



## Forty-Sixth Annual Meeting Program

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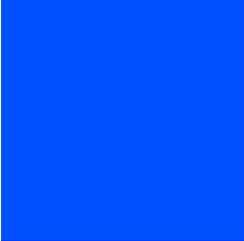
# Communication of Radiation Benefits and Risks in Decision Making

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**March 8–9, 2010**

Hyatt Regency Bethesda  
One Bethesda Metro Center  
7400 Wisconsin Avenue  
Bethesda, MD 20814



# Introduction

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## *Communication of Radiation Benefits and Risks in Decision Making*

### Forty-Sixth Annual Meeting of the National Council on Radiation Protection and Measurements

Effective communication about the benefits and risks of radiation has become an increasingly important aspect of making and implementing decisions on radiation health protection in government, medicine, industry, research laboratories, and academia. The primary goal of the 2010 NCRP Annual Meeting will be to examine key issues, current controversies, and new tools and findings related to radiation risk communication.

Topics to be featured at the meeting include:

- concepts and examples of effective risk communication today and in historical perspective;
- role of new tools and media as efficient vehicles for radiation risk communication;

- communication issues and challenges posed by potential acts of nuclear and radiological terrorism and radiation emergencies;
- communicating benefits and risks of medical applications of radiation for the diagnosis and treatment of disease; and
- mechanisms and examples of effective communications in decision making related to protection of human health and the environment.

Central to the theme of the meeting will be the engagement of all relevant stakeholders in the process of reaching decisions involving radiation protection, which is essential for achieving sustainability of the decisions.

# Communication of Radiation Benefits and Risks in Decision Making

*Monday, March 8, 2010*

## Opening Session

8:15 am **Welcome**  
Thomas S. Tenforde  
*President*  
*National Council on Radiation*  
*Protection and Measurements*

## Seventh Annual Warren K. Sinclair Keynote Address

8:30 am **Effective Risk Communication Before, During and After a Radiological Emergency: Challenges, Guidelines, Strategies and Tools**  
Vincent T. Covello  
*Center for Risk Communication*

## Basic Concepts and Examples of Effective Risk Communication

Paul A. Locke, *Session Chair*

9:30 am **Crafting Interactivity: Transforming Assumptions About Communication in Science and Policy**  
Mark A. Aakhus  
*Rutgers University*

9:50 am **Break**

10:15 am **Transparency, Openness and Accountability in Risk Assessment: Lessons from the National Academies Science and Decisions Report**  
Thomas E. McKone  
*University of California, Berkeley*

10:40 am **Panel on Getting the Message Out**  
Paul A. Locke, *Moderator*

### Panelists:

**Lessons Learned from Communicating with Stakeholders Who Have Many and Varied Perspectives**  
Todd Martin

**Communication 2.0: Increasing Information Reach and Impact Through New Media and Public Engagement**  
Jay M. Bernhardt  
*Centers for Disease Control and Prevention*

**Importance of Science in Accurate News Reporting: A Journalist's Perspective**  
Terry Moran  
*ABC News*

12:00 pm **Questions and Answers**

12:30 pm **Lunch** [box lunches will be available for \$15 (limited supply)]

**Social Networking: How It Can be Used to Improve Public Health Communication**  
Janice Nall  
*Centers for Disease Control and Prevention*

## Communication, Terrorism and Homeland Security

Steven M. Becker, *Session Co-Chair*  
Charles W. Miller, *Session Co-Chair*

2:00 pm **Panel on New Research, Recent Experience, and Emerging Challenges**  
Steven M. Becker, *Moderator*

# Program Summary

**Panelists:**

**London Polonium Incident: Lessons for Risk Communication**

G. James Rubin  
*Kings College London*

**American Attitudes About Terrorism and Other Threats: What Can Be Learned from Rapid Emergency Polls of the Public**

Gillian K. SteelFisher  
*Harvard School of Public Health*

**Risk Communication with Vulnerable Populations: Best Practices**

Deborah C. Glik  
*University of California Los Angeles School of Public Health*

**Risk Communication and Radiological/Nuclear Terrorism: A Strategic View**

Steven M. Becker  
*University of Alabama at Birmingham School of Public Health*

3:05 pm **Questions and Answers**

3:20 pm **Break**

3:40 pm **Panel on New Approaches, Projects and Initiatives**

Charles W. Miller, *Moderator*

**Panelists:**

**Federal Interagency Communication Strategies for Addressing Radiation Emergencies and Other Public Health Crises**

Charles W. Miller  
M. Carol McCulrey  
*Centers for Disease Control and Prevention*

**Federal Planning for Nuclear and Radiological Terrorism Community Preparedness**

Tammy P. Taylor  
*Office of Science and Technology Policy*

**State Perspectives on Effective Communication in Acts of Terrorism**

Adela Salame-Alfie  
*Conference of Radiation Control Program Directors*

**Informing and Engaging the Public in Preparedness Efforts: The Israeli Experience**

Bruria Adini  
*Israeli Ministry of Health*

4:35 pm **Questions and Answers**

4:45 pm **Break**

**Thirty-Fourth Lauriston S. Taylor Lecture on Radiation Protection and Measurements**

5:00 pm **Introduction of the Lecturer**

F. Owen Hoffman  
*Senes Oak Ridge, Inc.*

**Radiation Protection and Public Policy in an Uncertain World**

Charles E. Land  
*National Cancer Institute*

6:00 pm **Reception in Honor of the Lecturer**

# Communication of Radiation Benefits and Risks in Decision Making

## Tuesday, March 9

- 8:15 am **NCRP Annual Business Meeting**
- 9:15 am **Break**
- Communicating Benefits and Risks of Medical Radiation**  
Julie K. Timins, *Session Chair*
- 9:35 am **Changes in Medical Communication: Historical Perspective**  
Julie K. Timins  
*Diagnostic Radiology*
- 9:50 am **Toward a Holistic Approach in the Presentation of Benefits and Risks of Medical Radiations**  
Louis K. Wagner  
*University of Texas Houston Medical School*
- 10:05 am **Communicating the Benefits and Risks of Radiation Therapy: Maintaining Context, Perspective and Reassurance**  
Lawrence B. Marks  
*University of North Carolina at Chapel Hill*
- 10:20 am **Just the Facts: Mammography Saves Lives with Little if Any Radiation Risk to the Mature Breast**  
Daniel B. Kopans  
*Harvard Medical School*
- 10:35 am **Legal Aspects of Patient Communication**  
Leonard Berlin  
*Rush North Shore Medical Center*
- 10:50 am **Questions and Answers**
- 11:05 am **Break**
- Communication on Children's Imaging and on Computed Tomography**  
Fred A. Mettler, Jr., *Session Chair*
- 11:20 am **Introduction: Computed Tomography Radiation and Population Dose**  
Fred A. Mettler, Jr.  
*University of New Mexico*
- 11:25 am **Image Gently® Campaign: The Use of Social Marketing to Promote Radiation Protection for Children**  
Marilyn J. Goske  
*Cincinnati Children's Hospital Medical Center*
- 11:35 am **Image Gently® International: Communication Conundrums**  
Kimberly E. Applegate  
*Emory University School of Medicine*
- 11:45 am **Communicating About Computed Tomography: Challenges and Uncertainties**  
Rebecca Smith-Bindman  
*University of California, San Francisco National Cancer Institute*
- 12:00 pm **Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting**  
Steven Birnbaum  
*Associated Radiologists*
- 12:15 pm **Questions and Answers**
- 12:30 pm **Lunch**

# Program Summary

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## **Communication of Radiation Benefits and Risks in Decision Making**

Jill A. Lipoti, *Session Chair*

- 1:40 pm **Beyond Dose Assessment: Using Risk with Full Disclosure of Uncertainty in Public and Scientific Communication**  
F. Owen Hoffman  
David C. Kocher  
*Senes Oak Ridge, Inc.*
- 2:00 pm **Using the International Radiation Protection Association Guiding Principles: Putting Theory into Practice for Sustainable Implementation**  
C. Rick Jones
- 2:20 pm **Community Environmental Monitoring Program: A Case Study of Public Education and Involvement in Radiological Monitoring**  
William T. Hartwell  
David S. Shafer  
*Desert Research Institute*
- 2:40 pm **Psychosocial and Health Impacts of Uranium Mining and Milling on Navajo Lands**  
Susan E. Dawson  
*Utah State University*
- 3:00 pm **Break**
- 3:20 pm **Stakeholder Engagement Process in the ETHOS Project in Belarus**  
Thierry Schneider  
*Nuclear Evaluation Protection Centre*
- 3:40 pm **Panel Discussion**  
Don M. Curry  
Susan E. Dawson  
William T. Hartwell  
F. Owen Hoffman  
C. Rick Jones  
Thierry Schneider
- 4:20 pm **Future Directions of ICRP Committee 4: Application of ICRP Recommendations—From Stakeholder Involvement to Self-Help Protective Actions**  
Jacques Lochard  
*Nuclear Evaluation Protection Centre*
- 4:40 pm **Communicating Radiation Benefits and Risks: Some Lessons Learned**  
Paul A. Locke  
*Johns Hopkins Bloomberg School of Public Health*
- 4:50 pm **Closing Remarks**  
Thomas S. Tenforde  
*President, NCRP*
- 5:00 pm **Adjourn**

# Communication of Radiation Benefits and Risks in Decision Making

*Monday, March 8, 2010*

## Opening Session

8:15 am

### Welcome

Thomas S. Tenforde

*President, National Council on Radiation Protection and Measurements*

8:30 am

## Seventh Annual Warren K. Sinclair Keynote Address

### Effective Risk Communication Before, During and After a Radiological Emergency: Challenges, Guidelines, Strategies and Tools

Vincent T. Covello

*Center for Risk Communication*

The purpose of this presentation is to describe the elements of effective risk communication before, during and after a radiological emergency.

Effective risk communication is central to informed decision making about radiological risks. It establishes public confidence in the ability of individuals and organizations to deal with a radiological emergency.

Numerous studies have highlighted the importance of risk communication in enabling individuals and organizations to make informed choices. Effective risk communication provides people with timely, accurate, clear, objective, consistent and complete risk information. It is the starting point for creating an informed public that is:

- involved, interested, reasonable, thoughtful, solution-oriented, cooperative and collaborative;
- appropriately concerned about the risk; and

- more likely to engage in appropriate behaviors.

Effective risk communication is based on four models that describe how people process risk information and make risk decisions:

- risk perception model;
- mental noise model;
- negative dominance model; and
- trust determination model.

Each of these models and corresponding templates will be briefly described in this presentation.

Together, these models provide the intellectual and theoretical foundation for understanding the major challenges to effective risk communication before, during and after a radiological emergency. These challenges will be briefly described.

This presentation will conclude with a discussion of guidelines, strategies, and practical tools for communicating effectively about radiological risks.

## Basic Concepts and Examples of Effective Risk Communication

Paul A. Locke, *Session Chair*

9:30 am

### **Crafting Interactivity: Transforming Assumptions About Communication in Science and Policy**

Mark A. Aakhus  
*Rutgers University*

Science and policy communication is often understood as the transmission of information by scientific experts. Yet, contemporary demands for transparency and new approaches to governance call for something more as policy professionals and scientific experts find themselves in situations where they are responsible for involving and integrating the many, often conflicting, perspectives and goals of stakeholders. The information transmission orientation satisfies only some of the communicative demands of these situations that require support for managing disagreement and fostering coordination and collaboration. The aim of this presentation is to introduce

principles that can be used to craft interactivity between experts and nonexperts. Scalable communication designs will be presented from research on communication in policy processes and from work in the Global Sensemaking and Pragmatic Web communities that are applicable to technologically-supported deliberation. This presentation will suggest how expertise in scalable communication design can be developed so that policy professionals can embrace the demands of involvement without abandoning the need for competence in science and policy communication.

9:50 am

### **Break**

10:15 am

### **Transparency, Openness and Accountability in Risk Assessment: Lessons from the National Academies *Science and Decisions* Report**

Thomas E. McKone  
*University of California, Berkeley*

The process of risk assessment has been used to help understand and address a wide variety of hazards and has been instrumental to the U.S. Environmental Protection Agency, the U.S. Nuclear Regulatory Commission, other federal and state agencies, industry, the academic community, and others in evaluating public health, safety, and environmental concerns. In December 2008, on the 25th anniversary of its ground-breaking 1983 *Red Book*, the National Research Council issued its latest advice on risk

assessment titled *Science and Decisions, Advancing Risk Assessment*. This report takes on the difficult task of defining new directions for risk assessment and risk management. This presentation will provide an overview of this report with a focus on how it fosters transparency, openness and accountability in risk assessment.

The presentation will begin with an overview of the history, practice, and current state of risk assessment. Consideration will then be given to the challenges facing risk assessment over the next decade as a

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tool for policy and public discourse. As noted in *Science and Decisions*, “virtually every aspect of life involves risk. How we deal with risk depends largely on how well we understand it.” In order to better confront current and future challenges, *Science and Decisions* extends the approach of the *Red Book*, finding that risk assessment should be viewed as a method for evaluating the relative merits of various options for managing risk rather than as an end in itself. This requires considering a broader range of factors in risk assessment, including both chemical and non-chemical stressors, vulnerability of the exposed population, and the overall impact of actions on communities. The concluding chapters of *Science and Decisions* provide a plan for improving the utility of risk assessments expanding the role of risk assessment in decision making.

Among the lessons of *Science and Decisions* we discover that the key steps needed to foster transparency, openness and accountability in risk assessment include:

- define the problem—risk assessment works best when it confronts a well defined problem;
- make clear who is at risk—within human populations, there are significant variations in exposures to harmful agents and in vulnerability to these agents;
- identify the decision makers and ensure that their questions are addressed;
- evaluate whether a risk assessment will offer any new insight for a problem—will it be solutions-based or an effort at procrastination; and
- know how to put the result in context.

10:40 am

## Panel on Getting the Message Out

Paul A. Locke, *Moderator*

### **Panelists:**

#### **Lessons Learned from Communicating with Stakeholders Who Have Many and Varied Perspectives**

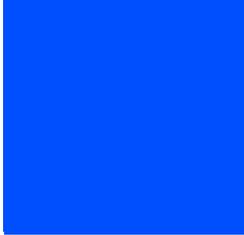
Todd Martin

Stakeholder involvement is rarely seen as an integral element of project decision making—whether the project is the siting, design and construction of a facility or the setting of a regulatory standard. Yet organized stakeholder opposition threatens countless projects. Acknowledging the role and influence of stakeholders and effectively involving stakeholders in project decision making is critical to success.

This presentation will describe the basic principles and approaches to stakeholder

involvement as well as proven methodologies for incorporating stakeholder involvement into the fabric of decision making. This presentation will include: identifying stakeholders, developing involvement processes, and using language understandable to stakeholders.

Overall, this presentation is aimed at giving decision makers the tools to effectively incorporate the critical elements of stakeholder involvement in project decision making.



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## **Communication 2.0: Increasing Information Reach and Impact Through New Media and Public Engagement**

Jay M. Bernhardt

*Centers for Disease Control and Prevention*

American consumers today have access to more health and risk information than ever before. The proliferation and ubiquity of electronic communication channels have made it easy for most people to seek and find information on almost any health related topic, and the information they uncover often spans diverse and divergent perspectives. As a result, people have an increasingly difficult time judging the accuracy and credibility of information coming from “experts” and are turning instead to peers and “friends” through online social networks to inform their health-related decision making. The Centers for Disease Control and Prevention (CDC) has been studying consumer information-seeking behavior for many

years and has developed new media health communication strategies to increase the reach and impact of its health information. CDC now engages its audiences using user-centered, web-based communication combined with social media channels, such as Facebook,<sup>®</sup> Twitter,<sup>®</sup> YouTube,<sup>®</sup> in order to provide health and risk information to consumers where, when and how they want and need it to inform healthy and safe decisions. This presentation will explain and explore CDC’s “2.0” communication strategy and will examine the reach and impact of health information provided to the public during the current 2009 H1N1 influenza pandemic.

## **Importance of Science in Accurate News Reporting: A Journalist’s Perspective**

Terry Moran

*ABC News*

Science is constantly in the news. From political debates over energy policies and bioethical issues, to advances in health sciences that are of keen interest to an aging population, to pure research into the cosmos or the subatomic world, to the continuing questioning of the theory of evolution—science occupies a central place in today’s print, broadcast, cable and online media.

How well do the media cover scientific inquiries and advances? What are the challenges in communicating sometimes abstruse scientific concepts to a general news audience? How can the media help to improve the scientific literacy of our audiences, and empower citizens to participate more fully in public-policy decision making that deals with science?

As a journalist in print and television news for almost 25 y, I have covered many stories where science played an important role—DNA forensic evidence and analysis in courtrooms; product-liability lawsuits; global climate change; embryonic stem-cell research; the influenza pandemic; energy policy; and, inevitably, the evolution “debate.” There are four big challenges mainstream journalism faces in covering these and other scientific topics:

- *Understanding the concepts.* Journalists are generalists, and most of us do not have deep scientific backgrounds. So the first order of business is grasping what it is we are covering.
- *Communicating the uncertainties.* The news is a headline-oriented business. We want bottom lines, clear

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conclusions, unambiguous “take-aways” for our audiences. But science is more often than not incremental in its advances, provisional in its conclusions, and open to revision. This conflict between the needs of news and the nature of science often produces misinformation.

- *Exposing the cranks.* Many voices clamor to get into every news story. Reporters are deluged with press releases, emails, and phone calls from advocates and activists on most big news stories. Some of these voices are extremist or frankly uninformed. So good reporters become good gatekeepers; as they develop an understanding of a story, and speak to the most widely respected authorities on it, they also weed out from the public debate distracting or destructive players. In science reporting, with so many pseudo-scientific claims and

movements in our society, the gate-keeping function of good journalism is much more challenging.

- *Delegitimizing the “denialists.”* We live in an age where, it seems, people can deny anything, find “reasons” for it, and get on television to proclaim it. From conspiracy theories about the origin of HIV-AIDS, to the anti-vaccine hysteria, to the willful misreading of the fossil record when it comes to the theory of evolution—the “denialists” are everywhere. Good journalism is about telling the truth, and it should do that to stem the tide of “denialism.”

Each of these challenges for journalists in covering science-related stories requires diligence and ethical professionalism to meet. But good stories require something else, too: They require you—good scientists who can inform, guide and participate in these important news stories.

12:00 pm

## Questions and Answers

12:30 pm

**Lunch** [box lunches will be available for \$15 (limited supply)]

## Social Networking: How It Can be Used to Improve Public Health Communication

Janice Nall

*Centers for Disease Control and Prevention*

In today's communication landscape, we can creatively use more tools than ever to provide public health information when and where it is most needed and to engage citizens in personal behavioral changes. For example, social media can play an important role in achieving an effective crisis communications response to public health emergencies. These technologies can help us to:

- increase the dissemination and potential impact of rapid public communications in incidents involving life-

threatening illnesses, acts of terrorism, or other potentially-major threats to public health;

- use emerging channels of communication to reach diverse audiences with tailored and personalized health messages;
- facilitate interactive communication and community engagement; and
- empower people to make healthier and safer decisions in protecting public health.

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Some of the key learning objectives of this presentation include:

- specific challenges and opportunities governmental entities face in using social media;
- strategies for integrating social media into crisis communications efforts;
- methods for encouraging rapid spread of messages to potentially affected members of the public; and
- ideas on how to tap into the “wisdom of the crowds” to improve public health communications.

## Communication, Terrorism and Homeland Security

Steven M. Becker, *Session Co-Chair*  
Charles W. Miller, *Session Co-Chair*

2:00 pm

**Panel on New Research, Recent Experience, and Emerging Challenges**  
Steven M. Becker, *Moderator*

### **Panelists:**

#### **London Polonium Incident: Lessons for Risk Communication**

G. James Rubin  
*Kings College London*

Alexander Litvinenko, a Russian dissident and former KGB officer, died on November 23, 2006 after having been apparently poisoned in a central London hotel. The mysterious circumstances of his death sparked enormous press interest focusing on potential links with international espionage. The discovery that he had been poisoned with radioactive  $^{210}\text{Po}$  added a new dimension to the case, as traces of radioactivity were subsequently discovered in numerous locations across the city. Given the possible risk to members of the public who might have been exposed to  $^{210}\text{Po}$  in the run-up to and immediate aftermath of his poisoning, the U.K. Health Protection Agency (HPA) mounted a major public health initiative to identify those people who had been at an affected area and to offer them a test, while also attempting to reassure the majority of the population of London that any risk to their health was negligible.

Using two linked studies, we tested the effectiveness of the HPA’s communications with both groups of people: the

general public and those who had been at an affected location. To assess the perceptions of the general public, HPA ran a cross-sectional telephone survey, randomly sampling 1,000 members of the London public. This survey collected data over a 3 d period immediately after HPA revised their risk assessment and began calling for more potentially-affected members of the public to make themselves known. Despite the spread of radioactive material across the city, public concern about the incident was muted—only 11.7 % of our sample felt that their own health might be at risk. Aside from demographic variables, the key factors associated with heightened perceptions of risk were believing:

- incident was related to terrorism rather than to espionage;
- targeted at the wider public, rather than at one person; and
- people who had not been in a contaminated area could be affected.

To assess the perceptions of members of the public who had been in a

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contaminated area, HPA conducted qualitative interviews with 86 participants who were randomly selected from a register compiled by HPA. While most participants responses were highly complimentary about the way HPA communicated with them, several specific opportunities for improvement were identified. In particular, participants were skeptical about what they felt were attempts to reassure, rather than inform, them.

The  $^{210}\text{Po}$  incident demonstrated that the public do not always perceive radiation to be a “dread risk”. . . the “spy story” aspects of this incident seemed to diminish any perceived risk to health. As a result of lessons learned from the incident, future research is now being planned to assess public perceptions and their correlates in the next major chemical, biological, radiological or nuclear incident to occur in the United Kingdom.

## **American Attitudes About Terrorism and Other Threats: What Can Be Learned from Rapid Emergency Polls of the Public**

Gillian K. SteelFisher  
*Harvard School of Public Health*

Understanding the views and concerns of the public is a critical factor for those who plan effective public responses to possible radiological/nuclear terrorist attacks, as well as for those who would need to communicate with the public at the time of such a crisis. Rapid emergency public-opinion polling provides a key tool in garnering such information. Polling carried out during the 2001 anthrax attacks and, more recently, during the H1N1 pandemic, may provide useful insights about the public’s response to crises in general, and suggest applications to radiological terrorism attacks specifically.

This presentation reviews key findings of a series of polls that were conducted over the course of the anthrax attacks and the H1N1 pandemic. Each poll is based on a randomly-selected, national sample of more than 1,000 people. These polls cover the public’s initial response to an

emergency, changes in attitudes over time, behaviors including the adoption of practices to reduce exposure to anthrax or slow the spread of the H1N1 and vaccination uptake. They also highlight public views of local, state and federal government responses to these events. Together, the results provide a view of differential reactions to the threat across the population and over time and the role that perceived threat plays in willingness to adopt behaviors. Results also highlight the public’s differential trust in information sources and suggest issues that are important—from their perspective—for public officials and others to address in crisis communications.

The presentation will also cover the use of rapid polling of the public in emergency situations and explain the strengths and limitations of this tool specifically in the context of radiological attacks.

## **Risk Communication with Vulnerable Populations: Best Practices**

Deborah C. Glik  
*University of California Los Angeles School of Public Health*

Being able to understand and meet the information needs of vulnerable populations is an essential component of risk

communication for homeland defense. This presentation will draw on recent research and practical experience in such

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areas as hazards education, health communication, and disaster preparedness and response to discuss what is known about crafting and disseminating messages for vulnerable populations.

Particular attention will be devoted to lessons learned from:

- LA PREP, a recently conducted disaster preparedness effectiveness study among low income Latinos in Los Angeles;
- Pre-Event Message Development Project, a national formative research study;
- Great California Shakeout, a state-wide preparedness exercise conducted in 2008 and 2009;
- Multijurisdictional Preparedness Exercise conducted in California in 2005; and

- Building effective public health community- and faith-based organization partnerships for disaster readiness.

Among the communication strategies to be considered are active listening and formative research, ongoing message development and pretesting, attention to language and literacy issues, use of ethnic or small media to communicate with hard-to-reach populations and interpersonal methods for message dissemination. Taking marketing and educational techniques and tailoring them to the needs and cultural perspectives of distinct social groups greatly enhances the possibility of successful communication for homeland defense. Highlighted will be case examples that have used participatory approaches, coalitions, formative research and pretesting, narrow casting, partnerships with community- and faith-based organizations, and ethnic, popular or new media formats.

## **Risk Communication and Radiological/Nuclear Terrorism: A Strategic View**

Steven M. Becker

*University of Alabama at Birmingham School of Public Health*

As the United States and other nations have moved to address the threat of terrorism involving radioactive materials, improving radiological/nuclear risk communication, public information, and emergency messaging has come to be seen as a high-priority focus. The process of improving radiological/nuclear terrorism risk communication can be conceptualized as occurring in four overlapping phases. The first phase involved the recognition that communication and information issues are pivotal in the unfolding of a radiological/nuclear terrorism event and in determining its outcome. The publication of NCRP Report No. 138, *Management of Terrorist Events Involving Radioactive Material*, which emphasized communication's profound effect on public reaction and government response, was an

important milestone in this first phase. In the second phase, recognition of the centrality of communication and information issues stimulated and inspired a variety of new research initiatives aimed at providing an empirical basis for improved radiological/nuclear risk communication. The Pre-Event Message Development Project, which examined people's perceptions, information needs, and views of informational materials, is one example of such efforts; others include focus group and interview research on the information needs of vulnerable populations, focus group research on emergency-responder concerns and information needs, studies of current radiological/nuclear informational materials, and surveys of public perceptions. In the third stage of efforts to improve radiological/nuclear risk

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communication, local, state and federal agencies, professional societies, and others have worked to utilize insights generated by empirical research in order to develop better and more responsive informational materials, emergency messages, templates, web content, web portals, and training tools. This third phase has also seen efforts to use research findings to identify the information needs and preferences of new key audiences in the responder community. Like the second phase, the third phase is continuing to unfold today and will likely continue into the future. The fourth phase in improving risk communication for radiological/nuclear terrorism—what might be

considered a mature phase—is only now just beginning. In this phase, there is a developing recognition that for radiological/nuclear risk communication to be fully effective, it must go beyond making better messages aimed at particular audiences. In particular, this emerging phase seeks to anchor radiological/nuclear information, emergency messaging, and risk communication in a broader approach: one that more actively and directly engages, activates and partners with the public. In this presentation, each of the four stages is discussed, and future challenges in improving radiological/nuclear risk communication are examined.

3:05 pm

## Questions and Answers

3:20 pm

## Break

3:40 pm

## Panel on New Approaches, Projects and Initiatives

Charles W. Miller, *Moderator*

### **Panelists:**

### **Federal Interagency Communication Strategies for Addressing Radiation Emergencies and Other Public Health Crises**

Charles W. Miller

M. Carol McCurley

*Centers for Disease Control and Prevention*

The threat of terrorism involving radioactive materials has grown significantly in recent years. A large-scale incident involving radiation would pose numerous preparedness and response challenges. It is increasingly clear that communication will be one of the most challenging, yet critical, elements of response. Providing clear, actionable, and credible information and messages will be key to reducing deaths, injuries and illnesses, and psychological impacts of the event.

Federal agencies have a variety of roles and responsibilities related to communicating with the public before, during and

after a radiological emergency. To better understand the various efforts currently under way, the Radiation Studies Branch of the Centers for Disease Control and Prevention convened a roundtable of representatives from federal agencies with responsibility for communicating with the public about radiation emergencies. The objectives of this meeting were to:

- provide a forum where participants could discuss with one another their respective roles and responsibilities in communicating to the public in the event of a radiation emergency,

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- identify existing radiological/nuclear emergency messages and materials for the general public,
- learn what communication planning activities are underway or planned across the various agencies, and
- discuss how the lines of communication can be broadened across agencies.

Roundtable participants shared valuable information about efforts underway to develop information and messages for a variety of audiences, and agreed that continued interagency coordination and dialogue about communication before, during and after an event are needed. The group suggested several strategies for future collaborative efforts, and indicated a desire to continue working together to develop and assess messages for radiological emergency preparedness and response. The group also recommended that more work be done to determine whether messages need to be packaged or tailored for specific special populations, and suggested that more research be conducted to answer questions about specific audience/cultural needs around communicating radiation risks. Extensive discussion centered on the advantages and disadvantages of having “pre-event” education efforts (*i.e.*, specific information campaigns to build a knowledge base about radiological emergency preparedness prior to such an event occurring). Some participants believed that it would

be better to focus on all-hazards pre-event education to build a “culture of preparedness” first. Other recommended strategies included exploring ways to counter public fatalism relative to radiation emergencies, and identifying priority outreach strategies—whether *via* direct-to-public communication or communication *via* partners and interlocutors.

The group also raised some overarching questions that should be discussed in future cross-agency collaborations, including:

- Should radiation pre-event education be a priority in light of limited resources? Would this be effective or would pre-event education about radiation only scare the public or be ignored entirely?
- What types of pre-event education are possible? The “it depends” factor associated with a radiation emergency makes it difficult to have messages created pre-event.
- How can we communicate radiation-related terms and concepts into terms that lay people can more easily understand?

