig Hricak, MD
David J. Brenner, P
S. James Adelstein
Donald P. Frush, M
Eric J. Hall, DPhil,
Roger W. Howell, P
Cynthia H. McCollough, PhD
Fred A. Mettler, MD
Mark S. Pearce, PhD

"In brief, there is reasonable, though not definitive, epidemiological evidence that organ doses in the range from 5 to 125 mSv result in a very small but statistically significant increase in cancer risk."

diation exposure, radiation risk estimation, dose reduction strategies, and regulatory options.

©RSNA, 2010

Radiology

Radiation Risks of Medical Imaging: Separating Fact from Fantasy[1]

William R. Hendee, PhD
Michael K. O'Connor, PhD

dures. For the purpose of risk estimation, doses to patients are converted to effective doses, even though the International Commission on Radiological Protection warns against the use of effective dose for epidemiologic studies or for estimation of individual risks. To extrapolate cancer incidence to doses of a few millisieverts from data greater than 100 mSv, a linear no-threshold model is used, even though substantial radiobiological and human exposure data imply that it is not an appropriate model. The predictions of cancers and cancer deaths are sensationalized in electronic and print public media, resulting in anxiety and

Are CT scans carcinogenic? This is controversial.

- Hall and Brenner

..resulting dose to population *will lead* to higher cancer rates, accounting for as many as 2% of all cancers in the U.S.

- Mezrich

.. atomic bomb different vs. “relatively low dose CT”

Mezrich R. jACR 2008 Vol 5:691.

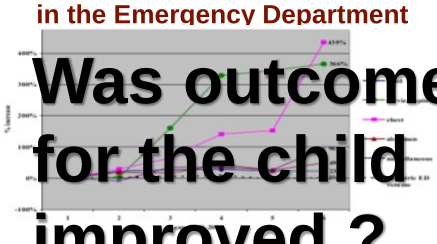
Image Gently
Does medical radiation cause cancer?

We don't know

We should act cautiously

as there is a risk

Increased Pediatric CT in the Emergency Department



Was outcome for the child improved ?

Broder et al. Emerg Radiol 2007; 14:227-32
Slide courtesy of Donald Frush, MD

Question 6

Why do we talk to parents about radiation risk?

Core principle of medical ethics

Patient Autonomy

Broder JS, Frush DP. J Am Coll Radiol 2014;11:238-242

Account for affective component in people's perceptions of risk

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Ropeik D. Risk Communication. More than Facts and Feelings www.iaea.org Vol 50-1

Dialogue, not instruction

Ropeik D. Risk Communication. More than Facts and Feelings
www.iaea.org Vol 50-1

Should encourage certain behaviors

Ropeik D. Risk Communication. More than Facts and Feelings
www.iaea.org Vol 50-1

Should discuss benefit/risk

Ropeik D. Risk Communication. More than Facts and Feelings
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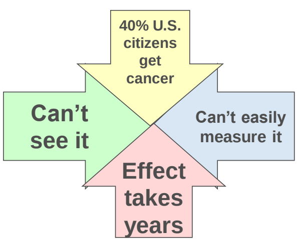
Question 7

How do we talk to parents about radiation risk?

WHY IS RADIATION A DIFFICULT TOPIC TO DISCUSS?



We need a simple, positive message to avoid bias

- Patients' understanding of risk is subject to bias.
- *Hueristics*: public views an issue as "dangerous or safe"
- We do not want parents to refuse <u>indicated</u> CT for their children out of fear

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Redelmeier DA et al. JAMA 270:72-76,1993

Example of *huerism*

- Birth control pill in England
- Risk for pulmonary embolism greater with pregnancy
- Yet public heard "BCP is bad for health" and renounced BCP

Lloyd AJ. Qual Health Care 10 (suppl1)i14-i18, 2001

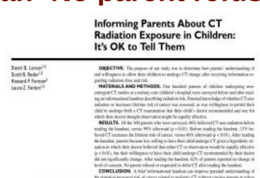
image gently

Education for the public/ parents

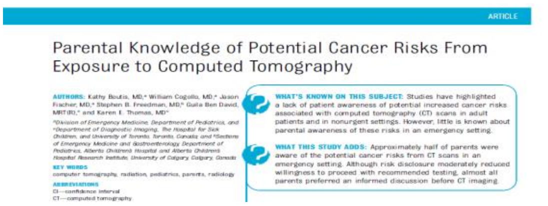
Only 7% of patients told of benefit/ radiation risk of CT scan prior to CT scan