Although a formal interagency workgroup has not been established, the participants of the communications roundtable have continued to interact and share progress and opportunities for moving this important effort forward.

## **Federal Planning for Nuclear and Radiological Terrorism Community Preparedness**

Tammy P. Taylor  
*Office of Science and Technology Policy*

In January of 2009 the Executive Office of the President (EOP) released interagency-developed *Planning Guidance for Response to a Nuclear Detonation – First Edition*, to provide emergency planners with nuclear detonation-specific response

recommendations to maximize the preservation of life in the event of an urban nuclear detonation. This guidance addresses the unique effects and impacts of a nuclear detonation such as scale of destruction, shelter and evacuation

# Communication of Radiation Benefits and Risks in Decision Making

strategies, unparalleled medical demands, management of nuclear casualties, and radiation dose management concepts. The guidance is aimed at response activities in an environment with a severely compromised infrastructure for the first few days (*i.e.*, 24 to 72 h) when it is likely that many federal resources will still be enroute to the incident. The target audiences for the guidance are response planners and their leadership including elected officials and incident commanders.

The *Planning Guidance – First Edition* does not expressly address the topic of public communications due to the fact that the U.S. Department of Homeland Security (DHS) was actively conducting a program to develop communication plans for response to nuclear detonations. It does, however, emphasize the importance of public communications and how critical pre-event public communications are to the success of response to a nuclear detonation. In March of 2009, the Homeland Security Institute (HSI) delivered DHS Office of Health Affairs its final report entitled, *Nuclear Incident Communication Planning*. HSI's interagency-informed, proposed communication strategy was developed for nuclear detonation incidents with three distinct components of communication guidance:

- pre-event education;
- national leadership guidance; and
- responder communication guidance.

The results of this work and continuing planning efforts out of the EOP will result in the inclusion of guidance devoted to the topic of public communications in the *Planning Guidance for Response to a Nuclear Detonation – Second Edition* intended for release in summer 2010.

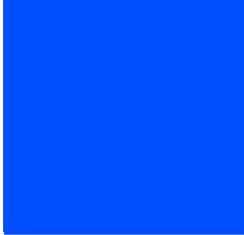
In the *Planning Guidance – Second Edition*, numerous efforts in the federal interagency on the topic of public information and/or communications for radiological and/or nuclear terrorism incident planning will be addressed. Recommendations emerging from efforts led by DHS and the Centers for Disease Control and Prevention will be included.

Key recommendations that will be addressed in the *Planning Guidance – Second Edition* include:

- specific information and actionable guidance for appropriate preparedness and protective actions relative to the public;
- physiological and psychological aspects of human behavior in public communications;
- public awareness training; and
- emergency responders and national leadership tactics for communicating protective actions to the public in the face of ambiguity and lack of scientific consensus.

In an effort to make substantial progress towards these recommendations, work within the interagency planning group has been initiated. The interagency work will be described in general themes as follows:

- literature review to develop recommendations regarding message expansion to schools, businesses, special-needs populations, and unaffected populations;
- gaps associated with public communications; and
- communications strategies and tactics to evaluate benefits and deficiencies.



# Abstracts: Monday, March 8

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## **State Perspectives on Effective Communication in Acts of Terrorism**

Adela Salame-Alfie

*Conference of Radiation Control Program Directors*

Effective communication during any emergency is based on the premise that the communities to which the message is directed are familiar with the directives given at the time of the emergency, and trust the entity providing the message. When communities have an understanding of the messages, and their rationale, they may be more likely to follow the directives given during the emergency. This may be particularly important in the area of radiological emergency response following an act of terrorism, where messages may appear to be contrary to recommended actions for other types of emergencies.

As we plan to respond to a radiological emergency, it is very important to have a library of “canned” pre- and post-event messages that can be used when time is of the essence. These messages need to be clear, consistent, and should be pre-tested well in advance (through focus groups or other means) to ensure that they are easily understood and to follow, and that new concepts are explained in layman’s terms. They should also include anticipated follow-up questions and actions that the public can take to reduce or minimize their exposure to radiation.

Advanced development of pre- and post-event messages will allow us to test the content of the message during nonemergency conditions. Having a well designed and consistent pre-event messaging campaign, that is aimed at educating the public on the basic concepts of radiation protection and the available protective

action recommendations, will help reduce the inherent fear of radiation, and will help the communities tasked with the development of a local radiological emergency response plan implement their plan.

To ensure familiarity and encourage compliance by members of the public, a good pre-event education campaign should take advantage of the availability of multimedia outlets and could start at schools and other public settings. Familiarity with the basic terms used in radiological emergency response such as the options for protective action recommendations will help ensure protection of the public, especially during critical times. The post-message templates should be readily available to government officials tasked with implementing the radiological emergency response plan, so they can be delivered soon after the event has taken place, even before details of the incident are available. These template messages should be written such that they can be easily modified or adapted depending on the event, and can be customized for the specific community (*i.e.*, location of appropriate shelters, evacuation routes, etc.) The use of such templates can help promote consistency and address many of the public’s key questions up front.

The continued involvement of members of the Conference of Radiation Control Program Directors in partnership with the federal agencies tasked with the development and delivery strategy of these messages is key to ensuring consistency and applicability across the country.

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## Informing and Engaging the Public in Preparedness Efforts: The Israeli Experience

Bruria Adini

*Israeli Ministry of Health*

Informing and engaging the public in preparedness and response efforts and enhancing resilience of the population is an integral component of crisis management in Israel. Social fortitude impacts on decision making during emergencies and is integrated in the response plans.

Pursuant to the lessons learned from the many multi-casualty events that occurred during the years 2000 to 2006 and the two major conflicts that Israel was confronted with in 2006 and 2009, it was apparent that the population needs reinforcement of the community and personal levels of resilience. Following several studies, resilience centers were created in numerous communities that focus on treatment, consultation, development and counseling of the population in times of crisis. These community treatment centers are involved in activities of preparedness, prevention, intervention and development of civilian resilience in crises.

Training and educating the public prior to the onset of an emergency is considered in Israel as a crucial component of emergency preparedness. During 2009, a national exercise was conducted involving the total population of the country. As part of the drill, the public was requested to follow the directives of the government and the Home Front Command, and to enter shelters upon the sound of sirens.

School intervention programs are conducted annually, aimed at facilitating and preparing children to cope with trauma situations. These interventions are based on the assumption that intervention programs can be implemented by mediators that are trained for this task and are supervised by health professionals. Teachers were found

to be the most effective mediators with children.

During emergencies, national spokespersons are appointed in order to actively inform the public regarding the conflict and its implications. These officials convey information to the public several times a day, utilizing both the electronic and written media. Public information centers are operated by the Home Front Command, the Ministry of Health, and local municipalities. These centers are manned by senior personnel that can offer an immediate response to queries of the public. Moreover, the frequent questions that are raised are centrally accumulated and referred daily to the spokespersons, who then present the answers through the media in order to inform the general public.

In order to strengthen the resilience of the population, it is important to clearly define policies during the health crises and convey them as openly and transparently as possible. Nevertheless, it is also important to be aware of the limitations and needed boundaries for sharing information, not due to information security or intelligence constraints, but rather taking into account the resilience of the society. At times sharing with the public all known information regarding potential risks might cause more harm than benefit. Such was the case in the 2006 conflict regarding non-conventional risks.

Surveys of status of the population are conducted during conflicts continuously, in order to monitor the impact of the conflict on the public and the results are considered as part of the process of decision making. The findings of these surveys were taken into account during the last

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two conflicts, when decisions had to be made whether or not to completely evacuate a psychiatric hospital that was exposed to missile attacks and whether to transfer patients from their regular wards in an acute-care hospital to sheltered facilities.

In conclusion, risk communication is a strong tool for supplying information and

should be utilized wisely and continuously. An informed population and relationships that are built on trust and reliability promote resilience. It is the role of leaders to anticipate the populations' needs before they emerge, and to act upon them so as to prevent their occurrence or mitigate their consequences.

4:35 pm

## Questions and Answers

4:45 pm

## Break

## Thirty-Fourth Lauriston S. Taylor Lecture on Radiation Protection and Measurements

5:00 pm

### Introduction of the Lecturer

F. Owen Hoffman  
*Senes Oak Ridge, Inc.*

### Radiation Protection and Public Policy in an Uncertain World

Charles E. Land  
*National Cancer Institute*

Ionizing radiation is a known, well-documented, and reasonably well-quantified human cancer risk factor. This fact is based on a remarkably consistent body of dose-response information from epidemiological studies of exposed populations, supported by experimental studies using animal and cellular models, and is largely ascribable to the relative ease, compared to other carcinogens, of estimating radiation dose to organs and local tissues. Statistical models for radiation-related cancer risk are increasingly used to inform radiation protection and the adjudication of compensation claims for cancers diagnosed following occupational and environmental exposures to ionizing radiation. The 2007 BEIR VII report, *Health Risks from Exposure to Low Levels of Ionizing*

*Radiation*, presented usable site-specific estimates in terms of excess relative and excess absolute risk with probabilistic uncertainty limits, for cancers of 11 organ sites modeled as parametric functions of radiation dose, gender, exposure age, and age at observation, for application to U.S. populations. The 2006 UNSCEAR report, *Effects of Ionizing Radiation*, reviewed the evidence for 24 organ sites and presented dose-response models for 13 as applied to different world populations, and the 2003 NIH report, *NCI-CDC Working Group to Revise the 1985 NIH Radioepidemiological Tables*, which was specifically directed at claims adjudication, presented estimates for 26 cancer types and subtypes affecting 22 organs.



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In an earlier presentation at the 2008 NCRP Annual Meeting (Health Phys. **97**; 2009), I argued that it is useful to view radiation protection as a political process that involves consent by stakeholders, a diverse group that includes people who might be expected to be risk-averse and concerned with plausible upper limits on risk, cost-averse, and concerned with lower limits on risk, or combining both points of view, and that quantification of uncertainties in risk is at least as important for this process as point estimates. The quantitative uncertainty analysis (QUA) approach to risk estimation has been explored in a number of NCRP reports, including Commentary No. 14, *A Guide for Uncertainty Analysis in Dose and Risk Assessments Related to Environmental Contamination* (1996); Report No. 126, *Uncertainties in Fatal Cancer Risk Estimates Used in Radiation Protection* (1997); and Report No. 153, *Information Needed to Make Radiation Protection Recommendations for Space Missions Beyond Low-Earth Orbit* (2006); as well as

in the 2003 NIH report, the 2007 BEIR VII report, and the 2006 UNSCEAR report.

Finally, it is possible that the QUA approach to radiation-related risk, although presently used in the United States to inform compensation adjudication for radiation-related cancer, and logically addressable in terms of negotiation among stakeholders, may not be the most important aspect of reaching agreement among stakeholders with different views. It is interesting in this respect to compare the occupational illness compensation scheme negotiated between British Nuclear Fuels and the relevant trade unions in the United Kingdom, and which now covers most major employers in the U.K. nuclear industry, with that legislated in the United States (the Energy Employees Occupational Illness Compensation Program Act of 2000) to compensate radiation-related cancer cases among former employees of the U.S. Department of Energy and its contractors.

6:00 pm

## Reception in Honor of the Lecturer

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## *Tuesday, March 9*

8:15 am **NCRP Annual Business Meeting**

9:15 am **Break**

## **Communicating Benefits and Risks of Medical Radiation**

Julie K. Timins, *Session Chair*

9:35 am **Changes in Medical Communication: Historical Perspective**

Julie K. Timins  
*Diagnostic Radiology*

### *Developing the Knowledge Base*

Upon the discovery of x rays in 1895, there was an immediate effort to determine the potential benefits of this mysterious modality. Medical applications, such as the diagnosis of fractures, were rapidly developed. Three years later x rays were in use in military field hospitals. Within months of Roentgen's initial report, x-ray dermatitis was recognized, followed shortly by descriptions of radiation damage to hands and fingers of operators. Recognition of potential carcinogenesis came later. Marie Sklodowska-Curie, Nobel Laureate and pioneer in the science of radioactivity, died of aplastic anemia as a result of her radiation exposure. Her daughter, Irene Joliot-Curie, Nobelist and researcher on artificially created radioactivity, died of radiation-induced leukemia.

Radiation therapy with radioactive sources such as radium began in the early 1900s. Some of the tissue effects of radiation became quickly apparent. Other late effects, such as acceleration of coronary artery disease and development of secondary cancers, were not acknowledged until relatively recently. The need to balance benefits and risks in the utilization

of medical radiation has long been recognized.

### *Radiology as a Medical Specialty*

Initially, radiology was incorporated into the practice of many nonspecialized physicians. As radiology developed into a separate specialty, the radiologist often practiced both diagnostic and therapeutic radiology and functioned as a consultant to the referring physician. Diagnostic radiology and radiation oncology have since diverged. Radiation oncologists have long functioned as primary care physicians during the treatment period. In diagnostic radiology, there has been a growing movement to expand the physician-patient relationship, promoting direct communication of results to the patient.

### *Paternalism versus Patient Autonomy in Medical Decision Making*

The early 1900s was the era of paternalism in medicine. The doctor advised the patient what procedures and treatments were recommended, and the patient followed his advice. This attitude has given way to a model of open communication and patient decision making. Nontraditional sources of information are widely available, particularly internet sources of

# Communication of Radiation Benefits and Risks in Decision Making

varying validity. Patients often demand specific diagnostic examinations and treatments.

## *Recent Approaches to Education on Radiation Benefits and Risks*

Information on the benefits and risks of medical radiation has traditionally been targeted to physicians and medical physicists. However, recently there has been an emphasis on educating the public. An explosion of information is targeted directly to the patient consumer, particularly online. Examples of topics of interest

include the radiation risks of computed tomography and the benefits and risks of radiation therapy in treatment of cancer. Websites of particular value to professionals and consumers alike include: the Food and Drug Administration, the Centers for Disease Control and Prevention, the American Association of Physicists in Medicine, the Health Physics Society, the jointly sponsored American College of Radiology/Radiological Society of North America website *RadiologyInfo*, and the National Cancer Institute, to name a few.

9:50 am

## **Toward a Holistic Approach in the Presentation of Benefits and Risks of Medical Radiations**

Louis K. Wagner

*University of Texas Houston Medical School*

Benefit and risk of medical radiological examinations are like poles of a magnet. Neither exists without the other. Unlike poles of a simple bar magnet, benefits of a procedure are often disproportionate to the risks. The art of communication is to relate these opposing aspects with clarity and a fair perspective.

Effective communication requires that the communicator consider the following:

- Is the audience an individual, a small group, or a large group?
- Who is the audience; what does the audience already know or think they know about the topic?
- What is the fair perspective that should be communicated? and
- If someone told me what I am about to say would I believe it, understand it, and feel that it was fairly presented with respect and courtesy?

Radiological medicine is bifurcated into two branches of professionals. The first is the medical profession that must deliver healthcare within the boundaries imposed by a patient's symptoms, the physician's experiences and skills, available

technologies, time constraints, and costs. The other branch is scientists who study risk and debate the strengths and weaknesses of epidemiological and laboratory data as well as our understanding of the long- and short-term effects associated with exposure to radiations. A natural bias exists in communications from these two branches. Literature has shown that physicians tend toward a perspective emphasizing benefits of a radiological study while underestimating risks imposed by the procedure. A physician's training in radiation risk is often confined to little or no didactic instruction about a topic that evolved from many man-centuries of research. Basic scientists who study risk are not trained in the medical benefits of procedures and do not see patients. Each group naturally perceives benefits-versus-risks in a manner biased by their background. This bias will be an integral part of communication unless a self-imposed effort is made by each party to reduce it.

An example of a built-in bias is the acronym: ALARA—meaning that radiation exposures be maintained as low as reasonably achievable. The acronym is apt

for radiation protection of workers where exposures to radiation are incidental, not intentional. But in medical practice, radiation exposure to a patient is intentional with the primary goal of providing benefit. ALARA focuses on risk. Medical care requires that the benefit/risk of a procedure, as a quotient, be as high as reasonably achievable. In the milieu of medical management, benefits of radiation applied to patients must be given fair emphasis relative to all risks imposed by those

applications (including risks such as uses of contrast agents). Medicine should separate itself from radiation protection mantras and build its own benefit/risk perspective of communication.

This presentation will address methods aimed at advancing communications of benefit/risk in a holistic manner that hopefully will bring clarity and a fair understanding to our audience of patients.

10:05 am

## **Communicating the Benefits and Risks of Radiation Therapy: Maintaining Context, Perspective and Reassurance**

Lawrence B. Marks

*University of North Carolina at Chapel Hill*

Radiation therapy is commonly used to treat a variety of malignant and benign conditions. For many conditions, radiation therapy provides improvements in local control, survival, and relief of troubling symptoms. Nevertheless, radiation is a recognized carcinogen and damaging agent. The field of radiation oncology has a many-decade tradition of acknowledging and studying the normal tissue reactions to radiation. Our focus in this area has led often to inappropriately-elevated perceived risks.

The vast majority of patients receiving radiation therapy have a favorable therapeutic ratio: that is, the benefits of the radiation exceed the risks. For example, radiation therapy for breast cancer improves the absolute 10 to 15 y overall survival by approximately 6 to 9 %. This reflects an approximate 7 to 10 % increase in breast-cancer-specific overall survival, plus an approximate 1 % excess in cardiac morbidity/mortality. Nevertheless, some women choose not to receive radiation due to the potential cardiac risks.

It is critical to communicate risks to patients in the context of the potential medical benefits. In most of the situations, the alternative treatments (e.g., extensive

surgery in lieu of limited surgery plus radiation) have far greater risks. The absolute magnitude of the risk should be clearly defined such that the patient and their family can put these risks in perspective. Further, the potential toxicities of radiation do not manifest until many years, or even decades, following radiation exposure. Thus, for many patients with serious diseases, the risks at such lengthy time horizons are not particularly relevant.

Patients appreciate if their concerns are acknowledged, rather than dismissed. It is important for the patients to be reassured that the medical team is aware of the risks of radiation, and are taking appropriate steps to minimize these risks (albeit not guarantee their prevention). An effort should be made to educate the patients to understand that the radiation oncology team includes nurses, dosimetrists, therapists, physicists and engineers who ensure that the equipment is functioning properly and that the dose is being delivered as intended.

The patients go through fairly elaborate procedures (immobilization, three dimensional imaging, simulation) to help the radiation oncology team minimize the risks to normal tissues. Explaining the

# Communication of Radiation Benefits and Risks in Decision Making

goals and details of these procedures (verbally, in writing, and occasionally *via* video) will help ease patient's fears and increase their confidence in their health-care team, and their compliance with these procedures. For example, patients are often immobilized in face-masks during radiation (sort of custom made "hockey-goalie-like masks) to help keep the patient still during therapy. This allows to be made the margin around the tumor smaller, thus reducing the risks. However, these masks are uncomfortable, confining and claustrophobic. Explaining the utility of the masks tends to improve compliance with, and acceptance of, the masks.

It is equally important for the nonradiation oncology members of the health-care team to be educated about radiation risks. Many physicians in nonradiation specialties are unclear about the true benefits/risks of modern radiation therapy. As with communication with patients and families, communication with other members of the health-care team should clearly place all risks in context and perspective. Colleagues also derive comfort from our acknowledging the risks of radiation, and are reassured by knowing that we are doing what we can to minimize these risks.

10:20 am

## **Just the Facts: Mammography Saves Lives with Little if Any Radiation Risk to the Mature Breast**

Daniel B. Kopans  
*Harvard Medical School*

Mammography screening is one of the major medical advances of the past several decades. Prior to 1990, the death rate from breast cancer had been unchanged in 50 y. Mammography screening began on a national scale in the middle of the 1980s and, as would be expected, the death rate from breast cancer began to drop in 1990. Since 1990, the death rate from breast cancer has decreased by 30 %. Studies in the Netherlands and Sweden, using direct measurements in the general population, show that most of the decrease is due to mammography screening beginning at the age of 40 y, with a small component due to improved therapies (therapy is more effective when cancers are small and earlier stage). A major concern, raised in the 1970s, was that the radiation from mammography might cause more cancers than would be cured.

Not only did this prove to be a huge overestimate, but it has become clear that it is radiation delivered in very young women (teenagers and women in their early twenties), before terminal differentiation has taken place, that is the time of risk. Once the breast has differentiated the risk from radiation is markedly reduced. By the time women reach their late thirties and early forties, there is no measurable risk from mammographic doses, and even the extrapolated risk is far below even the smallest benefit from screening. Hundreds of millions of mammograms have been obtained since the 1980s. If mammography were causing cancers, the incidence of breast cancer would be increasing. In fact, it is decreasing. Women need to be provided with this information to be reassured that mammograms save lives and that the radiation risk is minimal if any.

10:35 am

## Legal Aspects of Patient Communication

Leonard Berlin  
*Rush North Shore Medical Center*

A quarter of a century ago radiation physicist Lauriston Taylor characterized the public's perceptions regarding exposure to ionizing radiation and its potential hazards as a "cloud of ignorance or misunderstanding," and observed that there is a common feeling among the uninformed public and news media that radiation is so mysterious that "even the scientists don't know what's happening."

Are the public and news media any better informed today? Do they still wonder whether the scientists of today "really know" what is truly "happening" with regard to the nature of radiation exposure and its potential hazards? The answers to these questions are not clear-cut when one considers the conflicting headlines with which the public is confronted on a regular basis:

"Longstanding controversy exists about the level of carcinogenic risks attributable to low-level ionizing radiation."

"The benefit of catching a serious brain injury may be outweighed by the dangers of exposing children to radiation from a CT scan."

"One in 1100 children who receive CT scans may eventually die from a cancer caused by excess radiation."

"One 45-year-old woman with a history of kidney stones who had 70 CT scans over 22 years raised her lifetime risk of cancer by 10%."

"Even the lowest amount of exposure to radiation has some risk."

"Consensus has not been reached over the risk of low-level radiation exposure."

"Patients with a median age of 70, who were inadvertently exposed to eight times the expected level of radiation due

to a faulty CT scanner, carry a 1-in-600 risk of developing a brain tumor."

"A 2½ year-old boy who underwent 151 CT images of the brain instead of the prescribed 25 images has a lifetime increased risk of fatal cancer of 39%."

Concerns about possible harmful effects of exposure to radiation arising from diagnostic radiologic procedures have existed in both the scientific and lay communities for many decades. There is, however, no question that the degree of concern over the past few years has been escalated to the "anxiety" if not the "fear" level. Potential exposure to radiation is not a new issue, but it is certainly a "hot" issue.

Americans were exposed to more than six times as much ionizing radiation from diagnostic medical procedures in 2006 than they were in the early 1980s.

To what extent this increased exposure increases the risk of genetic mutations and/or development of cancer is not known with any degree of certainty. The available data are subject to varying interpretations, often debatable and controversial.

What should be communicated to the public? One of the fundamental precepts of the physician is to "do no harm." Yes, physicians are healers, but they are also educators and teachers. Thus, the medical and scientific community must encourage rather than discourage public attention and discussion regarding radiologic imaging and associated radiation exposure. In the 1952 Dwight Eisenhower-Adlai Stevenson presidential campaign, candidate Stevenson proclaimed that "We have to talk sense to the American people." He lost the election, but his words ring as true today as they did then: we must talk sense to the American people regarding

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radiation exposure and its potential hazards. The English author (and physician) W. Somerset Maugham wrote, "There's only one thing about which I am certain, and that is that there is very little about which one can be certain." Maugham's observation is clearly applicable to radiation exposure. We must talk to the public sensibly about the uncertainty regarding the hazards of radiation exposure.

Communication with the public should include the medical/legal ramifications

arising from exposure to radiation and the hazards related to such exposure. There has never been a successful medical malpractice lawsuit that alleged development of cancer or genetic defects resulting from diagnostic x-ray examinations. However, there have been and continue to be sporadic lawsuits filed alleging soft tissue injury resulting from overexposure to diagnostic radiologic equipment, and cancer caused by overexposure to radiation oncology equipment.

10:50 am

## Questions and Answers

11:05 am

## Break

## Communication on Children's Imaging and on Computed Tomography

Fred A. Mettler, Jr., *Session Chair*

11:20 am

### Introduction: Computed Tomography Radiation and Population Dose

Fred A. Mettler, Jr.  
*University of New Mexico*

11:25 am

### Image Gently® Campaign: The Use of Social Marketing to Promote Radiation Protection for Children

Marilyn J. Goske  
*Cincinnati Children's Hospital Medical Center*

Social marketing is a relatively new science that uses public media and commercial marketing techniques to promote "behavior changes that will improve the health of the population." The underlying premise of a social marketing campaign is that marketing principles are used to "influence a target audience to voluntarily ...modify a behavior for the benefit of individuals, groups or society as a whole" (Kotler *et al.*, *Defining Social Marketing*; 2002) Other names for these campaigns include public education or awareness campaigns or media interventions. Similar

to advertising, a variety of media are used to reach the target population which may be the general public, or a specific group such as the medical profession. These campaigns may use the internet (through website, email, podcasts, blogs, web journals, list servers, and Twitter), the more traditional print media (scientific publications, trade press, lay press) or posters, television and radio.

The Image Gently® campaign is an education, awareness and advocacy campaign in radiology that promotes radiation protection for children worldwide. Through

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the creation of the Alliance for Radiation Safety in Pediatric Imaging, the consortium promotes the need for radiation dose reduction as appropriate to optimize medical imaging. It seeks to create simple, straightforward messages and easily accessible educational materials to achieve this end. Through the Alliance (a partnership of over 50 medical organizations and societies, representing over 600,000 health-care professionals) the educational materials can be distributed throughout the world to effect change at the local level. In this presentation, the relatively new science of social marketing is reviewed and the theoretical basis for an effective communication campaign in radiology is discussed.

The positive message created by radiologists, medical physicists, and radiologic technologists working together emphasizes the medical benefits of computed tomography (CT) when the exam is “justified” and no alternative imaging is appropriate. By working with manufacturers of

medical imaging equipment, government agencies, nonprofits agencies, and other organizations, the campaign may serve to “short circuit” the time it takes for accurate medical information to reach the local user who is directly caring for the pediatric patient. There has been particular emphasis on improving medical literacy for parents through the creation of the Image Gently® medical imaging record card, CT scan brochure for parents (translated into nine languages) and an interventional radiology brochure. Examples of these communication strategies will be demonstrated. Measures of impact of the campaign will be reviewed. The methodology of social marketing has demonstrated that simple, straightforward safety messages on radiation protection targeted to medical professionals throughout the radiology community worldwide, utilizing multiple media, can affect awareness, potentially leading to change in practice that improves safety for our patients.

11:35 am

## **Image Gently® International: Communication Conundrums**

Kimberly E. Applegate  
*Emory University School of Medicine*

The internet has made global communication both feasible and a critical part of our work. The Image Gently® Campaign is an international volunteer effort to reduce the radiation exposure of children undergoing medical imaging. There are over 50 medical, radiology and physics organizations that form the Alliance for Radiation Safety in Pediatric Imaging. The alliance was founded by the Society for Pediatric Radiology, the American College of Radiology, the American Society of Radiologic Technologists, and the American Association of Physicists in Medicine in January 2008 to reduce radiation dose used in pediatric computed tomography (CT) exams. Since its inception, it has created educational modules on CT and interventional

radiology, parent education, and slide lectures for technologists, physicists, and medical student audiences.

There are 11 international organization members with two more pending approval. The international volunteers have translated the simple educational materials into nine languages with several more to be completed. Pediatric radiologist leaders from around the world will discuss radiation protection best practices and training needs at the Society for Pediatric Radiology 2010 spring meeting. Image Gently® is collaborating with the World Health Organization at international child health and the environment conferences as well as on the Global Initiative to Reduce Radiation Exposure, and will

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participate in the International Radiation Protection Association meeting in Helsinki in June. The opportunity to share best practices, concerns, and educational materials globally has led to new insights in radiation protection and global harmonization of risk communication messages.

In pursuing these initiatives, the success of the educational campaign depends on the individuals in each region of the world to not only translate the materials but to tailor the messages to best fit the needs of each nation (developed, less developed), the cultural values of the medical and patient communities, the perceived risk from radiation in each region (Europe versus United States), and the formatting of these materials for the public. For example, developing nations have less access to CT scanning so their educational needs would focus more on plain radiography

and fluoroscopy imaging optimization. The formatting of educational brochures or materials for each region should reflect the appropriate ethnicity, attire and interaction of medical personnel and their families to relate to the local cultural norms. For example, the photos of families and children undergoing CT imaging in the Image Gently® brochure needed to be adapted for the cultural norms of appropriate attire in the Arabic language translation. In another example, justification for CT use varies by geographic region and may be linked to public perception of radiation risk and CT scan use—in Europe there is a higher level of concern about ionizing radiation exposure compared to North America or Japan. Thus, public awareness and cultural values have led to less use of CT and ionizing radiation in Europe.

11:45 am

## **Communicating About Computed Tomography: Challenges and Uncertainties**

Rebecca Smith-Bindman  
*University of California, San Francisco  
National Cancer Institute*

The use of computed tomography (CT) for diagnostic evaluation has increased dramatically over the past two decades and is associated with substantially higher radiation exposure than conventional radiography. Further, the radiation doses from commonly performed diagnostic CT examinations may be substantially higher and more variable than generally quoted. The variation occurs between patients, facilities and type of study. Thus, depending on where an individual patient receives imaging and the specific technical parameters used, the effective dose received could substantially exceed the median reported doses. Further, estimates of the associated risk from these studies, often and most easily translated into the number of CT scans that will lead to the development of a single cancer, will also vary

widely depending on the specific type of CT examination and the patient's age and sex, and the technical parameters used to complete the study. Thus a single quoted statistic to summarize the risk of CT across all patient groups is simply too crude to provide meaningful information. This presentation will discuss results from several recent studies that have been completed which have quantified the radiation from a large number of CT examinations. Strategies that need to be undertaken to minimize the exposure and to reduce the variation in exposure across patients and facilities through greater standardization and oversight will be discussed. The need to develop metrics that need to be conveyed to patients and physicians alike to help them make informed choices about imaging will also be

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presented. Further, the need for outcome studies to help quantify the benefits of imaging in defined clinical situations will be discussed. This information is crucial to

inform the development of evidence-based guidelines for the appropriate use of imaging.

12:00 pm

## **Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting**

Steven Birnbaum  
*Associated Radiologists*

Patient exposure to radiation from diagnostic imaging has increased dramatically in the last 15 y, mainly due to helical computed tomography (CT) scanning and certain nuclear medicine procedures. Certain patient populations with repeated radiation exposure can be identified prospectively by CT technologists and radiologists. Retrospectively utilizing data mining techniques, additional patients may be found using well defined, although arbitrary radiation exposure thresholds, and their records may then be flagged in a radiology information system so that further CT imaging is performed only

following radiologist consultation and with strong clinical indication. These programs have been in place for 2 y in two small community hospitals in New Hampshire and have been shown to decrease repeat studies in these patient populations by at least 30 % in the initial stages of this program. Further strategies for decreasing patient exposure are outlined which include clinician and patient education, technical modifications to existing equipment, post-processing software, and regional and state efforts to effect change in the medical community.

12:15 pm

## **Questions and Answers**

12:30 pm

## **Lunch**

## **Communication of Radiation Benefits and Risks in Decision Making**

Jill A. Lipoti, *Session Chair*

1:40 pm

## **Beyond Dose Assessment: Using Risk with Full Disclosure of Uncertainty in Public and Scientific Communication**

F. Owen Hoffman  
David C. Kocher  
*Senes Oak Ridge, Inc.*

Evaluations of radiation exposures of workers and the public traditionally have been based on assessments of radiation dose, especially annual dose, without explicitly estimating risk, especially lifetime risk. In doing so, opportunities to

communicate the significance of dose estimates are limited to comparisons with dose criteria in regulations, doses due to natural background or medical x rays, and doses above which a statistically significant increase of disease has been

# Communication of Radiation Benefits and Risks in Decision Making

observed in epidemiologic studies. However, risk estimates must be made when questions arise concerning the chance that specific diseases might be induced by past or future exposure. Risk estimates depend on the total absorbed dose received by all organs over a lifetime, rather than the highest dose in any year. Risk estimates will vary depending on gender, age, exposure type (acute versus chronic), radiation type, including low-versus high-energy photons and electrons and low- versus high-LET radiations. It is not uncommon to find that two individuals with nearly the same effective dose have substantially different risks as a result of marked differences in the numerous factors known to determine risk that have little or no influence on estimates of effective dose. For example, although population-averaged effective doses are nearly equal from medical and natural sources of radiation, risk assessments indicate that the risk to the average member of the public from exposure to medical diagnostic x rays and computed tomography scans is now nearly twice the risk from exposure to natural background. Risk assessments have identified that indoor radon is a significant contributor to the baseline risk of lung cancer,

particularly among people who have never smoked. Risk assessments have shown the importance of childhood exposures to  $^{131}\text{I}$  in atmospheric fallout; those diagnosed with thyroid cancer later in life would frequently meet criteria established for federal compensation of cancer claims filed by military veterans and energy workers. Risk estimation enables comparisons of impacts of exposures to radiation and chemical carcinogens. Comparisons based on risk reveal major differences in the degree of health protection associated with exposure and dose-based regulations for radiation versus risk-based regulations for radiation and chemicals. However, radiation risk estimation with full evaluation of uncertainty has experienced limited application despite the many advantages risk assessment has over dose-based assessments. Why is this so? Certainly there is concern among radiation protection professionals that quantitative risk estimates with uncertainty produce the kind of information that attracts attention from the news media and is used by nuclear critics to alarm the lay public. The future challenge for risk assessors and risk communicators will be to overcome these concerns.

2:00 pm

## Using the International Radiation Protection Association Guiding Principles: Putting Theory into Practice for Sustainable Implementation

C. Rick Jones

The International Radiation Protection Association (IRPA) published their *Guiding Principles for Radiation Protection Professionals on Stakeholder Engagement* in February 2009. The publication of this document is the culmination of 4 y of work by the Spanish Society for Radiological Protection, the French Society of Radioprotection, the U.K. Society of Radiological Protection, and the IRPA organization, with full participation by the Italian Society and the Nuclear Energy Agency's Committee on Radiation Protection and Public

Health. The *Guiding Principles* provide field-tested and sound counsel to the radiation protection profession to aid it in the successful engagement with stakeholders in decision-making processes that result in mutually agreeable and sustainable decisions. Stakeholders in the radiation protection decision-making process are now being recognized as a spectrum of individuals and organizations specific to the situation. It is also important to note that stakeholder engagement is not needed or advised in all decision-making

# Abstracts: Tuesday, March 9

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situations but has been shown to be a tool of first choice in dealing with such topics as intervention and chronic exposure situations, as well as situations that have reached an impasse using traditional approaches to decision making. To enhance the contribution of the radiation protection profession, it is important for

radiation protection professionals and their national professional societies to embrace and implement the IRPA *Guiding Principles* in a sustainable way by making them a cornerstone of their operations and an integral part of day-to-day activities.

2:20 pm

## **Community Environmental Monitoring Program: A Case Study of Public Education and Involvement in Radiological Monitoring**

William T. Hartwell

David S. Shafer

*Desert Research Institute*

The Community Environmental Monitoring Program (CEMP) was created in 1981 to increase the openness and transparency of radiological monitoring conducted in communities around the Nevada Test Site (NTS), the principal location where the United States tested nuclear devices between 1951 and 1992. Since its inception, CEMP has provided local citizens with a hands-on role in the operation of a radiological monitoring network located in towns and ranches across an approximately 160,000 km<sup>2</sup> area of Nevada, Utah and California in the southwestern United States. Citizens who live in the towns where stations are located are directly involved in day-to-day operation and data collection, as well as in dissemination of information on radiological surveillance in their communities. Modeled in part after the citizen-run monitoring program instituted around the Three Mile Island Nuclear Power Plant following the 1981 accident there, the program seeks to address public concern about radioactivity from past nuclear testing activities and ongoing NTS activities involving radioactive materials and waste. CEMP is funded through the U.S. Department of Energy's National Nuclear Security Administration Nevada Site Office, and is administered by the Desert Research Institute of the Nevada System of Higher Education.

CEMP stations provide continuous measurements of gamma radiation and meteorological parameters at 29 stations. Biweekly air particulate samples are also collected for individual gross alpha and beta analyses, and for quarterly composite analyses of gamma-emitting radionuclides. For 23 stations, local citizens (two per station) are employed to monitor station operation and to collect particulate air-filter samples. While involving the public in data collection can contribute to a general level of trust about the process and results, responsibilities of the public participants in CEMP include participating in training to gain a level of knowledge about the monitoring process and results so that they can respond to inquiries from their communities. Transparency also is addressed through having the majority of the instruments at the stations available in near real-time *via* a public website, despite concerns that have occasionally arisen over sensor and communications network failures. While occasional failures might have been of minor concern from a credibility standpoint prior to the real-time availability of data, the same technologies designed to build trust can sometimes be viewed with suspicion by stakeholders when malfunctions occur. The website has been an important tool in fulfilling program goals of openness and transparency, but it

# Communication of Radiation Benefits and Risks in Decision Making

also has contributed to changing the makeup of the constituency the CEMP serves. Although nuclear testing at NTS ceased in 1992, continuing public concern about the potential for radionuclides to be transported off NTS has resulted in both a technological and philosophical evolution of the program that has led to its sustainability. The direct involvement of

stakeholders in the monitoring process provides a number of benefits, including increased public confidence in the results, significant cost-savings for the monitoring program, and the opportunity for citizens to serve their communities as knowledgeable laypersons on issues related to NTS and on topics such as radiation and health.

2:40 pm

## **Psychosocial and Health Impacts of Uranium Mining and Milling on Navajo Lands**

Susan E. Dawson

*Utah State University*

The uranium industry in the American Southwest has had profoundly negative impacts on American Indian communities. Navajo workers experienced significant health problems, including lung cancer and nonmalignant respiratory diseases, and psychosocial problems, such as depression and anxiety. There were four uranium processing mills and approximately 1,200 uranium mines on the Navajo Nation's 26,110 square miles. In this presentation, a chronology will be presented of how uranium mining and milling impacted the lives of Navajo workers and their families. In addition, Navajo communication patterns will also be addressed, including the roles of chapter houses (local governmental units), the media, and local uranium worker support groups. The Navajo initially had no language in which to conceptualize uranium and its hazards. The majority of uranium workers were employed before the creation of the Mine, Safety, and Health Administration and in general did not wear personal protective equipment (e.g., face masks and respirators). They were also not informed generally about the hazards of radiation on the job. The miners worked in largely unventilated mines with high levels of radon, and the millworkers worked in mills that would not meet today's health and safe standards. The workers wore their work

clothes home where they were laundered and many workers brought materials, which were allowed, home from the work site. Many workers and their families lived close to the work sites for extended periods. These work practices have led to fears and concerns among family members given that uranium was brought home from the various facilities. A concerted education effort of culturally sensitive and empowering programs was created about uranium issues. Local community leaders organized chapter house meetings across the reservation to inform workers and their families about the relationship between worker exposures and possible health problems. Information about these meetings was largely disseminated through local radio stations and Navajo newspapers. A reservation-wide effort resulted in activists working with political leaders and attorneys to write radiation compensation legislation which was passed in 1990 as the Radiation Exposure Compensation Act (RECA) and included underground uranium miners, atomic downwinders, and nuclear test-site workers. Later efforts resulted in the inclusion of surface miners, truck haulers, and millworkers in the RECA Amendments of 2000. On the Navajo Nation, the Office of Navajo Uranium Workers was created to assist workers and their families to

# Abstracts: Tuesday, March 9

apply for RECA. There were also uranium worker support groups for the miners and the millers on the reservation, which served to provide information, offer emotional support, and advocate for compensation. Present issues concerning the Navajo and other uranium-impacted groups include those who worked in mining and milling post-1971 and are

excluded from RECA and community and environmental health impacts related to uranium mine waste and mill tailings. Past perceptions about uranium impacts have contributed recently to the Navajo rejecting a resumption of uranium mining and milling on Navajo lands, which thus far has been upheld by the courts.

3:00 pm

## Break

3:20 pm

## Stakeholder Engagement Process in the ETHOS Project in Belarus

Thierry Schneider

*Nuclear Evaluation Protection Centre*

The long-term contamination of the environment associated with the Chernobyl accident created a complex situation, affecting all the dimensions of the daily life of the inhabitants: health, environment, social life, education, production, distribution of foodstuffs and commodities, etc. The surveys undertaken in the early 1990s highlighted that this complex situation led to a loss of control for the inhabitants of the contaminated territories and that classical approaches of communication were not efficient to provide them with comprehensive and useful information to deal with their situation.

In this context, 10 y after the accident, the ETHOS Project was set up by a European Team in Belarus as a pilot experiment in order to explore the feasibility of involving directly the local populations in their protection. This Project was developed in five villages and gathered teenagers, farmers, young mothers, teachers, and foresters and organized them for addressing different aspects of their lives, such as management of the radiological quality of meat and milk and radiological protection of children.

The process implemented in the ETHOS Project relies on a step-by-step approach to allow villagers to progressively regain control of their day-to-day life:

- The first step was dedicated to listening and learning from the villagers about their concerns, difficulties, wishes, both at the level of their individual life and as citizens living in a contaminated territory.
- The second step aimed at developing a common evaluation of the local radiological situation, performed jointly by the involved villagers, the local professionals, and the ETHOS experts.
- The third step was the identification of possible protection actions to be implemented locally with the existing resources or with a minimum of additional resources.
- The fourth step consisted in establishing (or re-establishing) links between villagers and the local authorities and professionals.

As far as the links were established, it was then possible to develop a real cooperation between all involved stakeholders with the common objective of improving the quality of life in the village, taking into account the constraints and difficulties associated with the local radiological situation.

In order to favor the dissemination of the approach, the following steps of the ETHOS Project were focused on the following characteristics:

# Communication of Radiation Benefits and Risks in Decision Making

- empowerment of local professionals from the health-care, education, and agriculture systems, as well as those in charge of radiation monitoring to allow them to directly implement the step-by-step approach;
- involvement of the different levels of authorities (local, regional, national) as well as national scientific institutes to accompany this process; and
- development of a practical radiation protection culture among the villagers

including the conditions for its transmission to future generations through the school system.

The ETHOS experience has shown that the direct involvement of the population in the day-to-day management of the radiological situation was feasible and a necessary approach to complete the rehabilitation program implemented by the authorities in contaminated territories.

3:40 pm

## **Panel Discussion**

Don M. Curry  
Susan E. Dawson  
William T. Hartwell  
F. Owen Hoffman  
C. Rick Jones  
Thierry Schneider

4:20 pm

## **Future Directions of the International Commission on Radiological Protection Committee 4: Application of ICRP Recommendations—From Stakeholder Involvement to Self-Help Protective Actions**

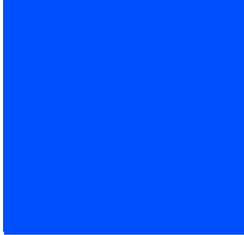
Jacques Lochard  
*Nuclear Evaluation Protection Centre*

For the first time in its 2007 recommendations, the International Commission on Radiological Protection (ICRP) mentions the need to account for the views and concerns of stakeholders when optimizing protection. ICRP considers actual stakeholder involvement in the optimization process introduces the flexibility in the management of radiological risk that is necessary to achieve more effective and sustainable decisions. Stakeholder involvement is now largely recognized as a proven means to achieve incorporation of values into the decision-making process, to resolve conflicts between competing interests, to build shared understanding with both workers and the public, and finally to improve the substantive quality of decisions.

A major evolution in the new recommendations is also the generalization of the

optimization principles to all types of exposure situations including those which were previously related to activities defined as interventions such as, for example, exposure to radon in dwellings, to naturally-occurring radioactive material, and to contaminated sites and territories. All these exposure situations are characterized by the fact that exposures of concerned individuals are largely result from their personal behavior.

Building on the experience with the management of long-term contaminated territories by the Chernobyl accident in the Commonwealth of Independent States and in Europe, ICRP introduced in its Publication 111 the concept of self-help protective actions, which in this particular context aims at the characterization by the inhabitants themselves of their own radiological situation by monitoring the



## Abstracts: Tuesday, March 9

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radiological quality of their direct environment, their external and internal exposure, the exposure of the people for whom they are responsible (e.g., children, elderly), and in adapting their way of life accordingly to reduce their exposure. Experience in the contaminated territories has also shown that the dissemination of a “practical radiation protection culture” among all segments of the population, particularly

through the education system, is key for the success of protection strategies in the long term.

ICRP is currently exploring how the concepts of “self help protective actions” and “practical radiation protection culture” may find a broader application for other exposure situations.

4:40 pm

### **Communicating Radiation Benefits and Risks: Some Lessons Learned**

Paul A. Locke

*Johns Hopkins Bloomberg School of Public Health*

4:50 pm

### **Closing Remarks**

Thomas S. Tenforde

*President, National Council on Radiation Protection and Measurements*

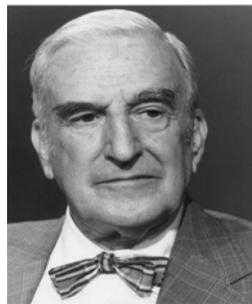
5:00 pm

### **Adjourn**

# Mission Statement

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To support radiation protection by providing independent scientific analysis, information and recommendations that represent the consensus of leading scientists.



Lauriston S. Taylor  
1929–1977



Warren K. Sinclair  
1977–1991



Charles B. Meinhold  
1991–2002



Thomas S. Tenforde  
2002–

*Scientific authority since 1929*



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Chris G. Whipple

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## **Registration**

Monday, March 8, 2010

7:00 am – 5:00 pm

Tuesday, March 9, 2010

7:00 am – 1:00 pm

*(no registration fee)*

**Register online at <http://registration.ncrponline.org>**

## **2011 Annual Meeting**

*Scientific and Policy Challenges of  
Particle Radiations in Medical Therapy  
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March 7-8, 2011

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These organizations have supported the work of the National Council on Radiation Protection and Measurements during the period of January 1 to December 31, 2009.

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Centers for Disease Control and Prevention  
Defense Threat Reduction Agency  
Department of Homeland Security  
Environmental Protection Agency  
National Institute for Occupational Safety and Health (NIOSH)  
Nuclear Regulatory Commission  
U.S. Navy

## **Grants**

American Association of Physicists in Medicine  
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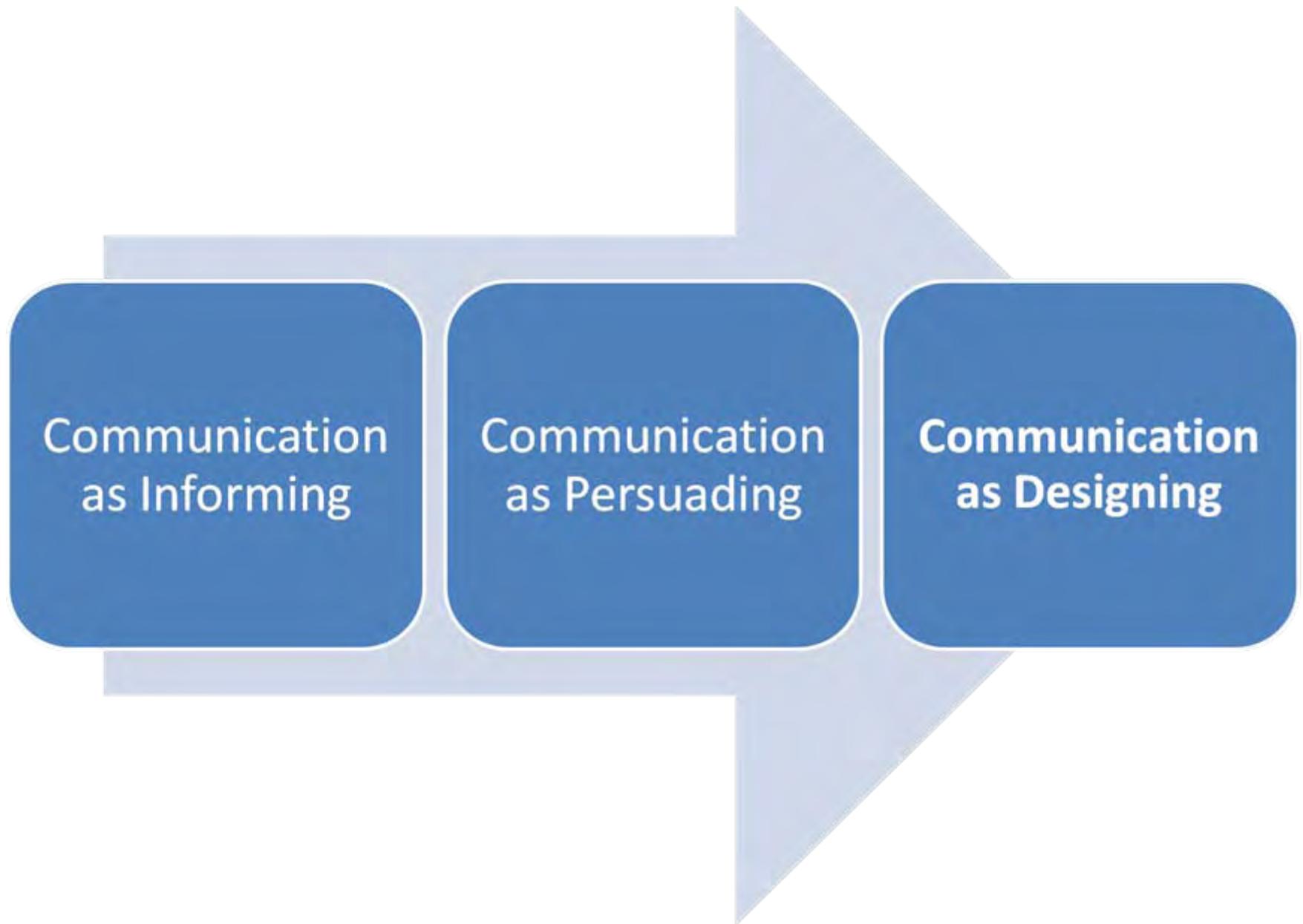
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# Crafting Interactivity

Transforming Assumptions about  
Communication in Science and Policy



# Interaction is an object of communication design

## Design Materials

Contributions

Sequences of Contributions

Participation Status

Topics

Interaction Goals

Sequences of Activity

Scenario 1: Public involvement

Scenario 2: Stakeholder consultation

# Designs for interaction are solutions to multiple contextual demands

## Scenario 1

- Reorganizes format for contributing
- Sorts out positions by stake in solution

## Scenario 2

- Resets the burden of proof
- Avoids false conclusion

A design for interaction is an hypothesis about achieving preferred communication

## Micro-Interactional Matters that Matter

Turn-Taking &  
Relevance

Speech as Action  
& Commitments

Face & Order

Repair &  
Coordination

Interactional  
Expectations &  
Misunderstanding

# Design-logics for managing disagreement

## Dialogue Designs

- Critical Discussion
- Bargaining
- Therapeutic

## Large Scale Deliberation Designs

- Funneling
- Issue-Networking
- Reputation Management

Communication as designing is a practice to be developed to meet the demands of involvement and the need for competence in science and policy communication.



NCRP Meeting 2010  
Bethesda MD

# Transparency, Openness, and Accountability in Risk Assessment: Lessons from the National Academies' "Science and Decisions" Report

Thomas E. McKone, PhD

Lawrence Berkeley National Laboratory  
University of California,  
Berkeley CA, USA

# Science and Decisions

- In December 2008, on the 25th Anniversary of the its ground-breaking 1983 “Red Book”, the National Research Council issued its latest advice on risk assessment “Science and Decisions, Advancing Risk Assessment.”
- This report defines new directions for risk assessment and risk management
- How does it foster transparency, openness, and accountability in risk assessment?

# Overview

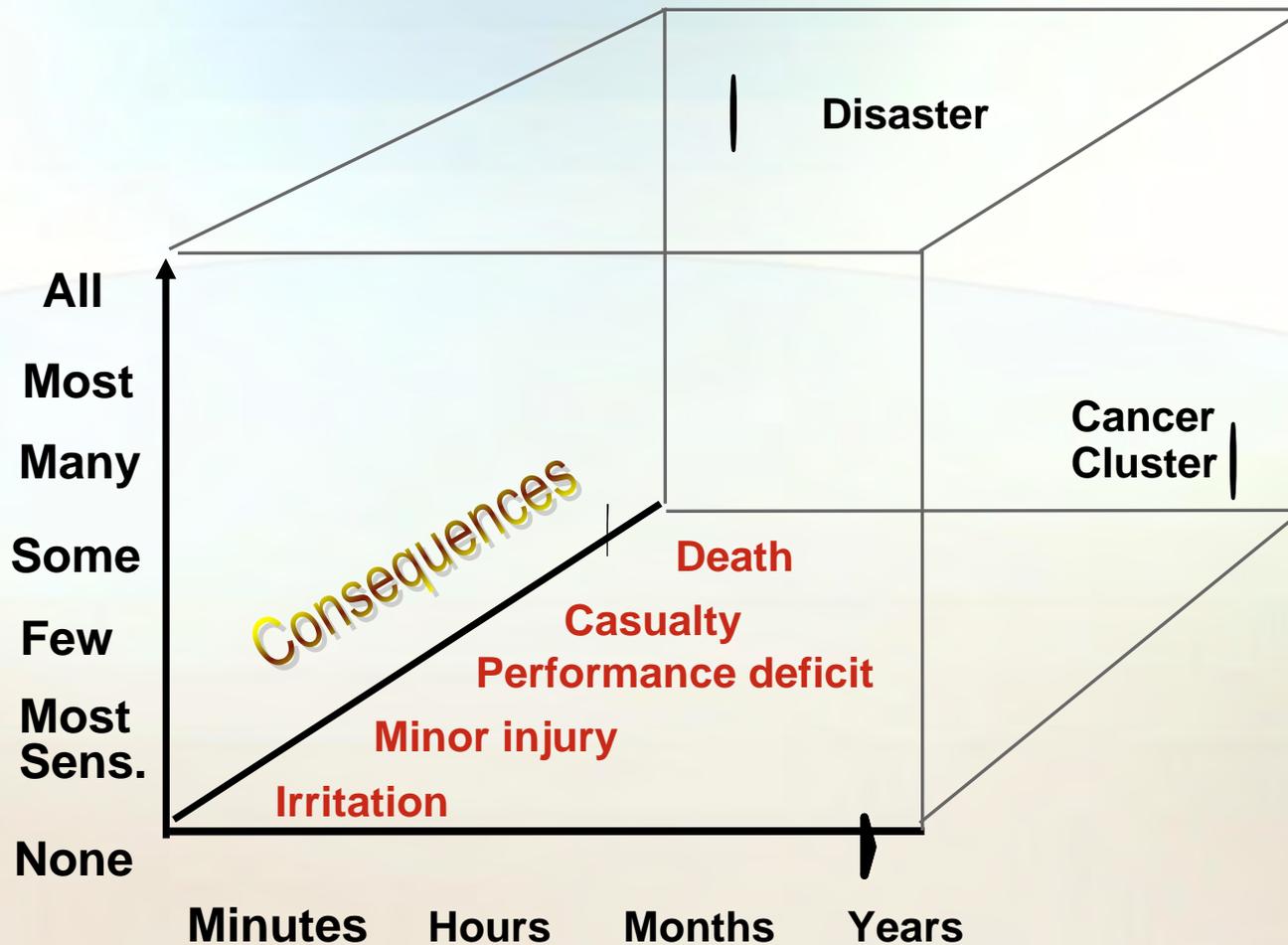
- History, practice, and current state of risk assessment
- Challenge:  
Considering and communicating a broader range of factors in risk assessment
- Solutions-based risk assessment
- Improving and expanding the role of risk assessment in decision making

# History, Practice, and Current State

- “Virtually every aspect of life involves risk. How we deal with risk depends largely on how well we understand it”
- **The goal of a risk assessment is to characterize the likelihood of harm (or loss) in a format that assists decision makers to tolerate, mitigate, or eliminate the source of potential harm**
- Risk assessments often lack openness, transparency and accountability