Lee C. Radiology 231;393-398, 2004

Parent survey
Only 66 % aware radiation used for CT scan- No parent refused CT


Informing Parents About CT Radiation Exposure in Children: It's OK to Tell Them

Larson DB et al. AJR 189;271, 2007


ARTICLE

Parental Knowledge of Potential Cancer Risks From Exposure to Computed Tomography

AUTHORS: Kathy Boutis, MD,[a] William Cogollo, MD,[a] Jason Fischer, MD,[a] Stephen B. Freedman, MD,[b] Guila Ben David, MRT(R),[a] and Karen E. Thomas, MD[a]

[a]Division of Emergency Medicine, Department of Pediatrics, and [a]Department of Diagnostic Imaging, The Hospital for Sick Children, and University of Toronto, Toronto, Canada; and [b]Sections of Emergency Medicine and Gastroenterology, Department of Pediatrics, Alberta Children's Hospital and Alberta Children's Hospital Research Institute, University of Calgary, Calgary, Canada

KEY WORDS
computer tomography, radiation, pediatrics, parents, radiology

ABBREVIATIONS
CI—confidence interval
CT—computed tomography

WHAT'S KNOWN ON THIS SUBJECT: Studies have highlighted a lack of patient awareness of potential increased cancer risks associated with computed tomography (CT) scans in adult patients and in nonurgent settings. However, little is known about parental awareness of these risks in an emergency setting.

WHAT THIS STUDY ADDS: Approximately half of parents were aware of the potential cancer risks from CT scans in an emergency setting. Although risk disclosure moderately reduced willingness to proceed with recommended testing, almost all parents preferred an informed discussion before CT imaging.

90% of parents want to be told about the risk

Pediatrics 2013; 132:1-7

Talking points

- Keep it simple-literacy level in US is 6th grade
- Emphasize the current health concern
- Describe the potential benefit
- Describe how the test will impact care
- Risks we take in every day lives
- Opportunity to ask questions

image gently

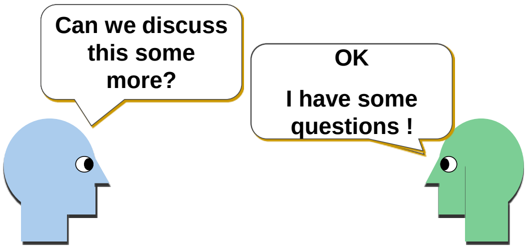
Phrases to use

- "We need more information to clarify your child's diagnosis…"
- "Comparing the potential risks of CT against the risk of your child's condition, the safest course is…"

image gently

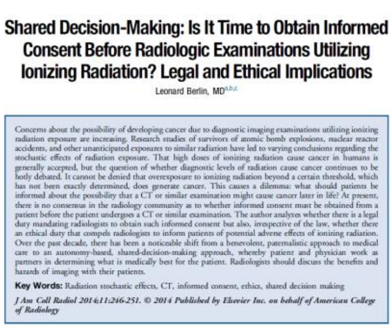
Broder JS, Frush DP. J Am Coll Radiol 2014;11:238-242

Discussion of radiation risk is complex- care must be taken to avoid parents refusing indicated scans



Question 8

Should we be getting informed consent for CT scans ?



Shared Decision-Making: Is It Time to Obtain Informed Consent Before Radiologic Examinations Utilizing Ionizing Radiation? Legal and Ethical Implications

Leonard Berlin, MD[a,b,c]

Concerns about the possibility of developing cancer due to diagnostic imaging examinations utilizing ionizing radiation exposure are increasing. Research studies of survivors of atomic bomb explosions, nuclear reactor accidents, and other unanticipated exposures to similar radiation have led to varying conclusions regarding the stochastic effects of radiation exposure. That high doses of ionizing radiation cause cancer in humans is generally accepted, but the question of whether diagnostic levels of radiation cause cancer continues to be hotly debated. It cannot be denied that overexposure to ionizing radiation beyond a certain threshold, which has not been exactly determined, does generate cancer. This causes a dilemma: what should patients be informed about the possibility that a CT or similar examination might cause cancer later in life? At present, there is no consensus in the radiology community as to whether informed consent must be obtained from a patient before the patient undergoes a CT or similar examination. The author analyzes whether there is a legal duty mandating radiologists to obtain such informed consent but also, irrespective of the law, whether there an ethical duty that compels radiologists to inform patients of potential adverse effects of ionizing radiation. Over the past decade, there has been a noticeable shift from a benevolent, paternalistic approach to medical care to an autonomy-based, shared-decision-making approach, whereby patient and physician work as partners in determining what is medically best for the patient. Radiologists should discuss the benefits and hazards of imaging with their patients.