# Dimensions of Harm

Number Affected

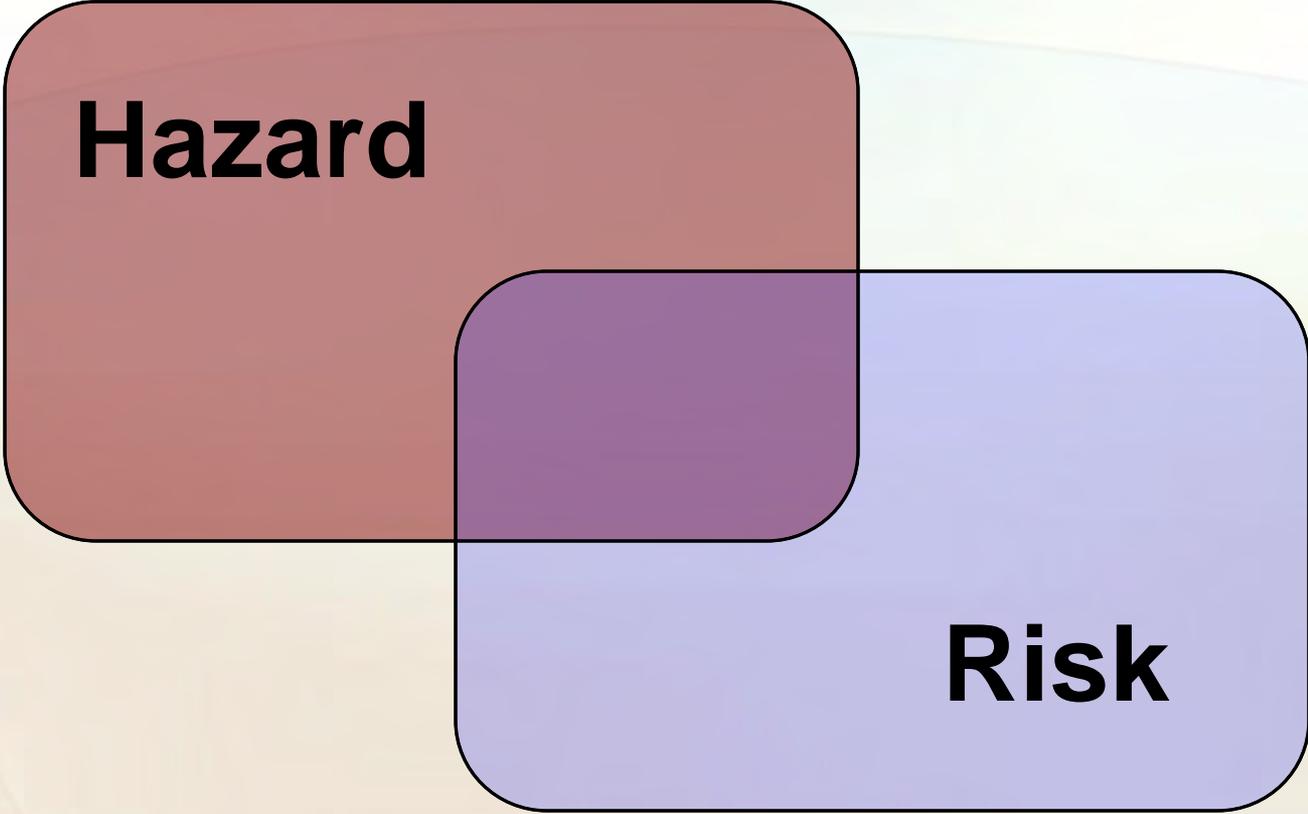


Time to Consequences

# How is Risk Assessment Distinct from other Health Protection Studies?

**The possibility of harm**

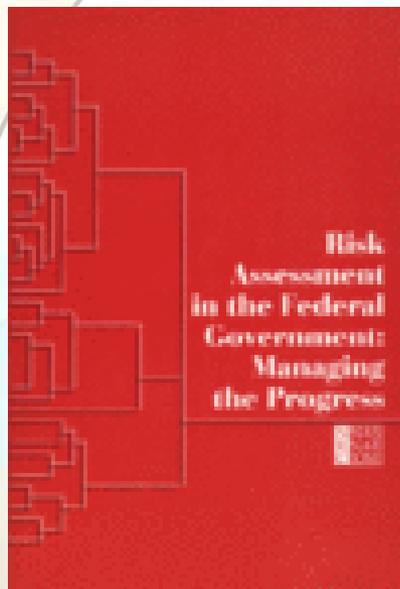
**Hazard**



**Risk**

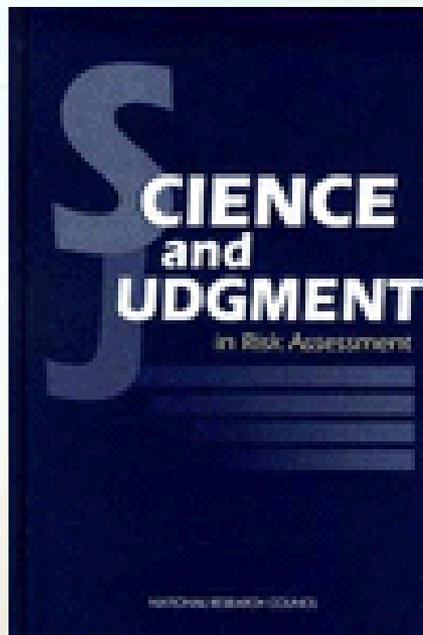
**The probability of harm**

# Red Book, Blue Book, New Book



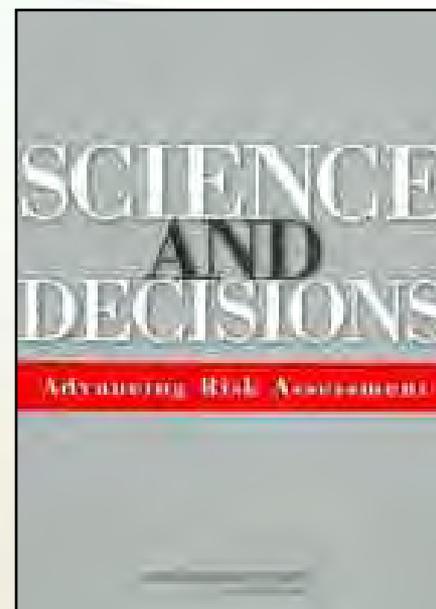
**1983**

Risk Assessment in the Federal Government: Managing the Process



**1994**

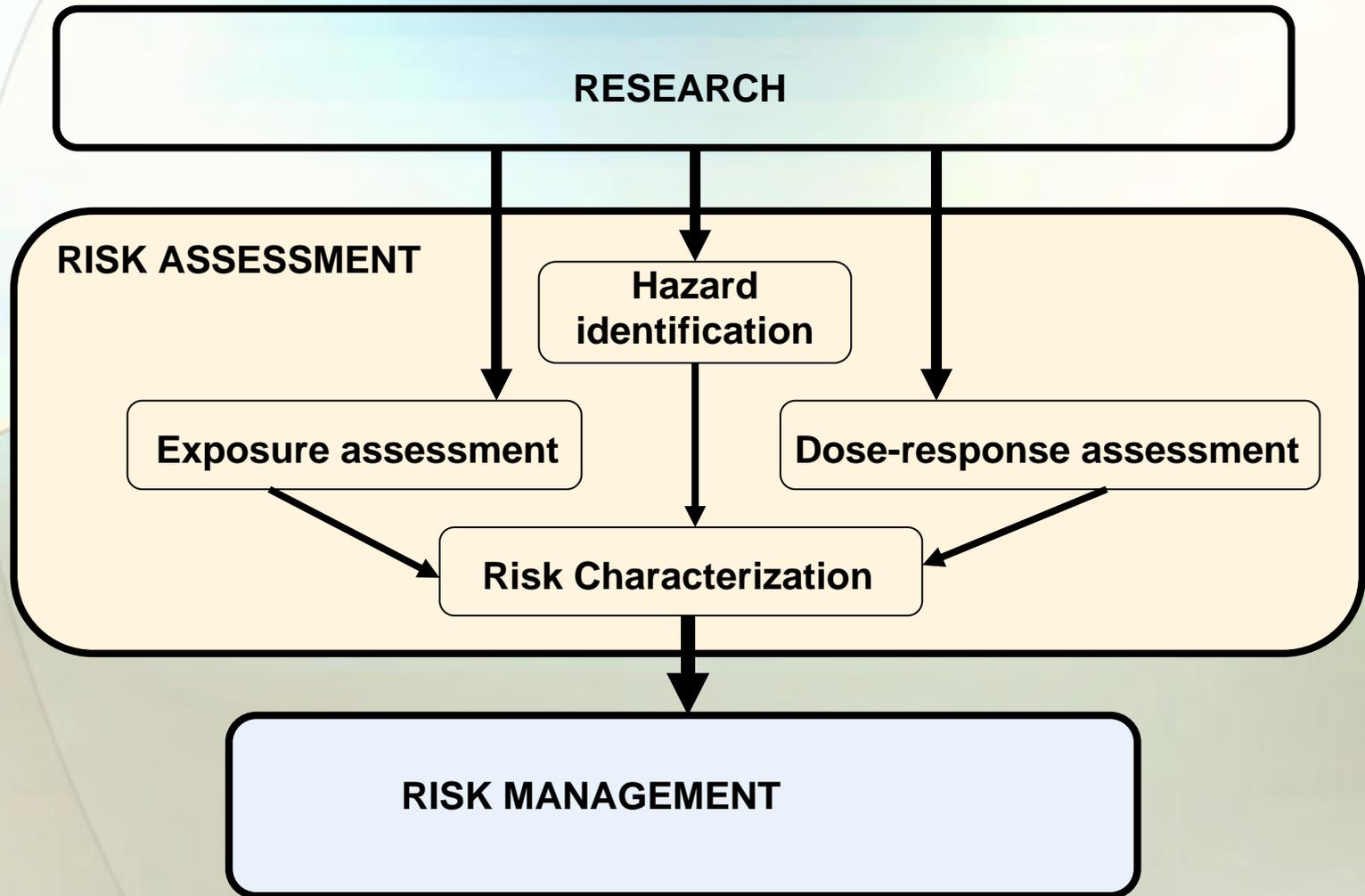
Science and Judgment in Risk Assessment



**2009**

Science and Decisions: Advancing Risk Assessment

# National Research Council Risk Paradigm



From "Risk Assessment in the Federal Government: Managing the Process (NRC,1983)

# An Evolving Process

“The committee recommends an important extension of the **Red Book** model to meet today’s challenges better—that risk assessment should be viewed as a method for evaluating the relative merits of various options for managing risk rather than as an end in itself.”

From the Summary of *Science and Decisions: Advancing Risk Assessment*

**PHASE I:  
PROBLEM FORMULATION  
AND SCOPING**

**PHASE II:  
PLANNING AND CONDUCT  
OF RISK ASSESSMENT**

**PHASE III:  
RISK MANAGEMENT**

- What problems are associated with existing environmental conditions?
- If existing conditions appear to pose a threat to human or environmental health, what options exist for altering those conditions?
- Under the given decision context, what risk and other technical assessments are necessary to evaluate the possible risk-management options?

**Stage 1: Planning**

- For the given decision context, what are the attributes of assessments necessary to characterize risks of existing conditions and the effects on risk of proposed options? What level of uncertainty and variability analysis is appropriate?

**Stage 2: Risk Assessment**

**• Hazard Identification**

What adverse health or environmental effects are associated with the agents of concern?

**• Dose-Response Assessment**

For each determining adverse effect, what is the relationship between dose and the probability of the occurrence of the adverse effect in the range of doses identified in the exposure assessment?

**• Exposure Assessment**

What exposures/doses are incurred by each population of interest under existing conditions?  
How does each option affect existing conditions and resulting exposures/doses?

**• Risk Characterization**

What is the nature and magnitude of risk associated with existing conditions?

What risk decreases (benefits) are associated with each of the options?

Are any risks increased? What are the significant uncertainties?

**Stage 3: Confirmation of Utility**

- Does the assessment have the attributes called for in planning?
- Does the assessment provide sufficient information to discriminate among risk-management options?
- Has the assessment been satisfactorily peer reviewed?

- What are the relative health or environmental benefits of the proposed options?
- How are other decision-making factors (technologies, costs) affected by the proposed options?
- What is the decision, and its justification, in light of benefits, costs, and uncertainties in each option?
- How should the decision be communicated?
- Is it necessary to evaluate the effectiveness of the decision?
- If so, how should this be done?

NO

YES

Science  
and  
Decisions  
2009

**FORMAL PROVISIONS FOR INTERNAL AND EXTERNAL STAKEHOLDER INVOLVEMENT AT ALL STAGES**

- The involvement of decision-makers, technical specialists, and other stakeholders in all phases of the processes leading to decisions should in no way compromise the technical assessment of risk, which is carried out under its own standards and guidelines.

# Challenge: Broaden the Utility of RA

- **Uncertainty, variability, vulnerability**
- **Consistent approach to carcinogens and non-carcinogens**
- **A focus on disease burden and community health**
- **Cumulative exposure and aggregate risk**
- **Focus on solutions**
- **Openness, transparency, and accountability**

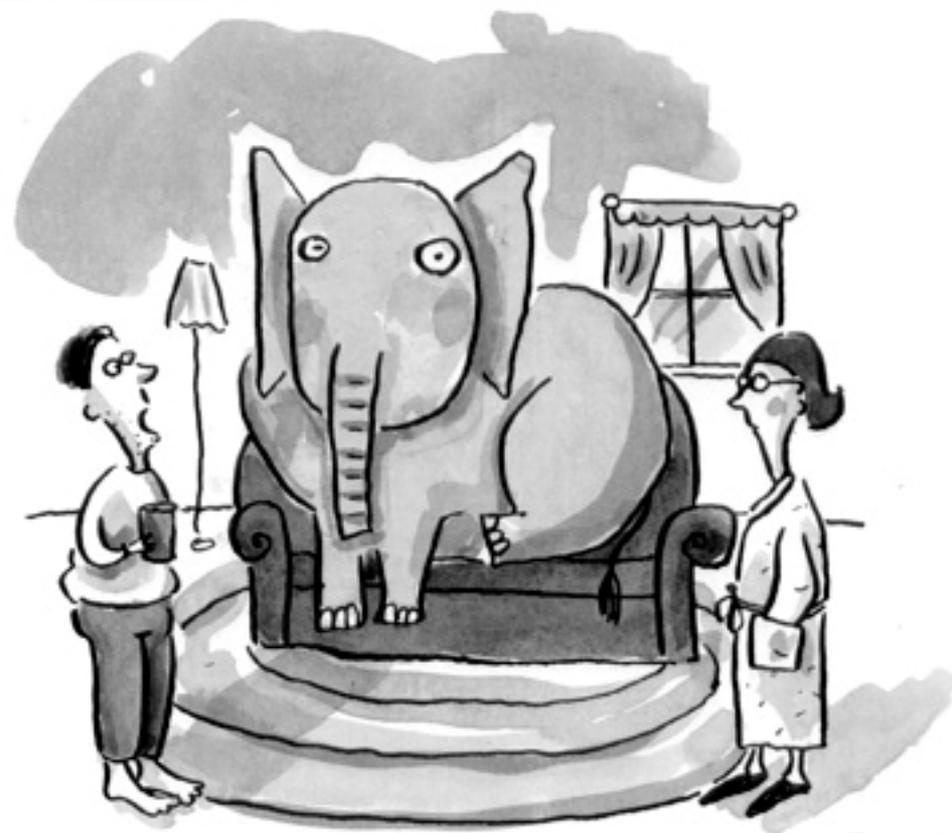
# Uncertainty!

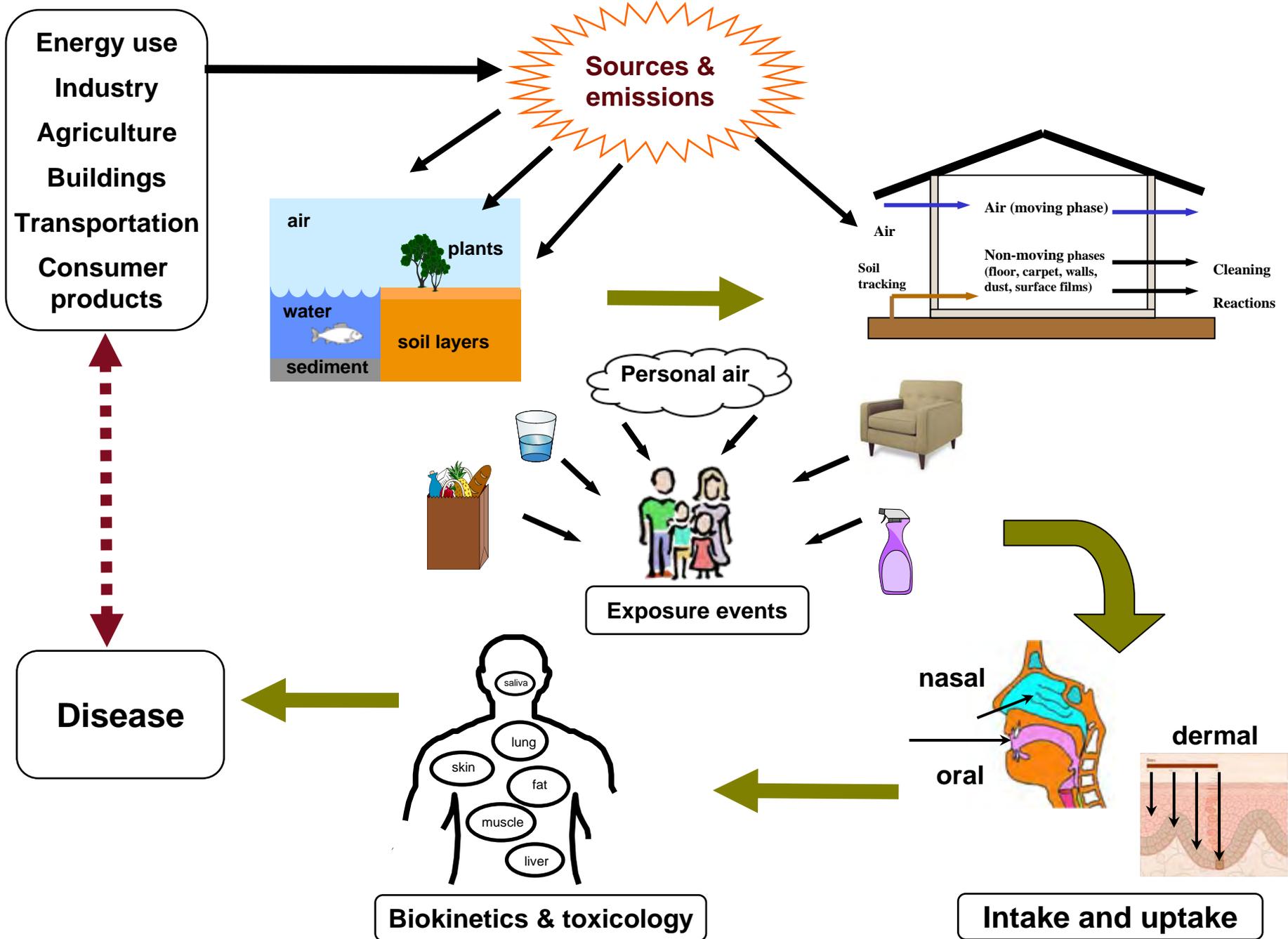
**Research findings are rarely, if ever, directly suitable for decision making**



**You Can't Ignore the 800 Pound Gorilla**

**Risk assessment provides a process for interpreting incomplete/uncertain research findings in support of decisions**





# Solutions-Based Risk Assessment

- **Laws administered by the EPA and other regulatory agencies tend to constrain the options considered for risk management**
- **Risk assessments should be part of a process that works to improve community health**
- **Approach public health and environmental problems by**
  - **arraying the widest possible range of options for dealing with these problems**
  - **then setting into motion the various technical analyses (risk assessments, risk control technology analyses, resource costs, etc.) that are necessary to achieve the optimum outcome**

# Risk Assessment and Decision Making

- **To be most useful in decision-making risk assessment must**
  - Consider the risks associated with existing conditions (that is to say, the probability of harm under the “take no action” alternative)
  - And the risk that would remain if each of various possible actions were taken to alter those conditions
- **Improvements in risk analysis at two broad levels**
  - First, improvements in the value of risk assessments for decision making
  - Second, improvements in the technical analysis supporting one or more of the steps of risk assessment can also be feasible, as new scientific knowledge becomes available

# Transparency, Openness, and Accountability in Risk Assessment

- Define the problem
- Make clear who is at risk
- Identify the decision makers and assure that their questions are addressed
- Evaluate whether a risk assessment will offer any new insight for a problem—
- Know how to put the result in context

# One perspective on stakeholder involvement at Hanford

NCRP

March 2010

Todd Martin

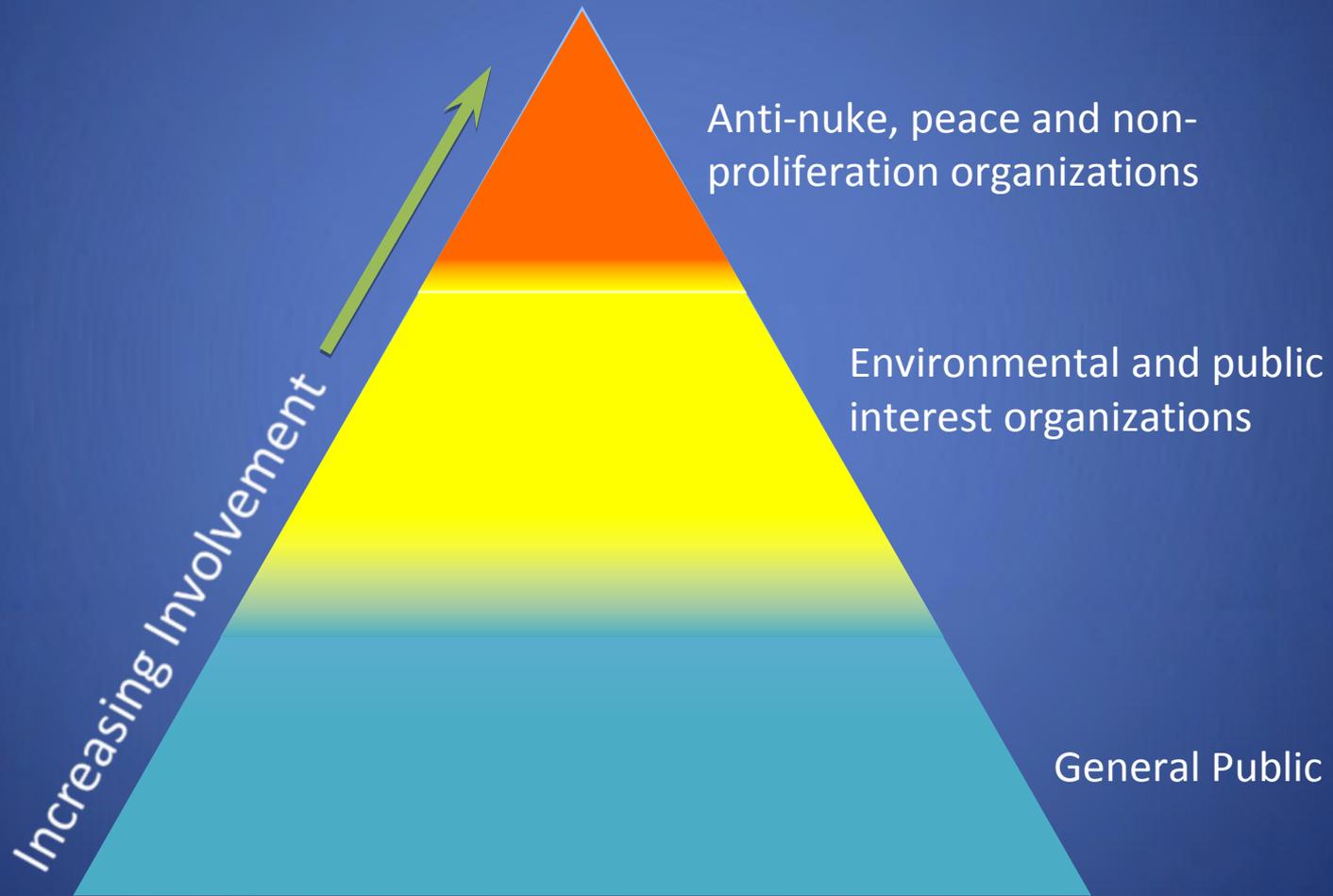
# What is Hanford?



# What did stakeholders care about?

- Ideological opposition to bombs
- Public, worker, environmental health and safety concerns
- Secrecy of nuclear weapons complex

# Involvement Pyramid



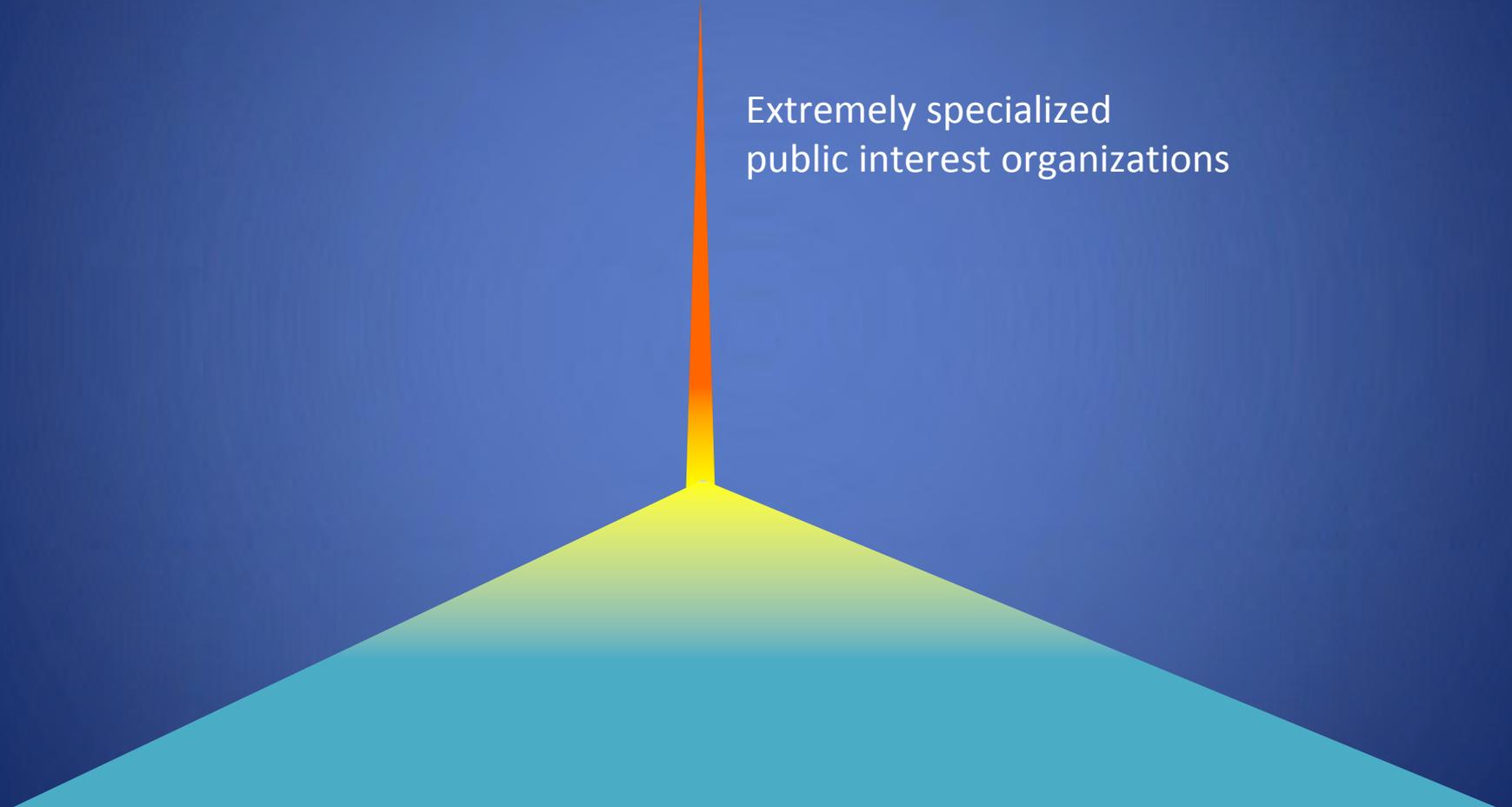
# Late 1980s-1990s changes

- Release of historical documentation
- Cease productions of weapons materials
- Commitment to cleanup
- Commitment to openness and transparency

# What was needed?

- Guidance for how to determine past impacts of releases
- Guidance for how to cleanup
- Guidance for how to involve stakeholders in cleanup decision-making

# The Thumbtack of Involvement



Extremely specialized  
public interest organizations

# Implications of the thumbtack

- Traditional involvement mechanisms often fail.
- Traditional metrics for measuring involvement often fail.
- Young people do not become involved.

# Some Solutions

- Develop involvement mechanisms focused on the point of the tack.
- Use those in the point to reach the yellow and blue.
- Keep trying but acknowledge reality.

# What is next?

- New nuclear proposals
- A cleanup that will require decades more.
- Waste legacy that will last thousands of years.



# Communication 2.0: Increasing Information Reach and Impact through New Media and Public Engagement

**Jay M. Bernhardt, PhD, MPH**

US Centers for Disease Control and Prevention



# CDC's Diverse Audiences

## Health Professionals

- 1,000+ Health Departments
- 1,000+ Partner Organizations



## The “Public”

- 300+ million Americans
- Populations in 50+ countries



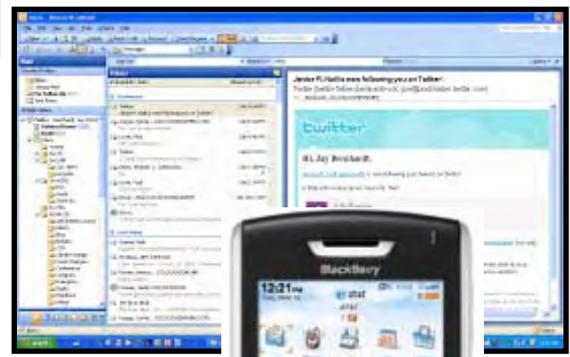
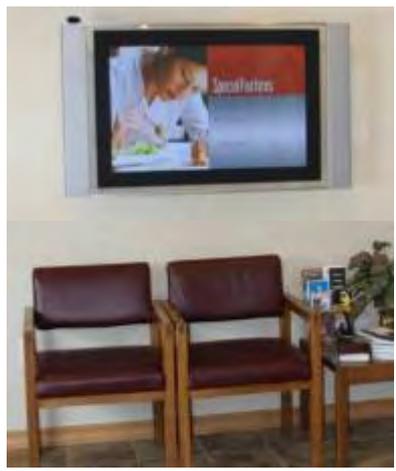
## Policy Makers & Stakeholders



# Where do they get their health info?



# How many screens do they see?





# How many channels do they watch?





# Where do they go online?



In today's world, the average informed person reads or listens to seven sources of information daily (Pew, 2008)

CDC Goal: Provide information to our target audiences (public, professionals, policymakers) when, where, and how they want and need it to inform healthy and safe decisions

# The Power of Social Media

The New York Times

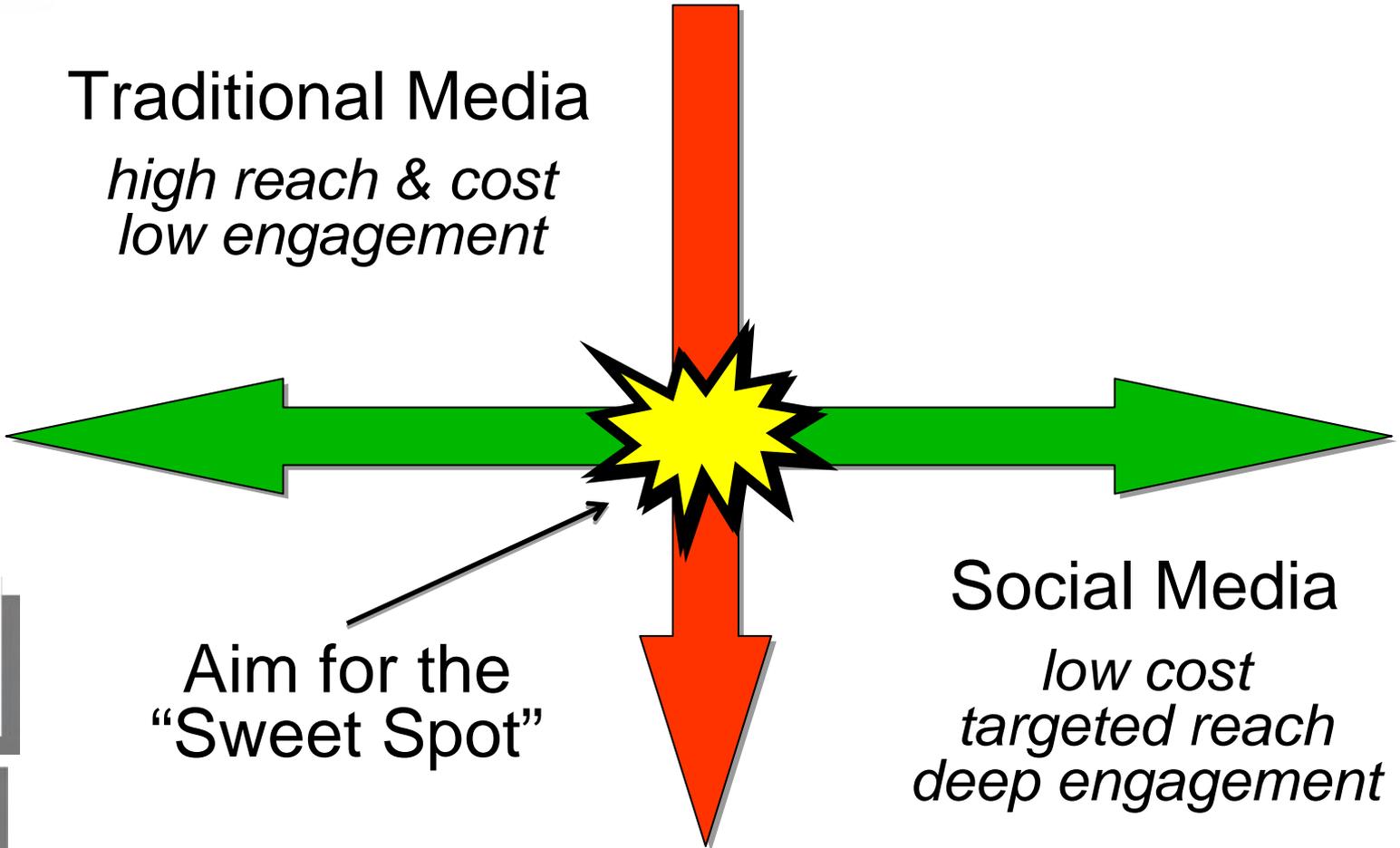


Traditional Media

*high reach & cost  
low engagement*



WebMD  
Better information. Better health.



Aim for the  
“Sweet Spot”

Social Media

*low cost  
targeted reach  
deep engagement*

facebook

flickr

You Tube

Blogger

twitter

# The Power of Peer Influence

“We have reached an important juncture, where the lack of trust in established institutions and figures of authority has motivated people to **trust their peers as the best sources of information.**”

**"A PERSON LIKE ME" NOW MOST CREDIBLE SPOKESPERSON FOR COMPANIES; TRUST IN EMPLOYEES SIGNIFICANTLY HIGHER THAN IN CEOs, EDELMAN TRUST BAROMETER FINDS**

**SURVEY SHOWS MICROSOFT AS MOST TRUSTED GLOBAL COMPANY AND TECHNOLOGY MOST TRUSTED SECTOR; TELEVISION, NOT NEWSPAPERS, LOSTS GROUND TO INTERNET AS TRUSTED SOURCE**

January 23, 2006, New York: Global opinion leaders say their most credible source of information about a company is now "a person like me," which has risen dramatically to surpass doctors and academic experts for the first time, according to the seventh annual Edelman Trust Barometer, a survey of nearly 2,600 opinion leaders in 13 countries. In the U.S., trust in "a person like me" increased from 20% in 2003 to 66% today. Opinion leaders also consider rank-and-file employees more credible spokespersons than corporate CEOs (42% vs. 28% in the U.S.).

The Edelman Trust Barometer found Microsoft Corporation the most trusted global company, followed by iconic companies in their home markets, including Toyota in Japan, Haier in China, Samsung in South Korea, and Petrobras in Brazil.

*We have reached an important juncture, where the lack of trust in established institutions and figures of authority has motivated people to trust their peers as the best source of information about a company, said Richard Edelman, President and CEO of Edelman. Companies need to move away from top-down messages and focus on their most trusted spokespersons, who are employees, not CEOs or other credible spokespersons.*

This year's survey assesses the impact on trust of a company's national origin, industry sector, behaviors and communications policies. Key findings, which are being presented the week at the World Economic Forum in Davos, include:

- Opinion leaders in Europe apply a significant "trust discount" for major U.S. brands, such as Coca-Cola (U.S. = 85% vs. Europe = 41%); McDonald's (51% vs. 28%); IBM (70% vs. 44%); and UPS (84% vs. 52%). There is no "trust discount" for non-American global brands operating in the U.S. or any other market (e.g. Sony = 74% in Japan, and 79% in the U.S.), with the exception of Japanese brands in China.
- Western based companies continue to make big strides in winning trust in the Chinese market. Big gains this year included Citigroup, Procter & Gamble, Shell, Unilever and UPS, all now rated trustworthy by more than 75% of Chinese respondents, and up from under 50% five years ago.
- German and Canadian companies are highly regarded by more than 70% of opinion leaders in every market surveyed. Less than 40% of opinion leaders expressed trust in global companies headquartered in emerging markets such as China and India, as well as in Korea. Such companies face particular trust deficits when seeking to buy companies in overseas markets.
- Companies in the technology and retail sectors are the most trusted, while energy and media-entertainment are the least-trusted industries. Pharmaceutical concerns face considerable skepticism in the U.S. and Germany, while financial firms fare much better in the U.S. and Asia than in Europe.
- Television is the big loser in media trustworthiness with the rise of the Internet. When asked where they turn first for trustworthiness information, 29% of respondents in the U.S. still cite TV first, down from 39% three years ago. The Internet is now cited by 19%, up from 10% in 2003. The same trend is evident in the U.K., where television has declined from 42% to 33% as respondents' first choice, while the Internet has risen from 5% to 15%. Newspapers, which are often thought to be the most serious casualty of the Internet wave, show rankings essentially unchanged in most markets at approximately 20%. Newspapers remain the first trusted medium of choice for respondents in France, Germany, Japan, Brazil, Korea, and Italy.
- "Articles in business magazines" is the most credible source of information about a company (U.S. = 66%, Canada = 52%, Brazil = 75%, Europe = 63%), followed closely by "friends and family," which has grown very strongly in the U.S. (80-122% vs. 36-58%), Brazil (94-98 vs. 106-172%) and Canada (70-142% vs. 76-58%).

--Richard Edelman, President and CEO, Edelman.  
 Source: <http://www.edelman.com/news/showone.asp?id=102>



# Social Media and Decision Making

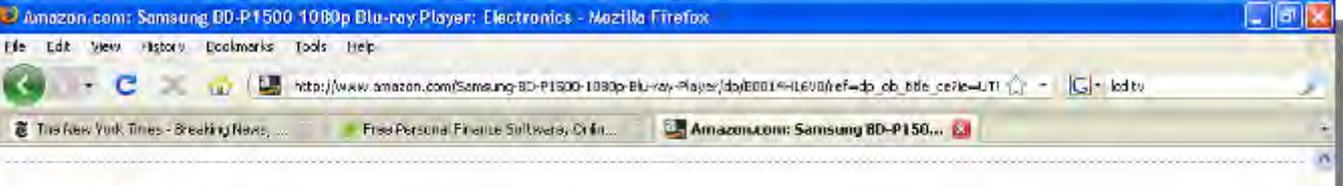


## Product Description

### Manufacturer's Description -- July 20, 2008

Experience the blu-ray difference with the SAMSUNG BD-P1500. The BD-P1500 lets you have it all – watch your favorite DVDs and blu-ray discs or listen to CDs with

Full 1080p resolution richer, bolder color p transmission bandwidth Ethernet connection Control all your Sam And advanced audio sound, for the great



## Answers to Bas

What is Blu-ray? Blu-ray is a new opt

## Customer Reviews

33 Reviews

5 stars:	(16)
4 stars:	(10)
3 stars:	(2)
2 stars:	(3)
1 star:	(2)

### Most Helpful Customer

103 of 106 people found  
★★★★★ Fine, basic pla  
By Kevin Moore "Kevin"  
I've been using this for 2 good stuff: Excellent look ethernet and USB port. < but I'm sure it work fine







# Micro-Blogging



Update 5/10/09: 2532 total cases of novel H1N1 flu, 3 deaths, 44 states affected in US:<http://bit.ly/Wropx> #swineflu #h1n1

2 minutes ago from web

**CDCFlu**  
CDC Flu

© 2009 Twitter. About Us Contact Blog Status Apps API Search Help Jobs Terms Privacy

**CDC CDCemergency**

Verified Account

Name CDC Emergency  
Location Atlanta, GA  
Web <http://bit.ly/emergenc>  
Bio CDC Emergency Preparedness and Response increasing the nation's ability to prepare for and respond to public health emergencies.

77 Following 913,254 Followers

Tweets 245

Actions  
Block CDCemergency

Following

Following  
✓ Following

RT @CDC\_eHealth Sign up for text messages from CDC on H1N1 flu and more: text HEALTH to 87000. More info: <http://is.gd/3nlxg> Please RT.

1:43 AM Sat 5/10 from web

RT @CDCFlu Anyone with asthma is at higher risk for flu related complications. Learn more: <http://is.gd/3nlxg>

Access important CDC info including H1N1 flu via the mobile CDC Website at <http://m.cdc.gov>

4:42 PM May 16/09 from web

**CDC\_eHealth**

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TweetDeck

All Tweets

Replies

Search twitter

Eating the dinner of champions - too hot and really little ceasar pizzas : Long weekend here (comat)

jeanandb, Thu 5 Jul 2009 via web

My take on klerf.ca : <http://myjut.com/044qf> . Spoiler alert: I'm not in love, but hey.

chidrean, Thu 5 Jul 2009 via web

is there a way to pass a url parameter to a url with the original referer before a 301 redirect is done?

meatdog, Thu 5 Jul 2009 via web

Company I consulted for today provides cool web-based financial service. 1 out of 4 ppl there had "never heard" of Inade or sinoforce. wow

markhll, Thu 5 Jul 2009 via web

@louisgray Yes, eBay and AOL.

stanford, Thu 5 Jul 2009 via Sumatra

@louisgray Probably GM, starting in the 1970s. Or even maybe Ford or Chrysler. People have severe brand loyalty.

hahem, Thu 5 Jul 2009 via Sumatra

@louisgray Livejournal was just as slow and unreliable a number of years ago as Twitter is today.

marcoha, Thu 5 Jul 2009 via Sumatra

@louisgray yes, Microsoft Windows

philliphs, Thu 5 Jul 2009 via Sumatra

forum looks like the twitter maintenance just started. lets hope no fall whales.

jeanandb, Thu 5 Jul 2009 via web

@icollabor that must mean the notion of Twitter as ambient intimacy is working well.

jeanandb, Thu 5 Jul 2009 via web

FriendFeed now is half of a Twitter. I have 14,777 followers on FriendFeed. Got there a lot faster than Twitter did.

scobtan, Thu 5 Jul 2009 via web

Twitter has a 2-hr maintenance in 20 min in san Francisco. It's getting better. They are warning us how to deal maintenance & not a crash.

nichefreak, Thu 5 Jul 2009 via web

More More

More More

Last updated: 1:37 with 1 tweet / next update: 1:42

Twitter.com

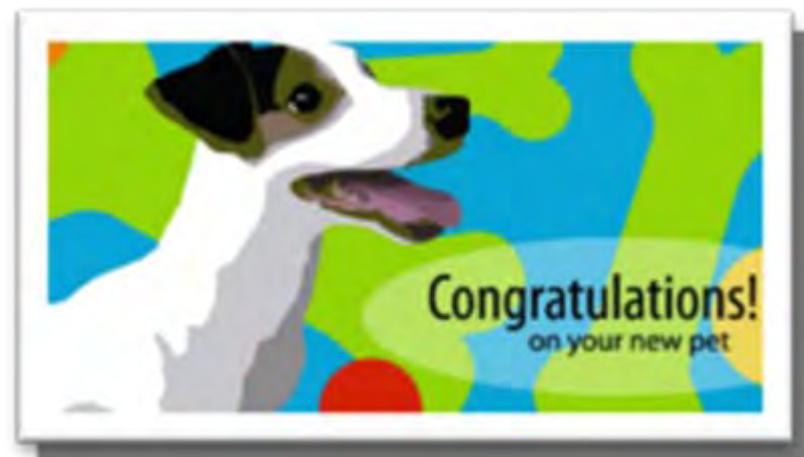
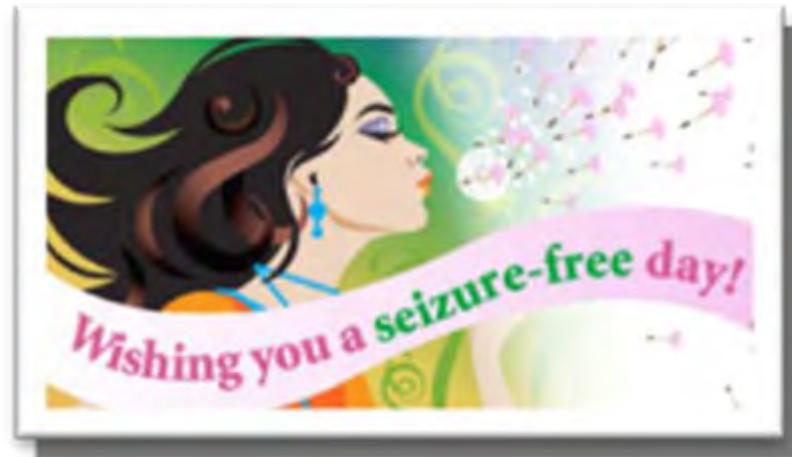
Twitter Status Party.mash.it





# Virtual Worlds: Second Life





“Mobile users are inseparable from their devices... And as these devices become more capable, they are evolving into extensions of users’ desktops and home communications and entertainment systems.”



Average number of hours per day mobile phones are within arm’s reach:

**19 hours**

(From: Pew Internet & American Life Project, The Social Life of Health Information, Accessed September 10, 2009

<http://www.pewinternet.org/Reports/2009/8-The-Social-Life-of-Health-Information.aspx>)

From: eMarketer, Mobile Users and Usage: It’s Personal, Accessed on November 4, 2009 at [http://www.emarketer.com/Reports/All/Emarketer\\_2000589.aspx](http://www.emarketer.com/Reports/All/Emarketer_2000589.aspx)



# Mobile Health (mHealth)



**Know your HIV status?**

**Text: Your Zip Code**  
**To: KnowIt or 866948**

To find HIV Test Centers near you.

[www.hivtest.org](http://www.hivtest.org)

**CDC Text Messages**

**Flu Antivirals**

Antiviral drugs 4 treating flu work best if started w/in first 2 days of symptoms. Call CDC 800-232-4636. <http://m.cdc.gov>. To opt-out reply HEALTH QUIT.

[More...](#)

**Test smoke alarms and carbon monoxide detectors**

Test your smoke alarms and carbon monoxide detector when u turn your clocks back on Nov 1; replace batteries if needed. Call CDC 800-232-4636 or <http://m.cdc.gov>

CDC share ⓘ

08:22 09.24.09

4 CDC Info  
 Txt: HEALTH  
 To: 87000

[LEARN MORE](#)





“...The CDC is clearly making an effort to provide site visitors with multiple ways and formats to consume this serious content, from video explanations to podcasts featuring health domain experts...

...So yes, swallow your pride. We can learn from the ‘big, fat, impenetrably slow and bureaucratic’ agencies out there. Suck it up and take action.”

-- Pete Blackshaw  
*Advertising Age*



# Health Communication 2.0



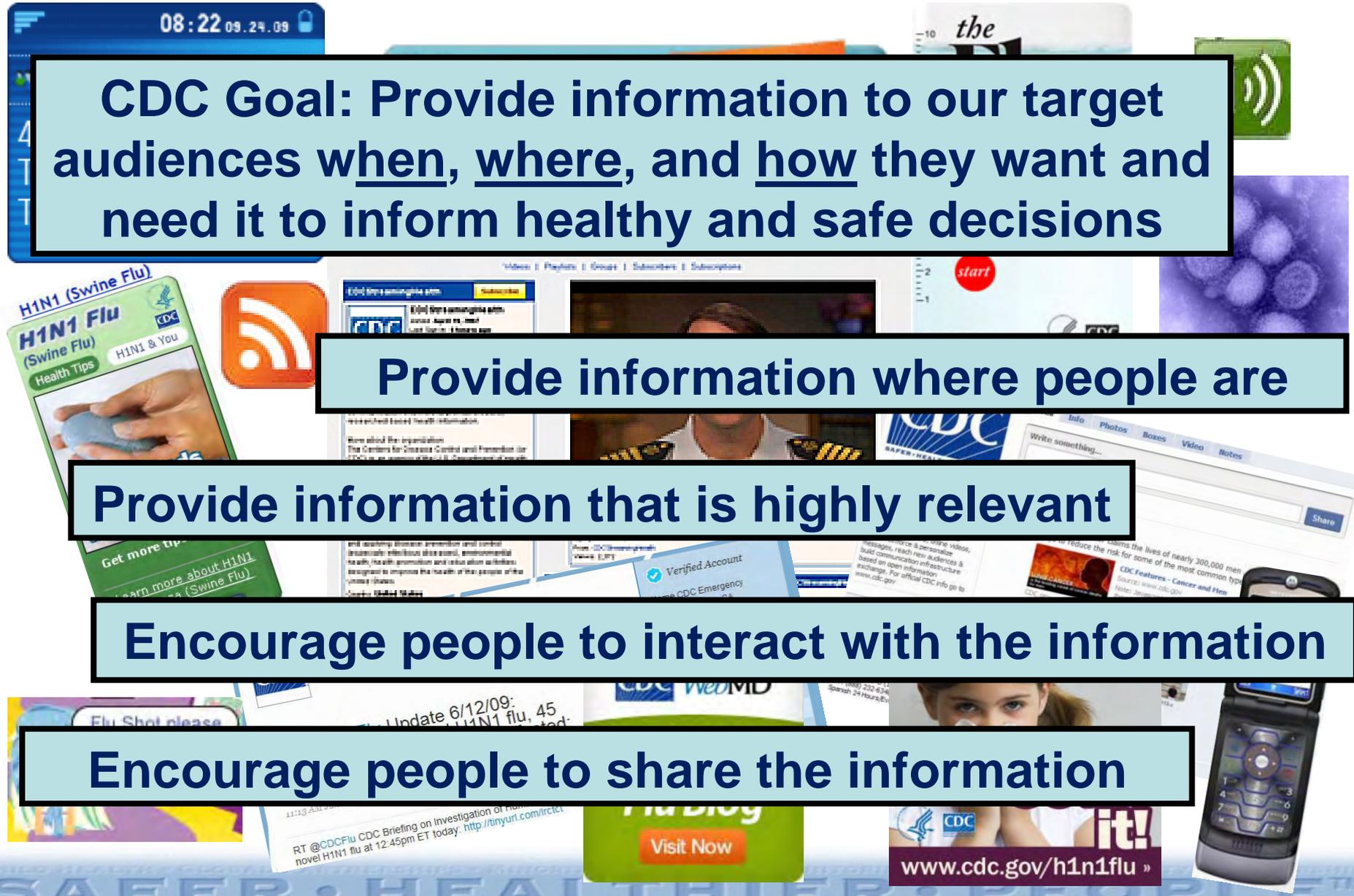
**CDC Goal: Provide information to our target audiences when, where, and how they want and need it to inform healthy and safe decisions**

**Provide information where people are**

**Provide information that is highly relevant**

**Encourage people to interact with the information**

**Encourage people to share the information**





# Thank you

Web: <http://www.cdc.gov/socialmedia>

Metrics: <http://www.cdc.gov/metrics>

Blog: <http://blogs.cdc.gov/healthmarketingmusings>

Twitter: <http://www.twitter.com/jaybernhardt>

Email: [jbernhardt@cdc.gov](mailto:jbernhardt@cdc.gov)

This presentation is the opinion of the author and does not necessarily represent the official position of CDC or HHS.

# The London Polonium Incident: Lessons in Risk Communication

James Rubin

King's College London



- 1 Nov 06 Litvinenko meets contacts at the Millennium Hotel and Itsu Sushi bar
- 4 Nov Admitted to hospital.
- 17 Nov Placed under armed guard
- 20 Nov Scotland Yard Counter-Terrorism Unit takes over investigation
- 23 Nov Litvinenko dies
- 24 Nov Confirmation that he was poisoned with Polonium 210. Traces found in the hotel and sushi bar

## Update Statement on the Public Health Issues related to Polonium-210

25 November 2006

The Health Protection Agency is providing expert advice on the public health issues surrounding the death of Mr Alexander Litvinenko. Following the results of further assessments we are updating our advice.

Some small quantities of radioactive material have been found in a small number of areas at the Itsu sushi restaurant at 167 Piccadilly, London, and in some areas of the Millennium Hotel, Grosvenor Square, London, and at Mr Litvinenko's home in Muswell Hill.

We are therefore asking anyone who was in the Itsu restaurant, or who was in The Pine Bar or the restaurant of the Millennium Hotel on 1 November to contact NHS Direct on 0845 4647 where they will be given advice on what to do.

The substance found is Polonium-210. The Chief Medical Officer, Professor Sir Liam Donaldson, is issuing advice to GPs and hospitals on the risks and clinical implications of exposure to Polonium-210.

We want to reassure the public that the risk of having been exposed to this substance remains low. It can only represent a radiation hazard if it is taken into the body - by breathing it in, by taking it into the mouth, or if it gets into a wound. It is **not** a radiological hazard as long as it remains outside the body. Most traces of it can be eliminated through handwashing, or washing machine and dishwasher cycles.

The Agency is also investigating the clinical areas of the two hospitals where Mr Litvinenko was treated.

The police investigation continues. We will provide further public information as appropriate.

If you are an overseas visitor and were in any of the above places on the dates listed you should email the Health Protection Agency for advice: [overseasadvice@hpa.org.uk](mailto:overseasadvice@hpa.org.uk). If you do not have access to email you can contact NHS Direct on 0845 4647 but only via a mobile telephone.

- What information did exposed members of the public find helpful?
- How worried were the general public?  
And what helped to reassure them?



**Qualitative Interviews with Members of the Public  
from  
Itsu or the Millennium Hotel**



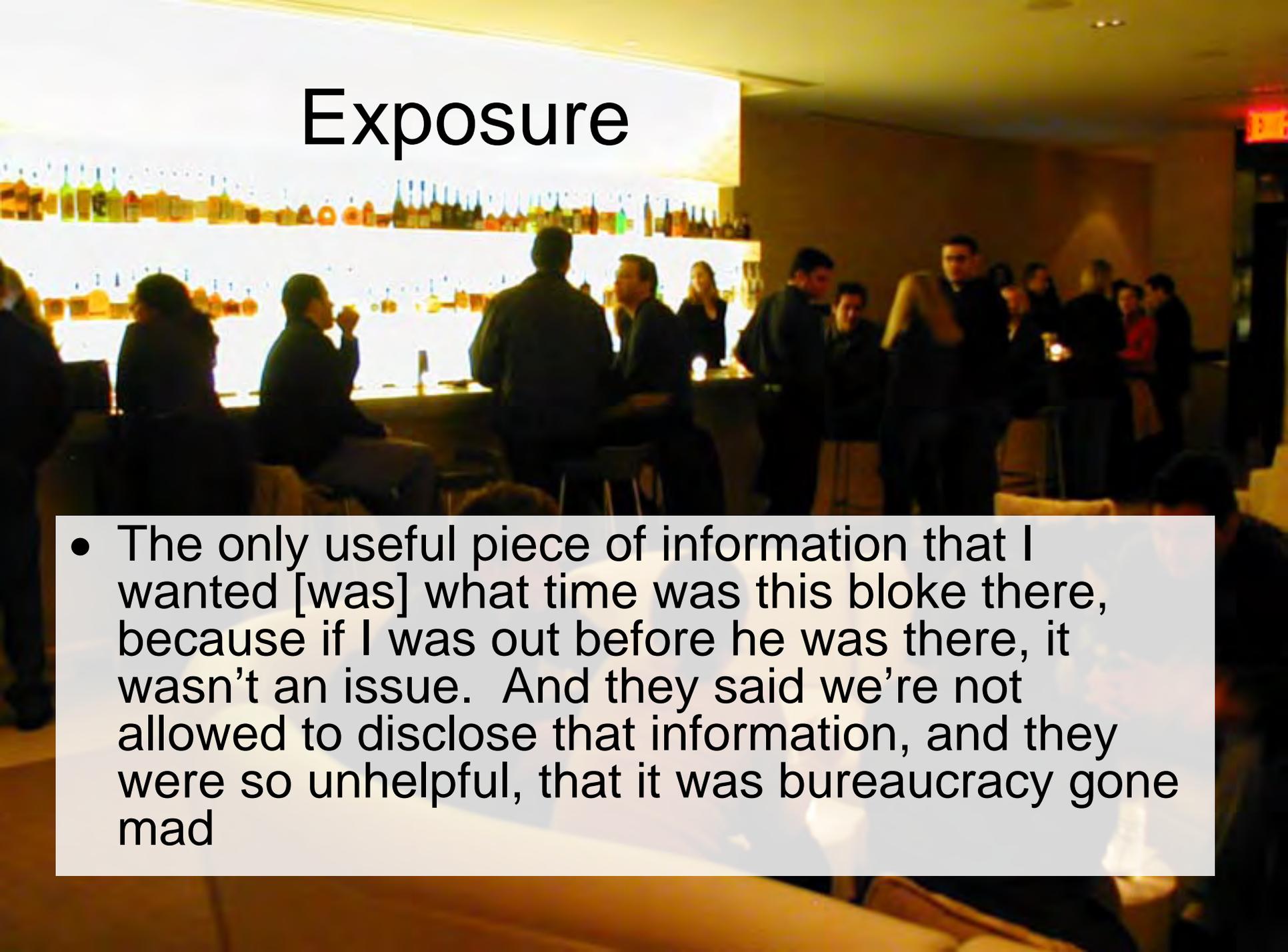
# Generally positive responses

- Three [people called me back], three separate calls [...] It was fantastic.
- We all have dealings with the NHS one way or another, there's different stories, but this has been very good.

# Information, not 'reassurance'

- All they said was platitudes which were effectively meant to reassure, how reassuring they were I'm not sure.
- It seems that in a situation like this that if someone says don't worry it is a very low risk that something happens to you, that actually doesn't make me feel more comfortable.
- I didn't feel that the advice they gave me was focussed on my well-being so much as on making sure I didn't panic.

# Exposure



- The only useful piece of information that I wanted [was] what time was this bloke there, because if I was out before he was there, it wasn't an issue. And they said we're not allowed to disclose that information, and they were so unhelpful, that it was bureaucracy gone mad

# Symptoms

I wasn't overly worried myself because, to be quite blunt, the guy was dead. I would have been majorly ill myself if I'd been severely caught out by it.

A photograph of a man lying in a hospital bed. He is wearing a light green hospital gown. His eyes are closed, and he has a neutral expression. Several medical sensors or electrodes are attached to his chest with adhesive tape. The background shows a window with a view of trees outside.

I just needed to know that I didn't fall into a particular health bracket. If I was answering yes to [the symptom questions] then I would have been very, very worried. The fact I said no on most of them did reassure me.