Key Words: Radiation stochastic effects, CT, informed consent, ethics, shared decision making

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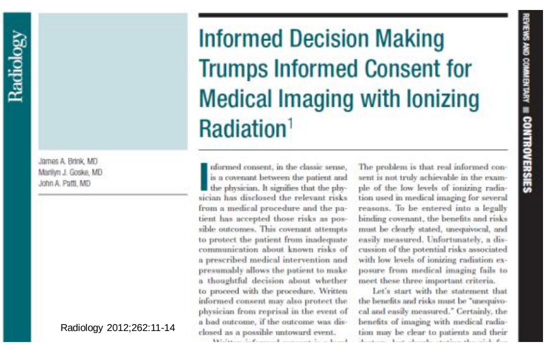
Len Berlin, MD

- "There is insufficient data to justify an unequivocal determination of whether cancer will develop from diagnostic –level radiation."
- Current standard of care does not require informed consent
- MD have a *moral* duty to discuss potential risk of radiation, when appropriate



Radiology

REVIEWS AND COMMENTARY ■ CONTROVERSIES

Informed Decision Making Trumps Informed Consent for Medical Imaging with Ionizing Radiation[1]

James A. Brink, MD
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Informed consent, in the classic sense, is a covenant between the patient and the physician. It signifies that the physician has disclosed the relevant risks from a medical procedure and the patient has accepted those risks as possible outcomes. This covenant attempts to protect the patient from inadequate communication about known risks of a prescribed medical intervention and presumably allows the patient to make a thoughtful decision about whether to proceed with the procedure. Written informed consent may also protect the physician from reprisal in the event of a bad outcome, if the outcome was disclosed as a possible untoward event.

The problem is that real informed consent is not truly achievable in the example of the low levels of ionizing radiation used in medical imaging for several reasons. To be entered into a legally binding covenant, the benefits and risks must be clearly stated, unequivocal, and easily measured. Unfortunately, a discussion of the potential risks associated with low levels of ionizing radiation exposure from medical imaging fails to meet these three important criteria.

Let's start with the statement that the benefits and risks must be "unequivocal and easily measured." Certainly, the benefits of imaging with medical radiation may be clear to patients and their

Radiology 2012;262:11-14

Informed decision making

"meaningful dialogue between physician and patient instead of unidirectional dutiful disclosure of alternatives, risks and benefits by a physician"

image gently

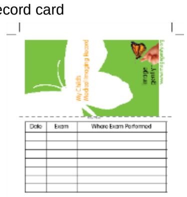
Braddock Ch 3rd et al. JAMA 1999;282 (24):2313-2320

Question 9

What are Image Gently resources for parents?

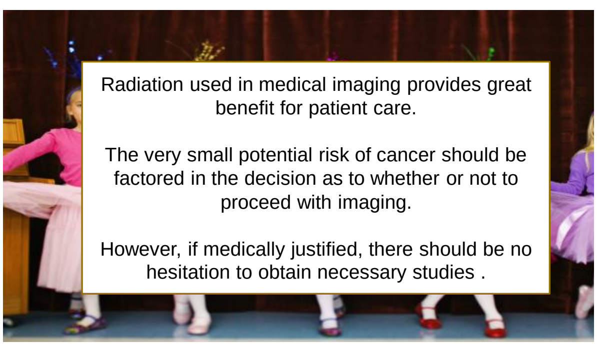
IG Parent Campaign Rollout January, 2009

- 8 free parent brochures
- Free medical imaging record card



www.imagegently.org

“ How safe is a CT scan for my child?”



Radiation used in medical imaging provides great benefit for patient care.

The very small potential risk of cancer should be factored in the decision as to whether or not to proceed with imaging.

However, if medically justified, there should be no hesitation to obtain necessary studies .

THANK YOU