# Urine results

- Well the test results came back normal, although there's no indication of what normal is....I've really got to take their word for it, haven't I? That's not overly reassuring I've got to say.
- What is 'of no concern'? It would have been nicer to know what the Polonium amount was
- It would have been great from my point of view, had it said your Polonium 210 level is this, and they don't, they just tell you that you've 'no cause for concern.'



## Key Functions

[Infectious Diseases](#)  
[Chemicals & Poisons](#)  
[Radiation](#)  
[Emergency Response](#)  
[Business Activities](#)  
[Local & Regional Services](#)

Last updated on 15 March 2007

**What is polonium 210?**

Polonium-210 (Po-210) is a radioactive material. It occurs naturally and is present in the environment and in people at very low concentrations. It can also be made by irradiation of other materials. Polonium-210 has a half-life of 138 days. It undergoes decay by emitting alpha particles, accompanied by very low intensity gamma rays.

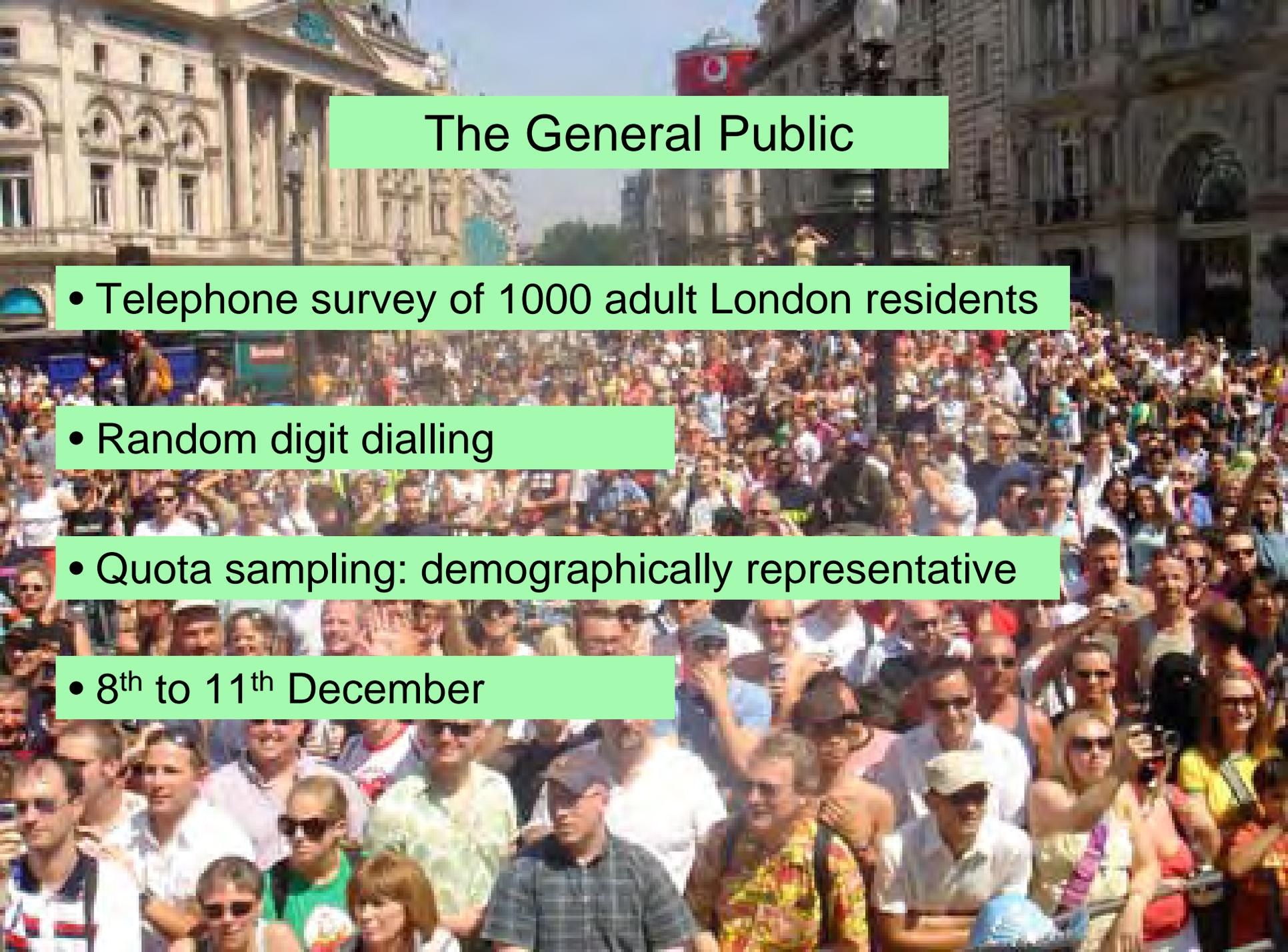
Alpha particles do not travel very far – no more than a few centimetres in air. They are stopped by a sheet of paper or by the dead layer of outer skin on our bodies.

Polonium-210 is used industrially, for example in anti-static devices in factories.

Because polonium-210 is a naturally occurring radionuclide, we all have a very small amount in our bodies. This contributes to the natural radiation dose we all get every year.

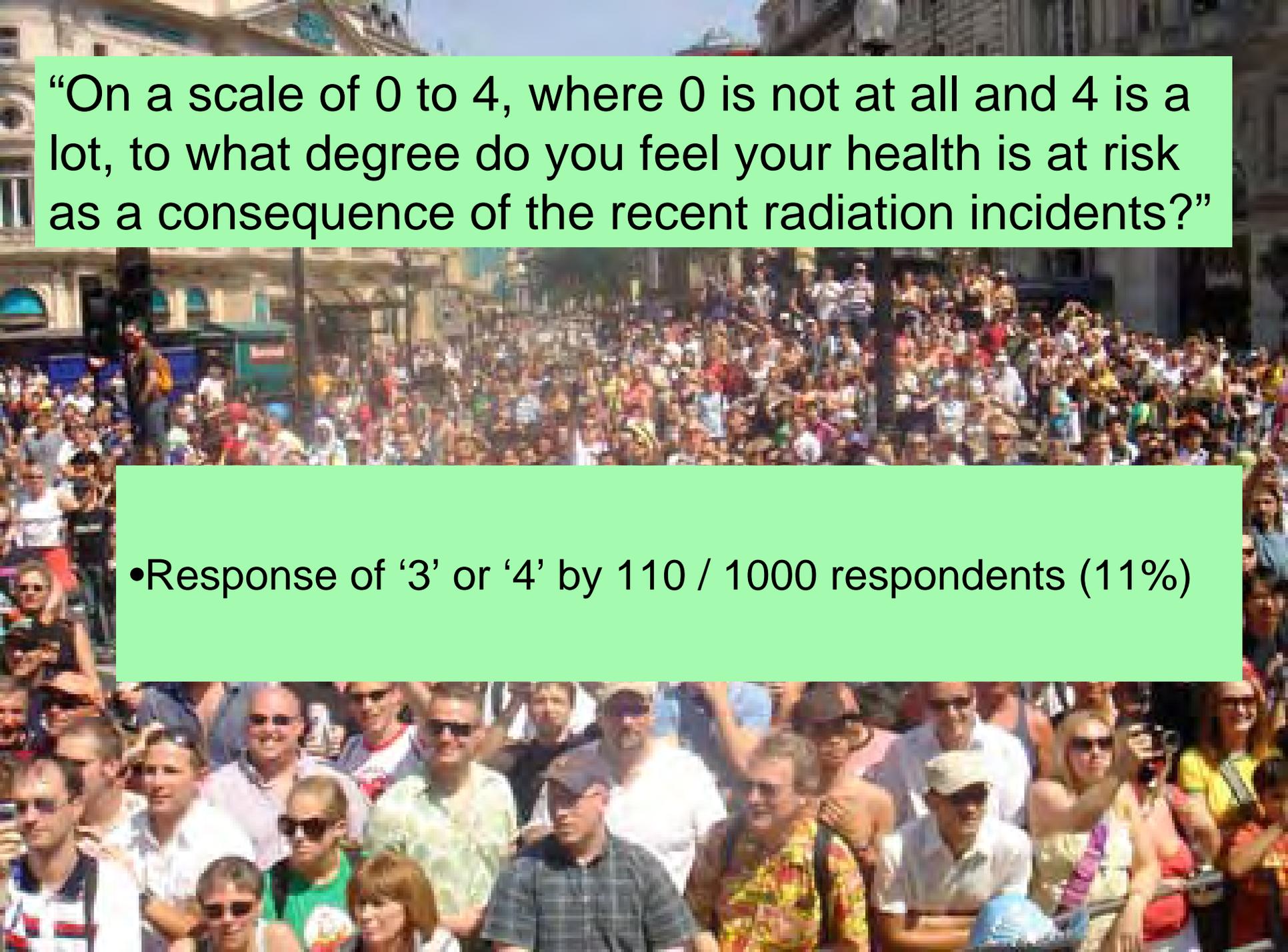
- [FAQs about public health issues related to the Polonium-210 incident](#)
- [Advice to relatives, friends, co-workers and those who have been in close contact with people who have received positive test results](#)
- [Monitoring for Polonium-210](#) (22kB)
- [Measurement of Polonium-210 in urine](#) (16kB)
- [Assessment of doses from measurements of polonium-210 in urine](#) (105 kB)

- **General Information**
- [How can Polonium-210 biologically harm people?](#)
- [Information for overseas visitors in relation to the Polonium-210 incident](#)
- [FAQ - Public health issues related to Polonium-210](#)
- [Advice to those who have been in close contact with people who have received positive test results](#)



## The General Public

- Telephone survey of 1000 adult London residents
- Random digit dialling
- Quota sampling: demographically representative
- 8<sup>th</sup> to 11<sup>th</sup> December



“On a scale of 0 to 4, where 0 is not at all and 4 is a lot, to what degree do you feel your health is at risk as a consequence of the recent radiation incidents?”

- Response of ‘3’ or ‘4’ by 110 / 1000 respondents (11%)

Question	<i>(% Correct)</i>	Adjusted odds ratio
Polonium 210 occurs naturally in the environment	<i>(27%)</i>	1.3 (0.8 to 2.1)
Exposure to polonium 210 is always fatal	<i>(58%)</i>	1.6 (0.9 to 2.3)
Polonium 210 is usually only dangerous if it enters your body, for example if you eat it	<i>(58%)</i>	1.6 (1.0 to 2.5)
If polonium 210 gets onto your clothes, it can be removed using a normal washing machine	<i>(15%)</i>	1.3 (0.7 to 2.6)
Most people exposed to polonium 210 will start to feel ill within a few days	<i>(26%)</i>	1.7 (0.9 to 3.0)
The main health effects of polonium can take many years to develop	<i>(39%)</i>	1.1 (0.7 to 1.8)
It only takes a few minutes for scientists to test if you have been exposed to polonium 210	<i>(37%)</i>	1.3 (0.8 to 2.1)
There are medicines available which can prevent people exposed to polonium 210 from becoming ill	<i>(59%)</i>	1.1 (0.7 to 1.6)
If you have not been in one of the areas known to be contaminated with polonium 210, then there is no risk to your health	<i>(71%)</i>	3.2 (2.1 to 5.1)

- It's daft really. You do really think about the James Bond spin on it all
- It just reminded me of an episode of Spooks put it that way.
- playing Mission Impossible in central London
- I would describe it a bit like 24, the TV series.

Which of these phrases best describes recent events:	Adjusted odds ratio
Terrorism (15%)	2.7 (1.5 to 4.6)
A public health threat (17%)	1.9 (1.1 to 3.4)
Crime, espionage or spying (68%)	Reference

Which of these phrases best describes recent events:	Adjusted odds ratio
An incident intended to harm the general public (14%)	5.9 (3.2 to 10.9)
An incident intended to harm a small number of specific people (40%)	1.6 (0.9 to 2.8)
An incident intended to harm only a single person (46%)	Reference

# Implications

*For exposed groups*

- 1. Offer information, not reassurance.*
- 2. Individually tailored information, if possible.*
- 3. Explain what tests are for, and what the results mean!*
- 4. Constantly up-dated info is important.*

# Implications

*For the general public*

- 1. Motives matter – a dirty bomb will elicit different responses.*
- 2. Telling the public where is not at risk is important.*



**KING'S**  
*College*  
**LONDON**

University of London

- Mike Catchpole
- Helen Maguire
- Oliver Morgan
- John Simpson
- Stephani Hatch
- Lisa Page
- Richard Pinder
- Paul Riley
- James Rubin
- Simon Wessely

# American Attitudes about Terrorism and Other Threats:

## *What Can Be Learned from Rapid Emergency Polls of the Public*

Gillian K. SteelFisher, PhD, MSc  
Harvard School of Public Health

*Funded as part of cooperative agreements between HSPH/the National Preparedness Leadership Institute and the Centers for Disease Control (CDC) and also between HSPH/the National Public Health Information Coalition (NPHIC)/HSPH and the CDC.*

# Rapid Emergency Polling

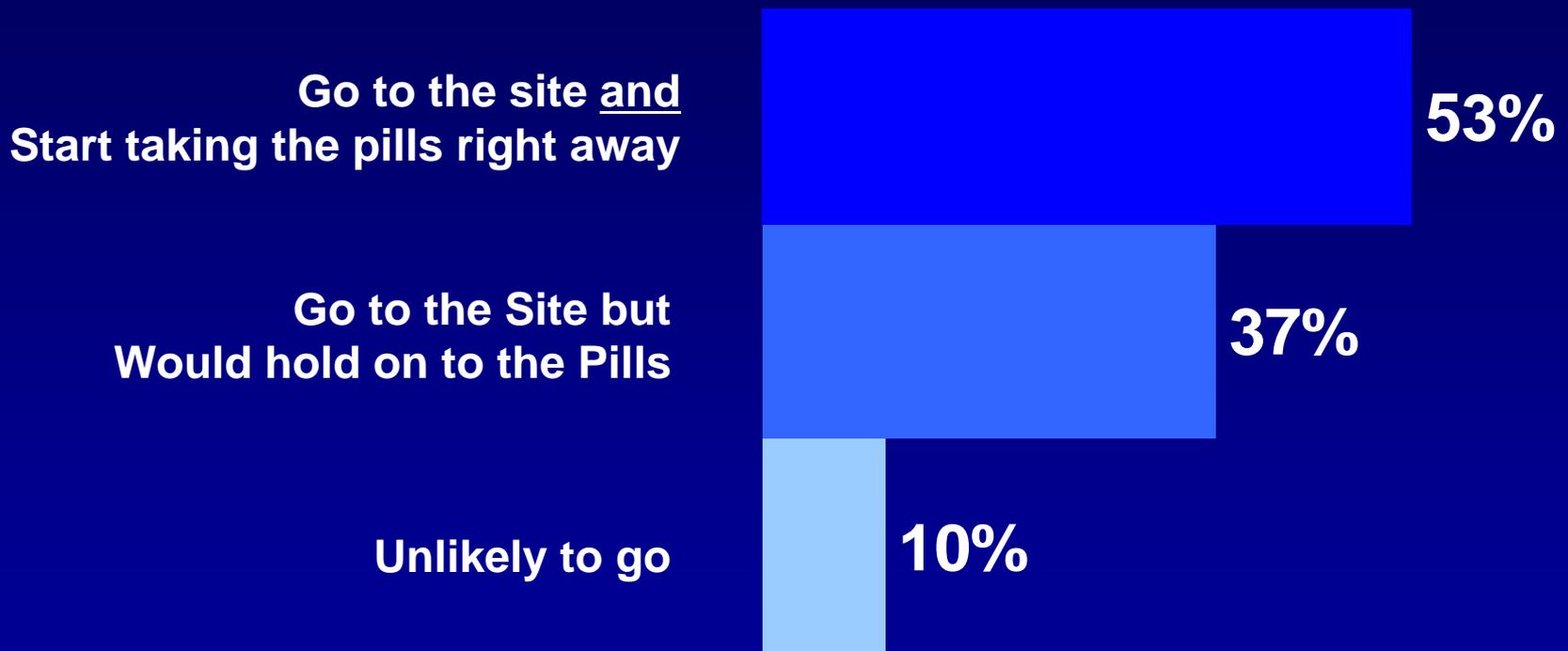
- Technology transfer from politics
- Support communications and material response in an emergency
- Telephone polls of ~1000 people using randomized samples
- Conducted at baseline, mid-crisis and aftermath points
- Advantages:
  - Immediacy – Minimizes recall biases
  - Turnaround time – Use in current efforts
- Aim to understand:
  - Public knowledge and concern about threat
  - Public response to date and views of future recommendations
  - Public information-seeking behavior

# Tension Between Public and Experts In an Emergency

- Officials and others want to help public take actions to protect themselves
  - Information
  - Material support
- Public actions can conflict with expert advice
  - H1N1 Case Study
  - Anthrax Attack Scenario

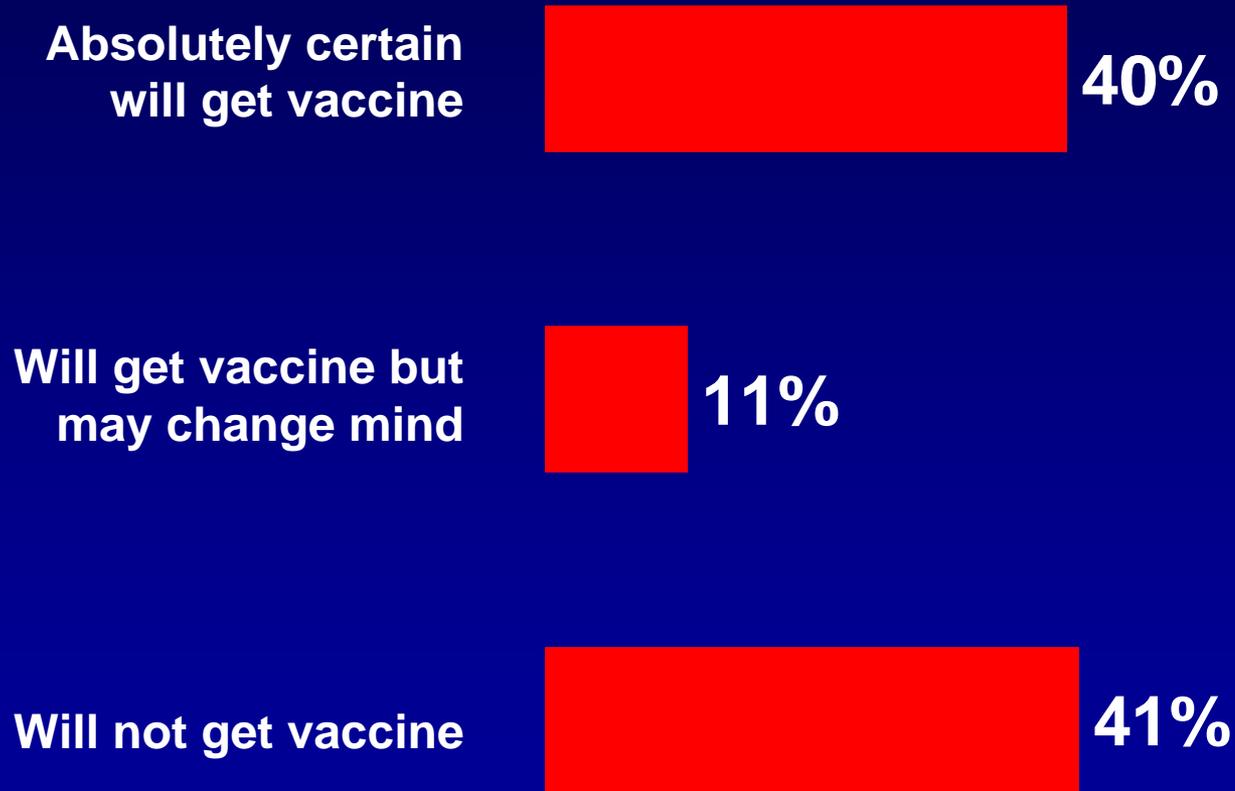
# Public Views on Whether They Follow Full Recommendations: Go to Site and Start Taking Pills Right Away

% of adults saying they would be most likely to...



# Intent to Get H1N1 Vaccine

% of adults saying...



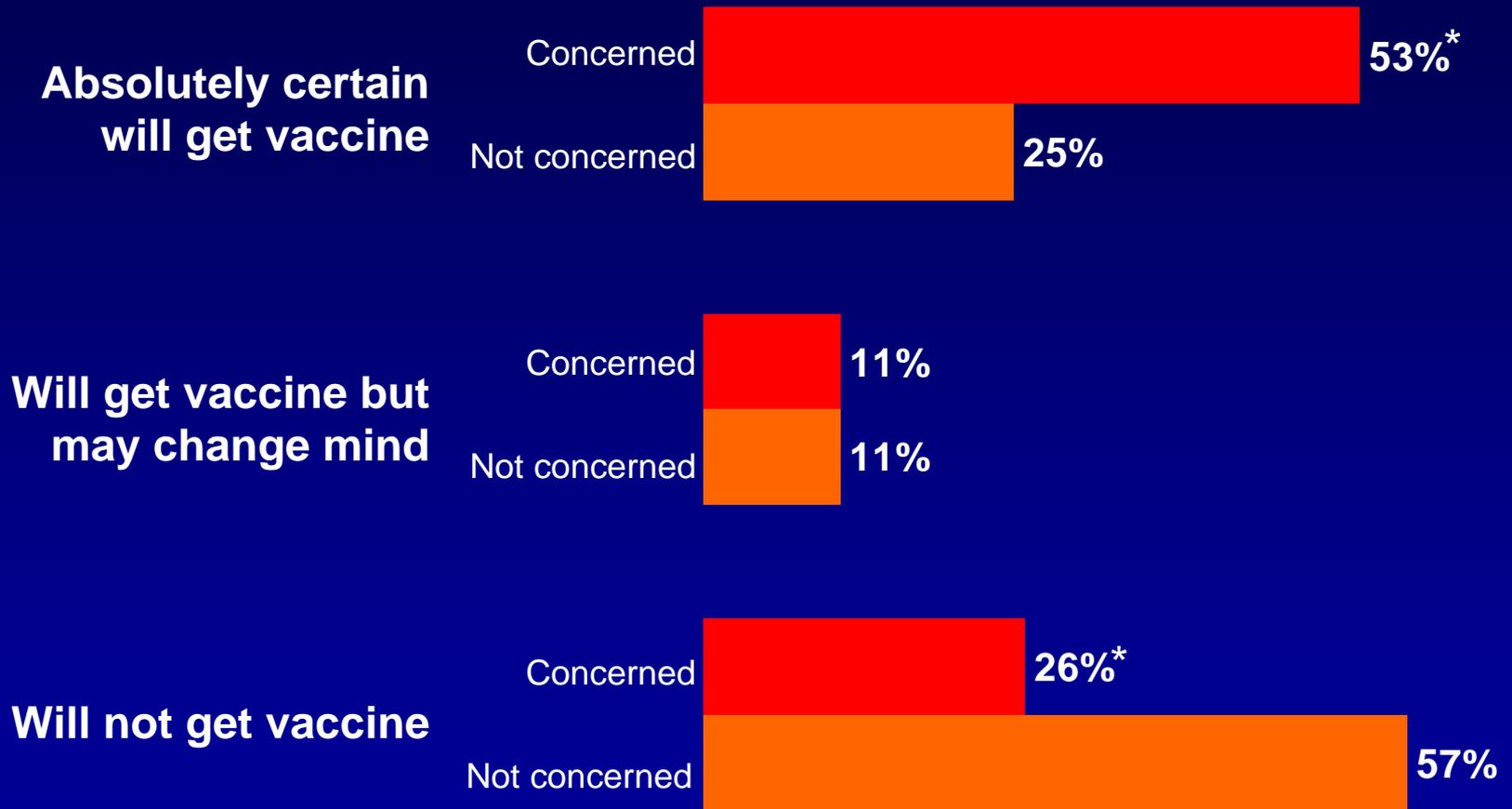
# Understanding Public Response

## Actions May Seem Counterintuitive, Unless You Understand that...

- The public doesn't respond to major disaster risks unless they feel personally threatened. They do not like to think about potential negative consequences.
- If they feel threatened, people generally act rationally, to protect themselves and their family, based on their perceptions of the situation.
- People act based on information or knowledge that they have, even if it is incorrect.
- People follow advice from trusted sources.

Concern about Threat Prompts Action

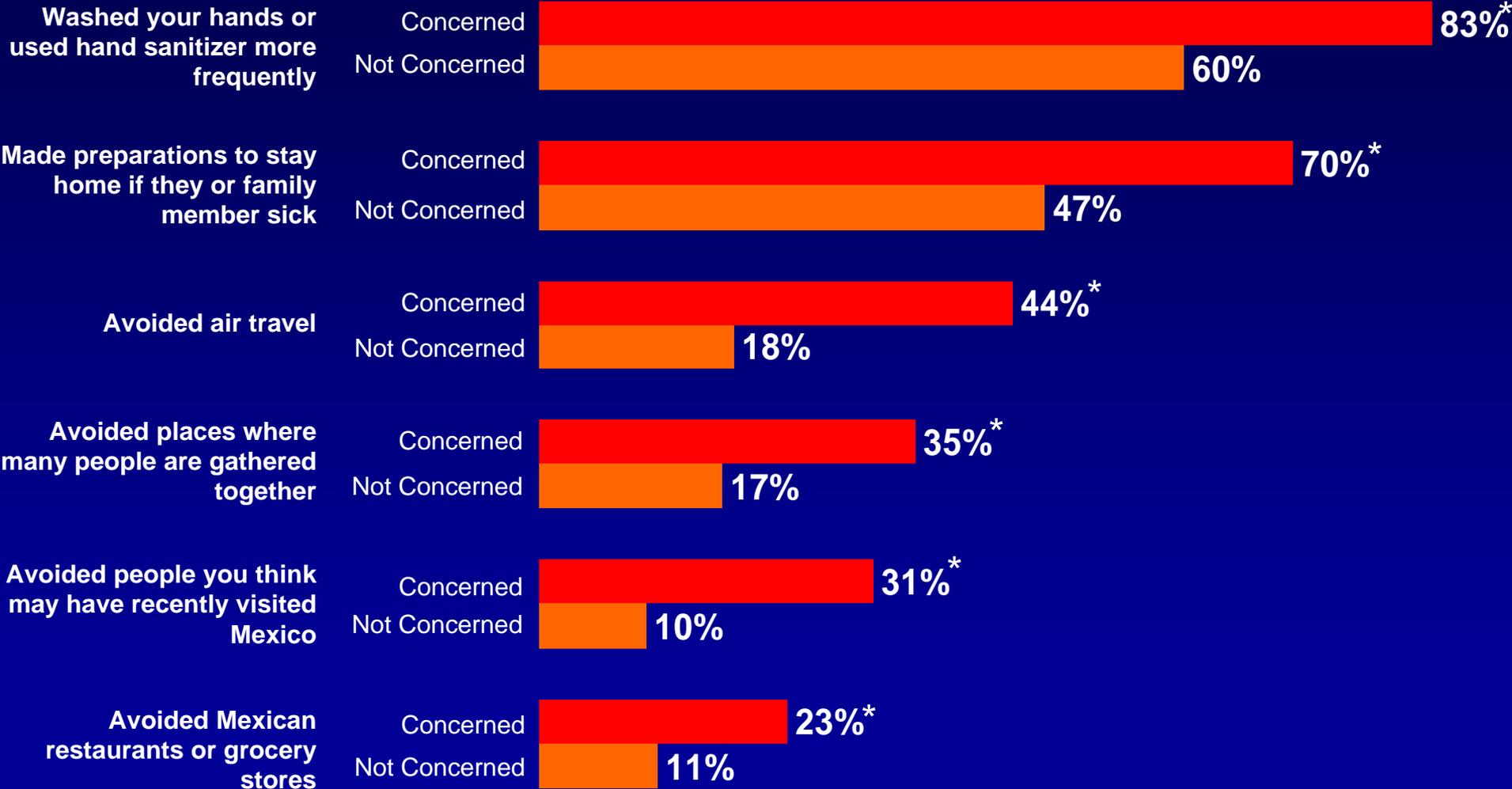
# Americans Who Say they Will Get the H1N1 Flu Vaccine: By Concern Level



\*Statistically significantly different from responses of those who say they are "not concerned" that they or someone in their immediate family may get sick from H1N1 during the next 12 months

# Steps Americans Have Taken in Response to Outbreak: By Concern Level

% of adults saying



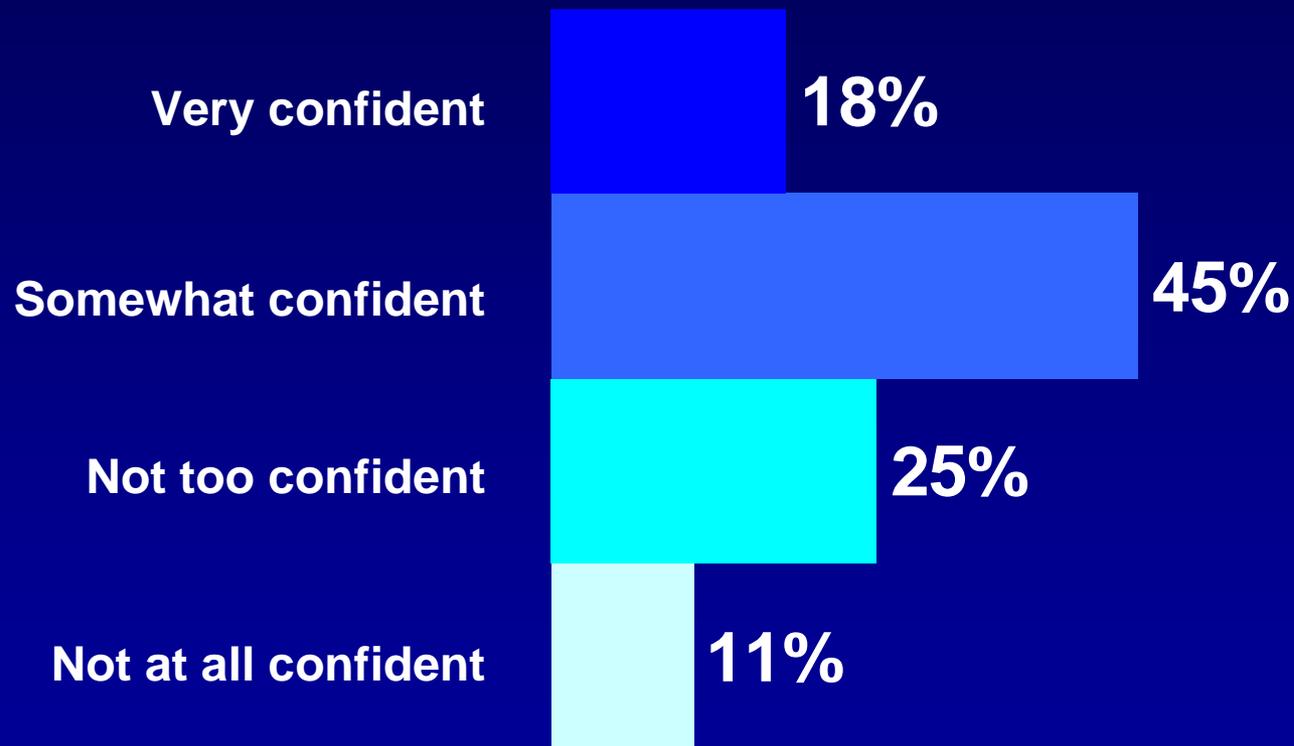
\*Statistically significantly different from responses of those who say they are "not concerned" that they or someone in their immediate family may get sick from H1N1 or swine flu during the next 12 months at the 95% confidence level

Harvard Opinion Research Program, Harvard School of Public Health, May 5-6, 2009.

# Trust & Confidence in Government Impacts Compliance

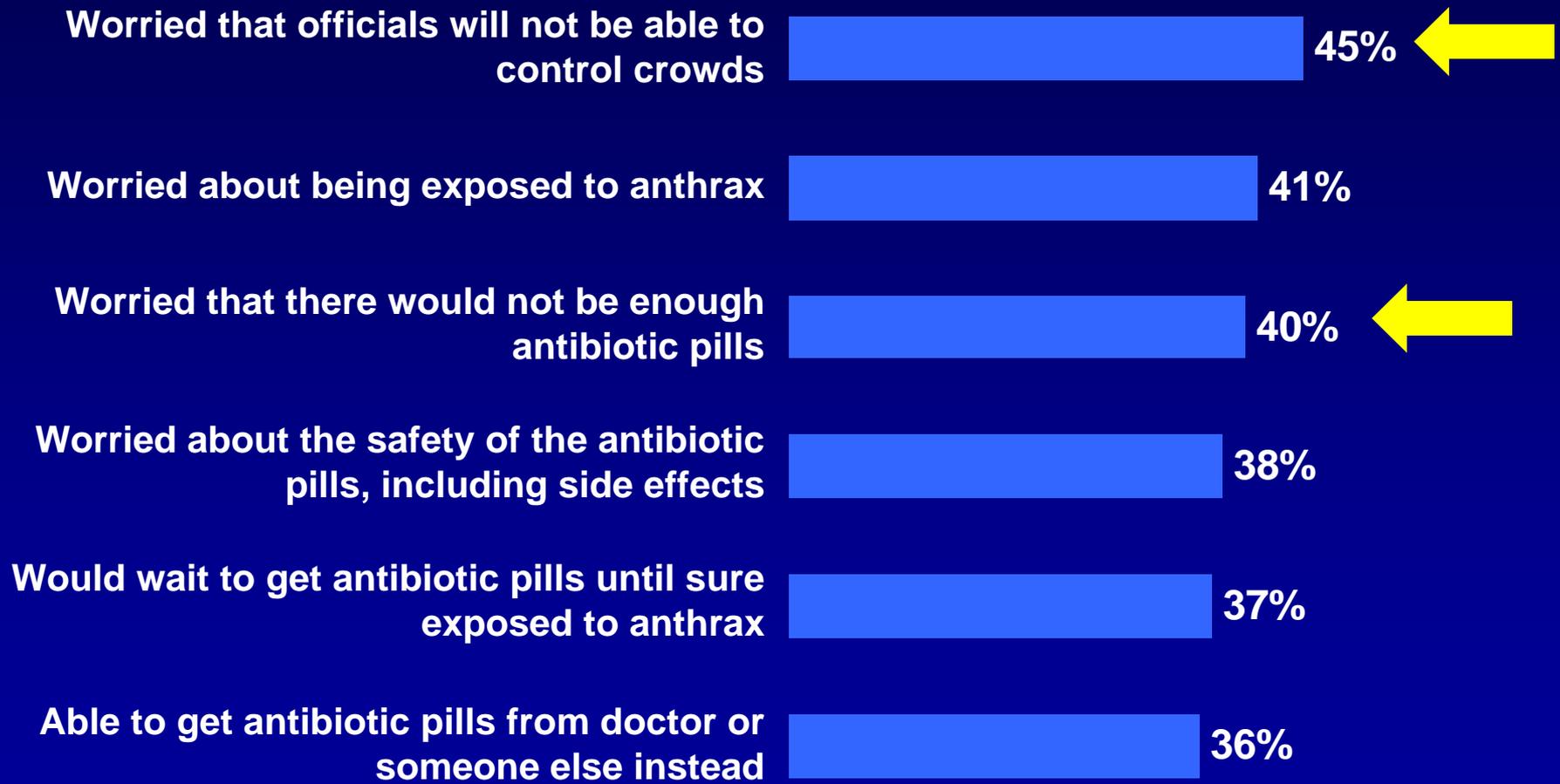
# Public Confidence that the Government has a Sufficient Supply of Antibiotic Pills

% of adults saying...



# Reasons People are Unlikely or Only Somewhat Likely to Go to Dispensing Site within 48 hours to Get Antibiotics

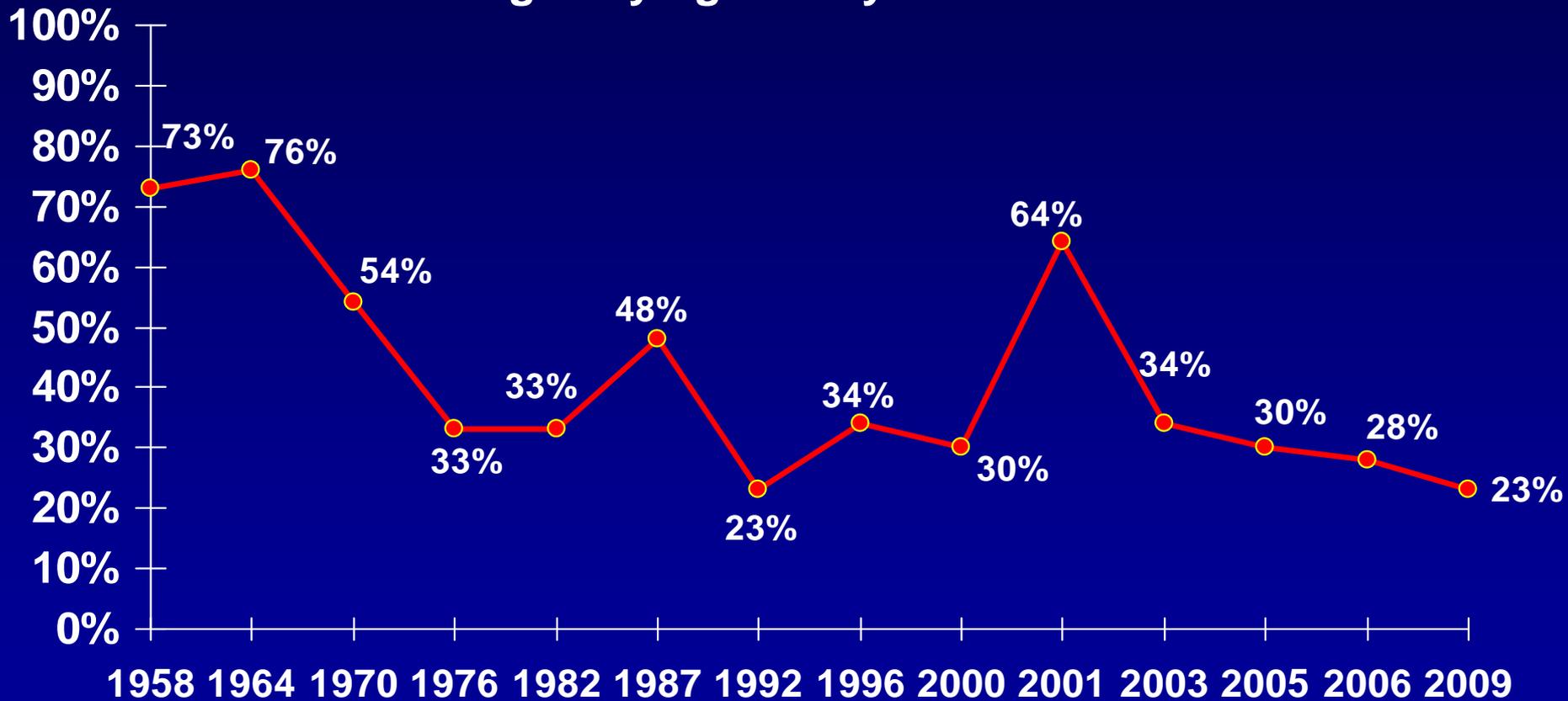
% of adults who are unlikely or only somewhat likely to go\* saying “major reason” ...



\*Among adults who would be unlikely or only somewhat likely to go to a dispensing site within 48 hours in order to get antibiotic pills for themselves or their children (n=355)

# Trust in the Federal Government to Do What Is Right

## Percentage Saying “Always/Most of Time”

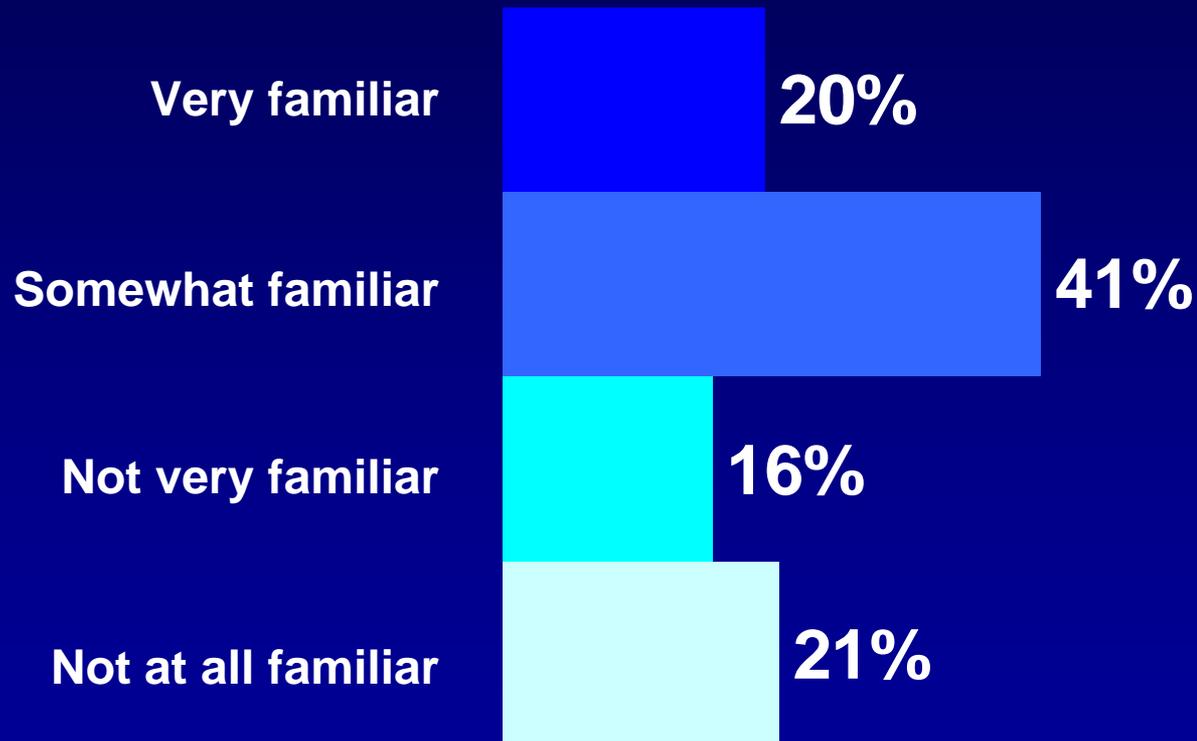


*Trends from 1985 to 2003 are from ABC News/Washington Post and NPR/Kaiser/KSG surveys 2000-2003. Trends from 1982 and previous years from Michigan-American National Election Study. 2005 data from CNN/Gallup/USA Today. 2006 and 2008 data from CBS News/NY Times.*

# Information Believed as Fact Impacts Compliance

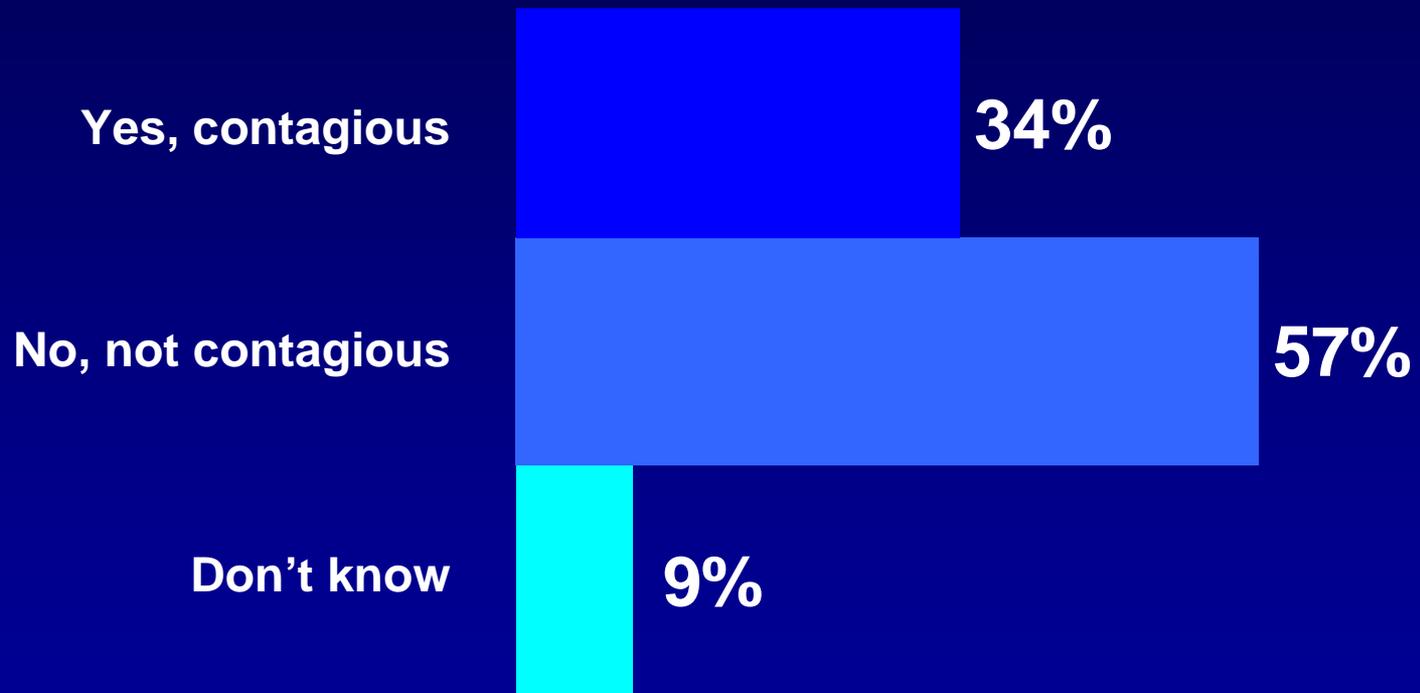
# Public Familiarity with the Term “Inhalation Anthrax”

% of adults saying...



# Mistaken Belief that Inhalation Anthrax is Contagious

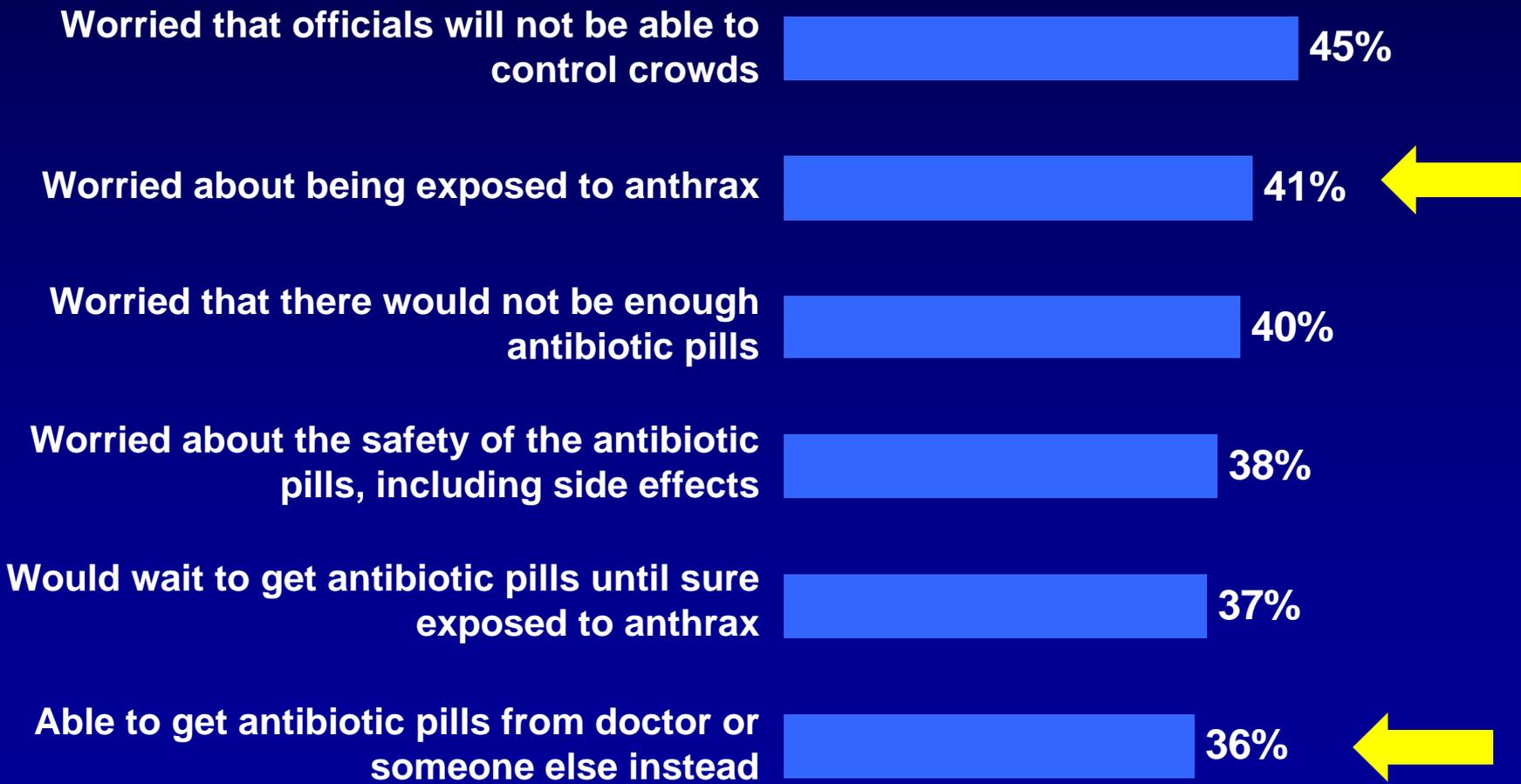
% of adults who are familiar with “inhalation anthrax” saying...



\*Among adults who are “very” or “somewhat familiar” with the term “inhalation anthrax” (n = 692)

# Reasons People are Unlikely or Only Somewhat Likely to Go to Dispensing Site within 48 hours to Get Antibiotics

% of adults who are unlikely or only somewhat likely to go\* saying “major reason” ...



\*Among adults who would be unlikely or only somewhat likely to go to a dispensing site within 48 hours in order to get antibiotic pills for themselves or their children (n=355)

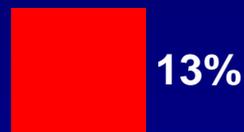
# Parents of Children 6 Months or Older: Intent to Get H1N1 Vaccine for their Children

**% Among Parents of Children 6 Months or Older**

**Got H1N1 vaccine  
for their children**



**Intend to get H1N1 vaccine for their  
children by end of Feb 2010**



**Do NOT Intend to get H1N1 vaccine for  
their children by end of Feb 2010**



# Parents of Children 6 Months or Older: Reasons Parents Will Not/Are Not Sure About Trying to Get H1N1 Vaccine for their Children

*% of these parents\* saying "major reason"...*



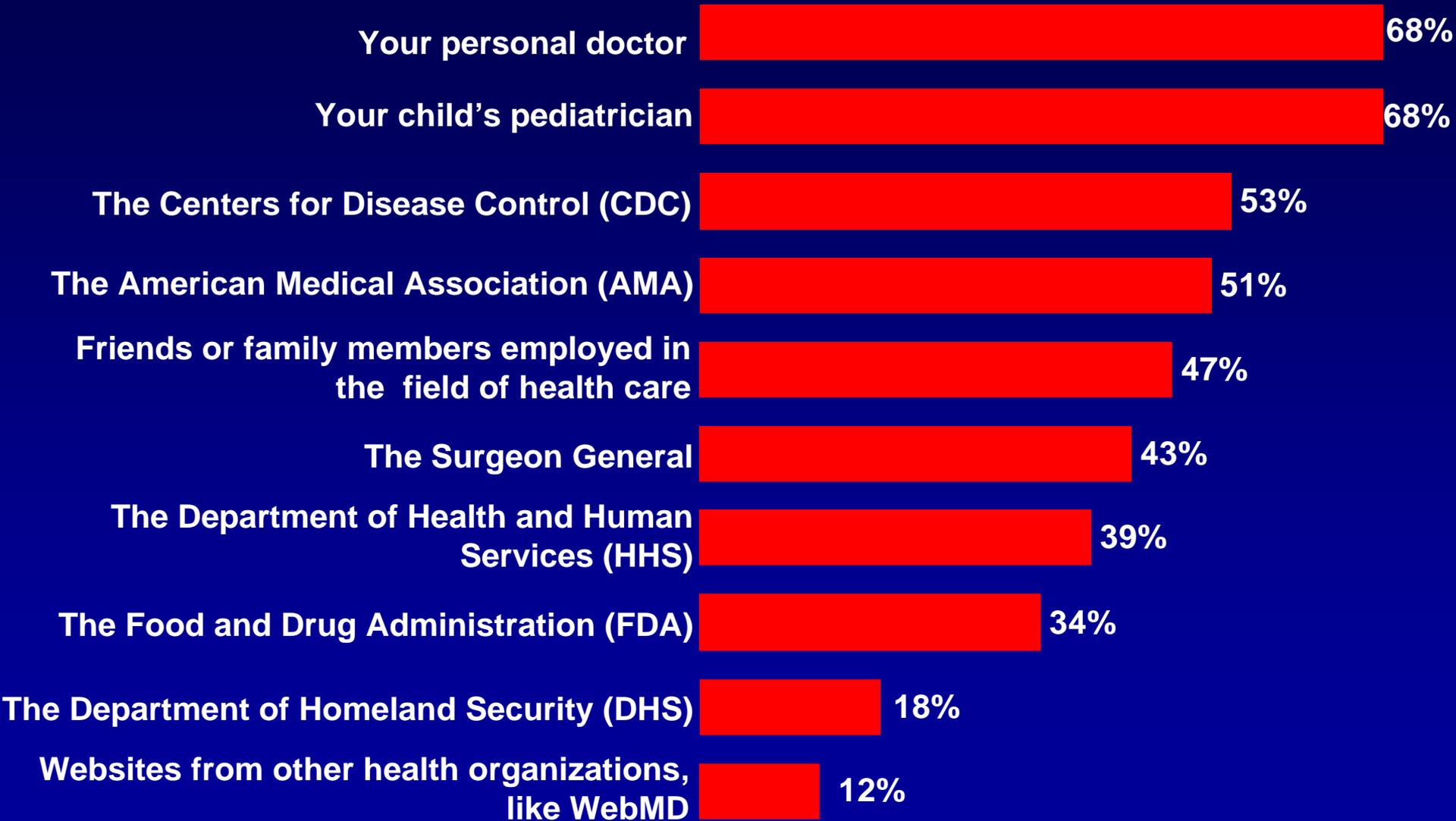
\*Among parents of children 6 months or older who said they will not or are not sure about trying to get the H1N1 vaccine for their children by the end of February 2010

Harvard Opinion Research Program, Harvard School of Public Health, January 20-24, 2010.

Trusted Sources Influence Behavior

# Americans' Trust in Groups Giving Advice about H1N1 Vaccine

*% saying trust a great deal*



# Applications to Radiological/Nuclear Emergencies

# Planning for and Responding to Radiological/Nuclear Emergencies

- **Baseline assessment**
- **In an emergency – real-time data**

# Information Officials Will Need About Public Response

- **What does the public believe they know?**
  - About the issue
  - About who is at risk
  - About the safety of treatment or precautions
- **What does the public think of advice for self protection?**
  - Is it consistent with their beliefs and experiences?
  - What information do they think they need?
- **What are their experiences?**
  - What are they doing to protect themselves?
  - What problems are they experiencing?
- **Where is the public going to turn for information?**
  - What sources of information do they think are most relevant?
  - Which spokespeople or agencies are most trustworthy?

# Risk Communication with Vulnerable Populations: Best Practices

Deborah Glik

UCLA School of Public Health



# Introduction

- Vulnerable populations are groups that are not well integrated into the health care system because of ethnic, cultural, economic, geographic, or health characteristics. (Urban Institute, 2009) \*
- Vulnerable populations include:
  - Racial and Ethnic minorities
  - The rural and urban poor
  - Undocumented and recent immigrants
  - Non native English speakers
  - Those with disabilities or multiple chronic conditions
  - Isolated elderly
  - Transient populations

\* Available:

[http://www.urban.org/health\\_policy/vulnerable\\_populations/index.cfm](http://www.urban.org/health_policy/vulnerable_populations/index.cfm)



# Background on Literacy

- Many members of vulnerable populations have low literacy
  - Literacy is defined as the ability / skill / competency to understand ( decode ) text based materials.
  - Low Literacy in US (Health Activity Literacy Survey, 2003)
    - 7 % barely functional
    - 19 % low levels of literacy ( 1's)
    - 27% mediocre levels ( 2's)
- 46 % of US adults have low literacy



# Background on literacy

- 5,000,000 adults in Ca ( approximately 22%) speak a language other than English in their home
- 2,000,000 native English speakers in California are functionally illiterate
  - <http://www.caliteracy.org/resourcesreferrals/literacystatistics/index.html>



# Background on literacy

- This is just verbal and numeracy literacy
- Other types of literacy include, science, technology, health, computer
- Causes of low literacy
  - Low educational levels
  - Language and cultural barriers (ESL)
  - Cognitive deficits
  - Aging
- In health communication these populations considered hard to reach



# Basic Principles

- Aim for two grade levels below target audience literacy level :
  - e.g. if primary school education level then aim for 3rd to 5th grade readability level
- Give readers the most important points first and last
  - Tell them what to do, tell them why, repeat the what
- Group information into chunks
- Give an action step to do immediately



# Basic principles

- Sequence steps based on how audience will use the information
- Separate information into:
  - what audience needs to know
  - wants to know
  - is concerned about
- Generally this translates into messages about personal survival, exposure, treatment and prevention.
- Visuals must be meaningful, captioned



# Basic Principles

- In a crisis presume stress in audience and use low literacy principles for communication
- Active learning important
- Drill = practice what is learned
- Adult education premise = learn-drill-learn
- Instruction is directly linked to application and then followed up with discussion for reinforcement



# Example: H1N1 Messaging

- What were the 4 main H1N1 messages from last year's outbreak ?
- Wash hands
- Cover nose and mouth when coughing or sneezing
- Stay home when sick
- Get vaccinated
- What do we notice about these messages?



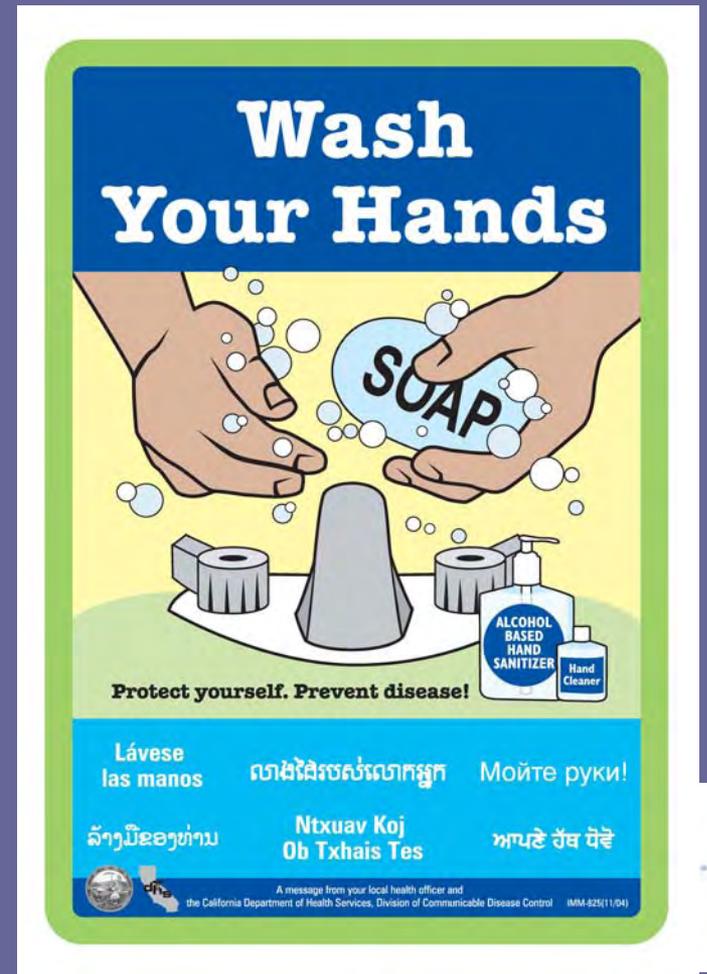
# Case study example #1 – California multi-jurisdictional training (CMJT- 2004)

- Problem : many local health departments (LHDs) lack resources to do effective outreach with vulnerable populations in a crisis
- Organizations that serve these populations, local media, or alternative outlets more effective in reaching vulnerable populations (a narrowcast approach) than broadcast media
- Premise : to do effective outreach effort with CBO and FBO partners in a crisis, need to already have established working relationship with them



# Case study #1: CMJT materials distribution drill

- Developed community partners lists
- Trained local health department (LHD) staff to create MOUs, a distribution plan, means to reach people quickly through CBOs/FBOs in a hypothetical crisis that has health implications
- Created and distributed cling on materials
- One day distribution through community partnerships January 2004
- Mobilize volunteers to help distribute
- Businesses, schools, clinics, transportation depots, small mom and pop stores, public access venues, malls were all places where fliers were distributed successfully



# Case study # 1 : CMJT – evaluation

- Emphasis on process tracking forms
- Partner org- contact person
- Number of materials received and not received
- Number of materials distributed and not distributed
- Locations where materials were distributed-
  - How many materials distributed to location
  - Describe where posted
- Describe who distributed the materials for the organization
- **OUTCOME:** in those jurisdictions with pre- established relationships distribution better



# Case study # 1 : CMJT

- Exemplifies the basic risk and health communication principles :
- *Go where the people are*
- Use culturally competent media and that includes distribution channels
- Do not assume vulnerable people are listening to or reading broadcast media
- Do not assume vulnerable people are comprehending what they hear
- Learn – drill – learn (and this includes professionals) :  
learn about a narrowcast approach, do it and document it in drill , debrief about experience



# Case study #2 – LA PREP ( 2006- 2007)

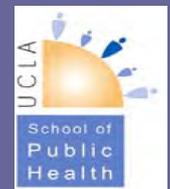
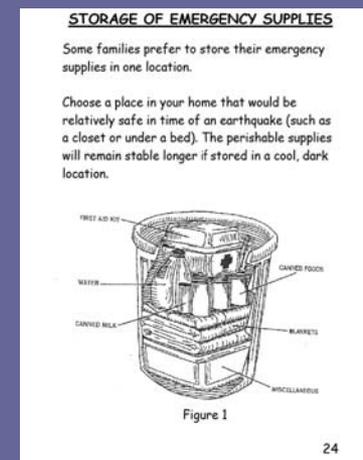
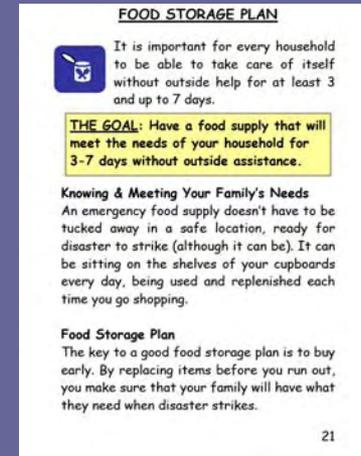
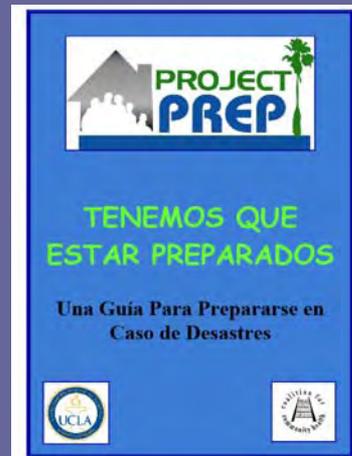
- Problem: Household level disaster preparedness includes having sufficient disaster supplies and a family communication plan.
- Many households remain unprepared.
- LA Prep : small scale community based intervention among low income recent immigrant Latino families in Los Angeles County
- Outcomes desired among study households :
  - increase household disaster supplies
  - have a worked out communication plan
- Implementation – compare face to face education with media only group.



# Case study #2 – LA PREP

- Media group (n =100)
- Culturally tailored booklet
- Laminated shopping card
- Perforated preprinted communication cards

- Booklet examples



# Case study #2 – LA PREP

- Platicas group (n =87)
- Media materials
- Face to face
- meetings
- Promotora led

- Example of communication card
- Front

**TARJETA FAMILIAR DE COMUNICACIÓN**

Esta tarjeta pertenece a: Luis Miguel

NOMBRE	TELEFONO
1) <u>Mama-trabajo</u>	<u>( 323 ) 123-4567</u>
2) <u>Papa-trabajo</u>	<u>( 323 ) 123-4568</u>
3) <u>Carlos Lopez-casa</u>	<u>( 714 ) 987-6543</u>
4) <u>Tia Maria en MX</u>	<u>( 011 ) 52-686-577-1600</u>
5) <u>Gloria Trevi en MX</u>	<u>( 011 ) 52-686-123-4567</u>

- Back

**Donde Encontrarse en Caso de un Desastre**

Entre Lunes –Viernes en el día:  
1er) frente de Victor School 2do) frente de St James Ch.

Entre Lunes –Viernes en la noche:  
1er) frente de la casa 2do) frente de casa de Juan

En el fin de semana en el día:  
1er) frente de la casa 2do) frente de St James Ch.

En el fin de semana en la noche:  
1er) frente de la casa 2do) frente de casa de Maria



# Case study #2 – LA PREP

## Results :

- Both *promotora* led and media groups increased disaster supplies significantly from baseline to 3 month follow-up especially food and water ( $p < .001$ )
- The *promotora* led group had significantly more members with completed communication plan ( $p < .001$ ) at follow-up

## Conclusions:

- 1) targeted interventions work
- 2) for more complex communication plan, small group intervention superior
- 3) for disaster supplies media were sufficient.



# Case study #2 – LA PREP

- Basic principle for changing behavior in lower risk situation ( i.e. for preparedness)
  - Mass media is fine for awareness change and simple behavior change
  - For complex behavior change, must have some interpersonal interaction
- Also exemplifies adult learning principles  
Learn > drill > learn as group classes emphasized individual practice (filling out forms)



# Case Study #3 – Great Southern California Shakeout ( 2008)

- At 10 AM on an October morning 2008 a simulated earthquake crisis was broadcast and a regional earthquake drill conducted in Southern California
- People registered on line and were encouraged to drop, cover and hold for 60 seconds
- Three months of publicity prior to drill used web based, journalistic, television, email and interpersonal and organizational media



# Case Study #3 – Great Southern California Shakeout : Key Findings

- Data collected through online survey of selected registrants November - December 2008 (N= 2478, 25% response rate)
- 79% of those signed up for drill reported participating
- Participants who physically participated more likely to have practiced other aspects of their disaster plan
- Drill participants were 3 X more likely than non-participants to have attended a meeting about earthquake preparedness in their workplace or school (39% vs 12%).



# Case Study #3 – Great Southern California Shakeout : Key Findings

- But only 22% of people who signed up for the Drill were able to recall the key message – “Drop, Cover and Hold On” – without a prompt.
- 75% of those who signed up were white, compared to 42% in Southern California.
- Hispanics were vastly underrepresented (15% vs 39%), as well as Asian-Americans (7% vs 12%) and African-Americans (3% vs 7%).



# Case Study #3 – Great Southern California Shakeout

- Exemplified behavioral rehearsal
- Large scale drills are valuable learning tools for preparedness and response
- Used mass and interpersonal networks, however the latter were mainly professional and organizational
- Thus while very successful for a first time effort, as we predicted media used did not reach vulnerable or low literacy populations



# Case Study #3 – Great Southern California Shakeout

## Survey Participants by Zip Code



# Risk Communication with Vulnerable Populations: Conclusions

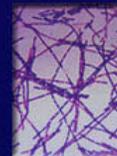
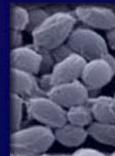
- To reach vulnerable populations:
  - Messages need to be simple and actionable
  - Media need to be local
  - Interpersonal communication important for complex behaviors
  - Drills are important but recruitment of vulnerable populations a problem
  - Basic messages stressed are about survival, prevention, exposure and treatment
  - Drills and interventions – evaluation is important
- Media platforms are changing : even among vulnerable populations we are moving to web based, digital and social media
- Must be aware of audience resistance: simple messages go a long way to helping overcome that.
- Whatever media platform, basic messaging and outreach principles relevant



# **Federal Interagency Communication Strategies for Addressing Radiation Emergencies and Other Public Health Crises**

**Charles W. Miller, PhD  
M. Carol McCurley**

***Radiation Studies Branch  
Division of Environmental Hazards & Health Effects  
National Center for Environmental Health  
Centers for Disease Control & Prevention  
Atlanta, Georgia***



# Throughout any public health emergency...

communication will be a key component of everything that is done. Public health officials will need to be able to communicate with...

- the public
- first responders/first receivers
- policy makers
- the media

# **“Communication Strategies for Addressing Radiation Emergencies and Other Public Health Crises”**

- **Roundtable held in Atlanta, Georgia, January 28-29, 2009**
- **Multiple Federal agencies participated**
  - **Department of Homeland Security**
  - **Federal Emergency Management Agency**
  - **Homeland Security Institute**
  - **Environmental Protection Agency**
  - **U.S. Department of Agriculture**
  - **National Institute of Environmental Health Sciences**
  - **Agency for Toxic Substances and Disease Registry**
  - **Centers for Disease Control & Prevention**

# Goals of the Roundtable

- **Provide a forum where participants could share their roles and responsibilities in communicating to the public in a nuclear or radiological emergency**
- **Identify existing messages and materials**
- **Share communication planning and projects underway**
- **Discuss how agencies can work together for preparedness**

# **Some of the Issues Discussed**

- **Most information is available via the Internet; this can be exclusionary**
- **Need to share information with State, local, and tribal partners**
- **How to communicate with a diverse population; there is no single “general public”**
- **How to educate without scaring people needlessly**
- **Selecting the appropriate spokesperson(s)**

# **Gaps and Challenges Identified**

- **Should pre-event education be a priority?**
- **What types of pre-event education are possible?**
- **How can radiation messages be simplified so the lay public can understand?**
- **Can we achieve cross-agency agreement on messages?**
- **What communication strategies are most effective?**
- **What can and cannot be addressed using an all-hazards approach?**

# **This Roundtable Was Only a Beginning**

- **A formal interagency workgroup was not established**
- **Agencies are working together on multiagency planning documents**
- **Agencies are conducting audience research and other activities to strengthen their messages and messaging strategies**

# THANK YOU

<http://emergency.cdc.gov/radiation>

Radiation Studies Branch, CDC

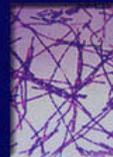
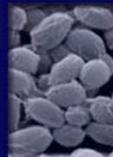
[rsb@cdc.gov](mailto:rsb@cdc.gov)

(770) 488-3800

Charles W. Miller

770-488-3725

[cym3@cdc.gov](mailto:cym3@cdc.gov)



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# Federal Planning for Nuclear and Radiological Terrorism Community Preparedness

Tammy P. Taylor

Office of Science and Technology Policy

Executive Office of the President

NCRP 2010 Annual Meeting

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# Planning Guidance for Response to a Nuclear Detonation

First Edition  
January 16, 2009

Developed by the Homeland Security Council  
Interagency Policy Coordination Subcommittee  
for Preparedness & Response to  
Radiological and Nuclear Threats



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Maximize preservation  
of life

Protect the emergency  
responder

Provide shelter and  
evacuation strategies

Address the impact of  
medical demands and  
management of  
nuclear casualties

Provide radiation dose  
management concepts

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# Response Planning and Community Preparedness

- **MUST** be done on a city-specific basis
  - Should emphasize life-saving priority
-

---

# First Edition Planning Guidance:

- Summarizes recommendations based on what is currently known about the consequences of a nuclear detonation in an urban environment
  - Provides recommendations based on existing knowledge and existing techniques
-

# Nuclear Aftermath - Like This?



Images from the aftermath of  
WWII bombing of Dresden and  
subsequent firestorms

---

# Contents of the Guidance Document:

- Chapter 1 - Nuclear Detonation Effects and Impacts in an Urban Environment
  - Chapter 2 - A Zoned Approach to Nuclear Detonation Response
  - Chapter 3 - Shelter in Place / Evacuation Recommendations
  - Chapter 4 – Early Medical Care
  - Chapter 5 – Population Monitoring and Decontamination
-

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## Second Edition

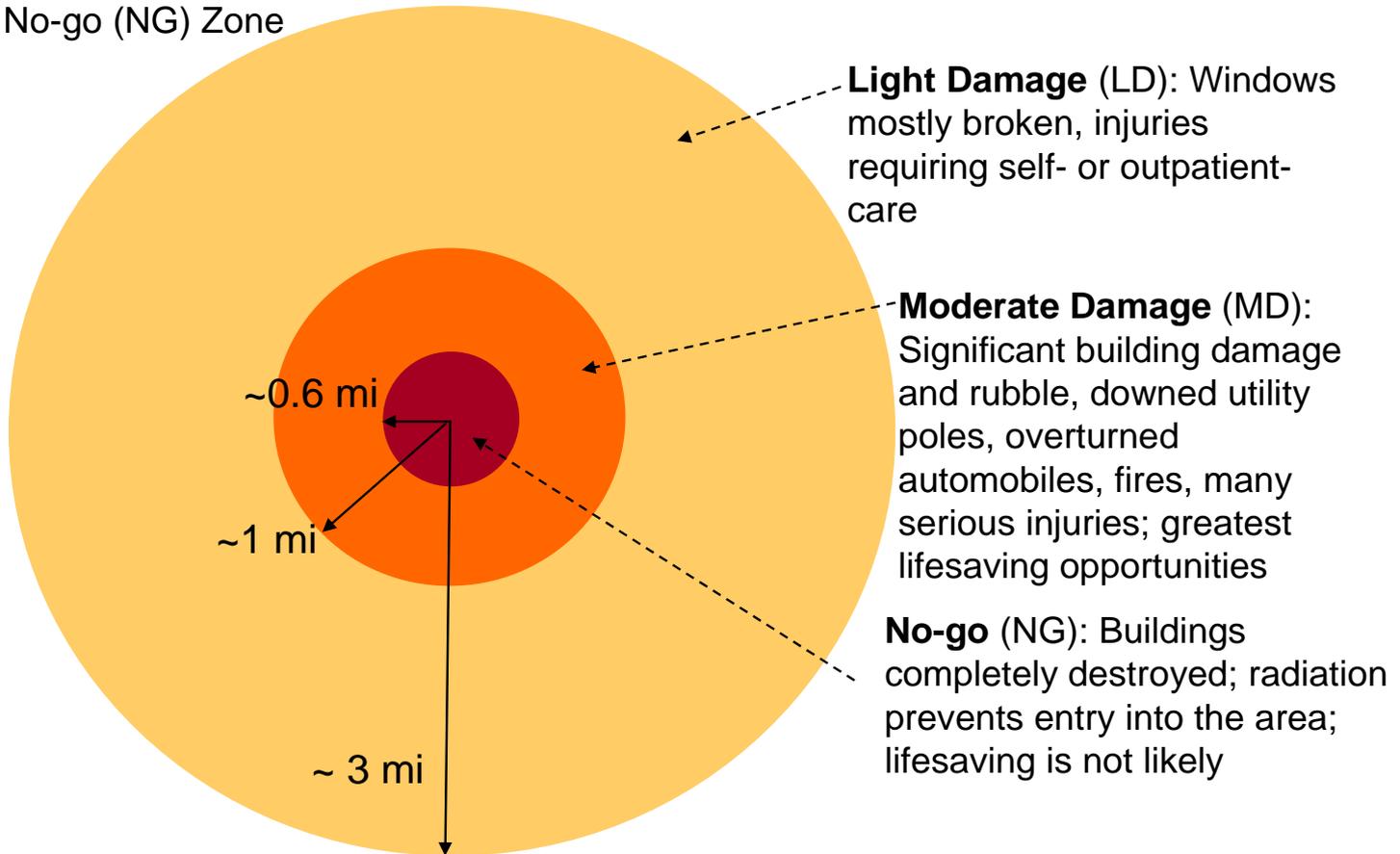
- Gaps have been identified in First Edition
- Recommendations need to be expanded to include updates from relevant S&T

# Scientific and Technological Gaps

- Effects of modern urban environment on nuclear blast, thermal effects, etc. (Los Angeles vs. Houston vs. New York City)
- Efficacy of urban sheltering and evacuation decision-making parameters
- Characterize urban nuclear explosion fallout (fallout mass, particle formation and size distribution, and radionuclide fractionation)

# Blast Zones (10kT Example Ranges)

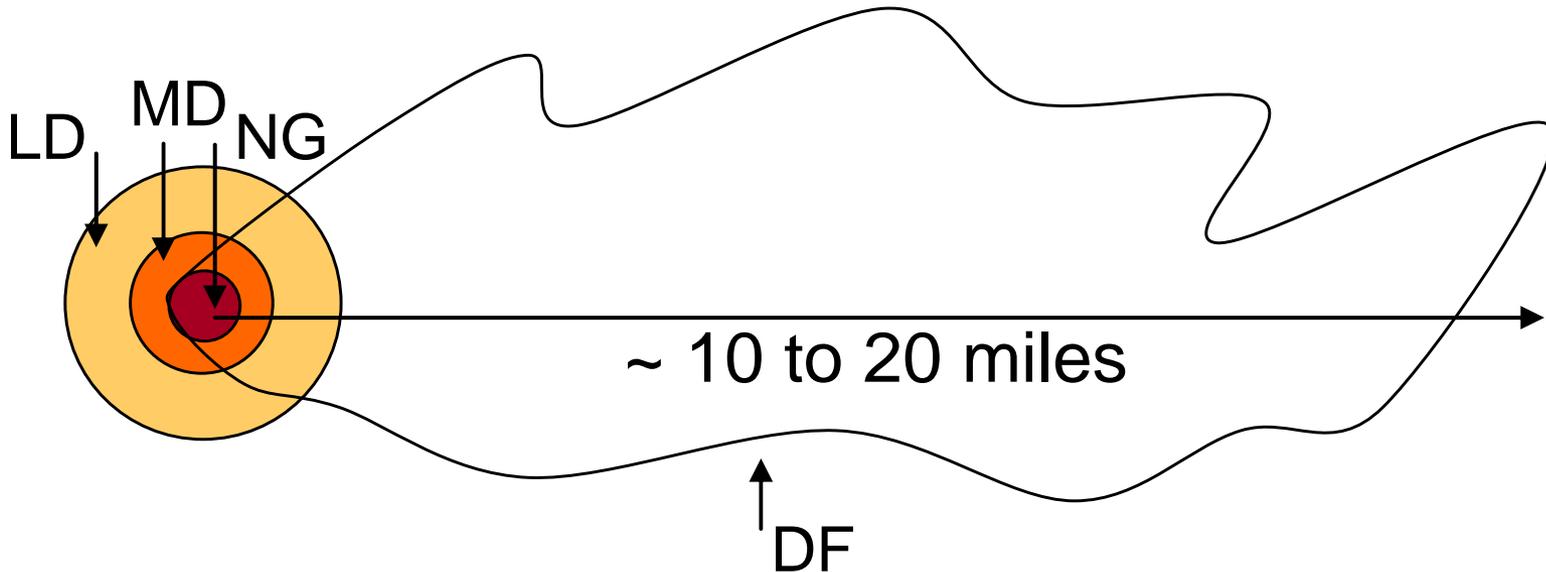
- Light Damage (LD) Zone
- Moderate Damage (MD) Zone
- No-go (NG) Zone

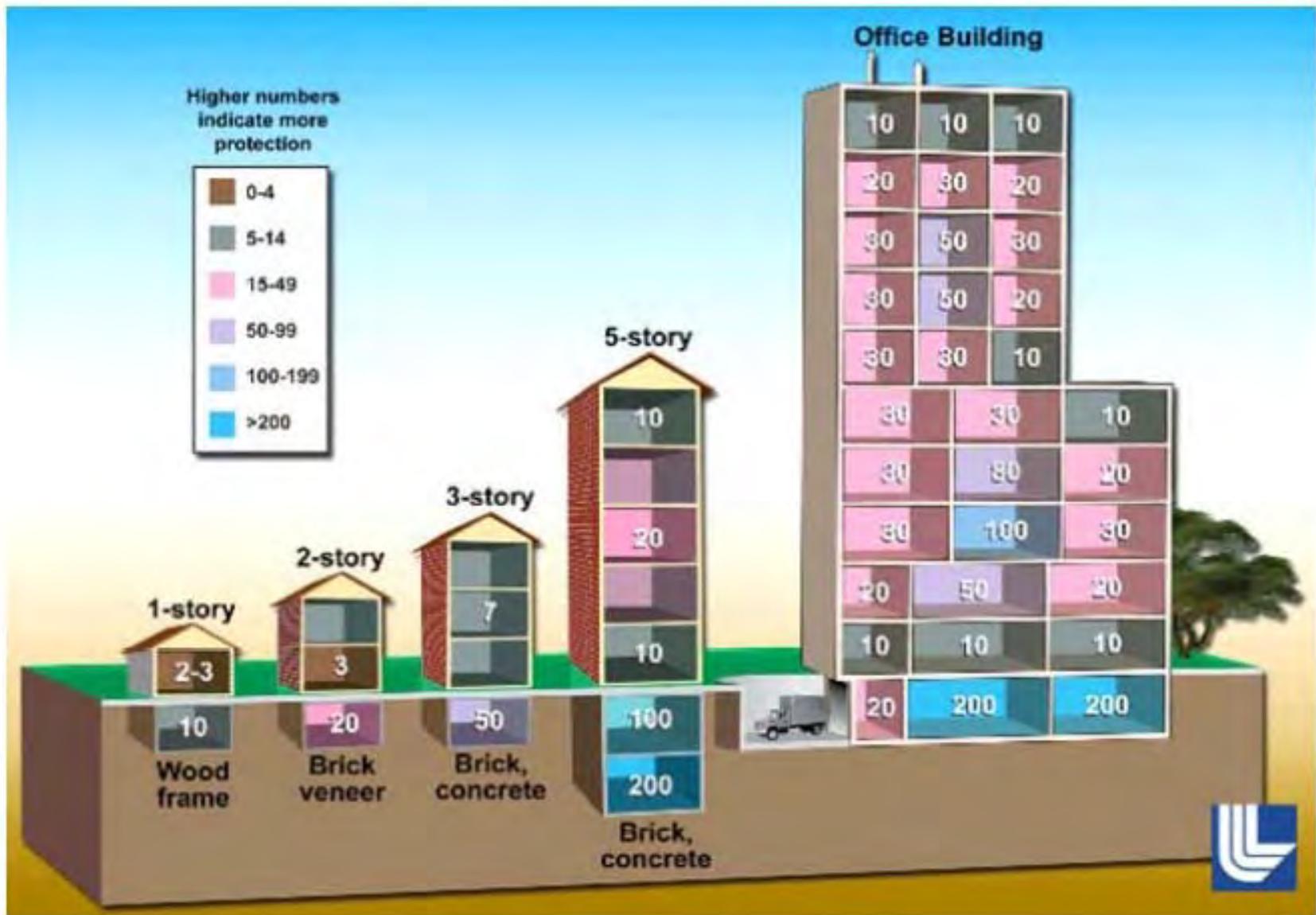


All approximated distances from center of detonation site

# Dangerous Fallout Zone

- **Dangerous Fallout (DF):** The DF zone is distinguished not by structural damage, but by radiation levels; a radiation exposure rate of **10 R/hour** is used to delimit this zone





**Figure 5.** Variations in shelter factors for residential and office structures. (Illustration provided courtesy of Brooke Buddemeier, Lawrence Livermore National Laboratory)

---

# Public Awareness Gaps

- Pre-event public information (e.g., food and water recommendations for pre-planned shelters)
  - Public information both prior to an imminent detonation and after
  - Self decontamination guidance – for public and responders
-

---

# Medical Gaps

- Psychological impacts to the population
  - Fatality management and management of human remains
  - Expected dose rates
  - Guidance on victim prioritization for care including laboratory support (biodosimetry), medical management, efficient use of scarce resources and triage
-

---

# Planning Gaps

- Continuity of local and State government
  - Worker safety and health - more extensive guidance
  - Nuclear detonation response training and exercise program
  - Recommendations regarding prioritization of efforts / assets
  - Federal assets and integration into State / local response efforts
-

---

## Logistics Gaps

- Equipment recommendations
  - Establishing and maintaining infrastructure for interoperable, EMP-resilient responder communications
  - Search and rescue guidance
  - Victim housing / sustenance guidance
-

# Domestic Readiness Group

## ■ IND Response Communications Working Group Key Questions

What is the state of the communications infrastructure as a function of time following a nuclear detonation?

What are the key public messages for the first 72 hours after a nuclear detonation and how can valid technical information, developed for decision makers, be shared with the public?

Who should deliver key public messages for the first 72 hours after a nuclear detonation and when should the messages be delivered?

---

# Key Recommendations

- A National Preparedness Campaign should be initiated to instruct and empower the public to take lifesaving measures following any catastrophic incident.
  - Finalize and distribute messages, with the exception of agency specific messages, to Federal, State, and local governments and response authorities.
-

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# Conclusions

- The Federal interagency community has developed consensus recommendations
  - Relevant initiatives from within Department and Agencies have informed the development of the Planning Guidance
  - We appreciate feedback:
    - Tammy Taylor
    - [ttaylor@ostp.eop.gov](mailto:ttaylor@ostp.eop.gov)
    - 202-456-6086
-



# State Perspectives on Effective Communication in Acts of Terrorism

Adela Salame-Alfie, Ph.D.

NYS DOH

Chair - CRCPD

# Pre-Event Messages Exist for:

## ■ Natural Disasters

- Weather (Hurricanes, tornados, ice storms, floods)
- Earthquakes
- Fires, mudslides, etc.

## ■ Man-made Events

- Airplanes
- Power loss
- Nuclear Power Plant Incidents/accidents
- Dirty Bombs/Improvised Nuclear Devices

## ■ Other emergencies

- H1N1

# Type of Information

- Actions to take to prepare (if advance notice) such as:
  - Listen to the radio/TV/monitor internet, etc.
  - Pack a bag, take your prescription medicines
  - Etc.
- Tell you what to do
  - Evacuation routes, maps
  - Location of shelters
  - KI
- Updates
  - Where to get additional information

# Types of Existing Messages

- Event specific
- Simple – Convey basic information
- Direct
- *Usually* consistent every time message is issued
- *Usually* easy to understand and follow

# What about RDD/IND Pre-event Messaging?

- Some information available on CDC, DHS, FEMA and other web sites
- People can find information about what an RDD/IND is, what to do, etc., but they have to search for it
- No concerted effort to outreach and educate the public on actions to take
- For many, the information is new and not intuitive
- Thankfully, no real experience exists though we can adapt from other experiences

# Do people follow the directives in the emergency messages?

## ■ Generally yes

- They know “the drill” (for example during hurricane season, tornados, etc.)
- Messages have been tested (in real life), sometimes improved based on experience
- Reinforced every time event repeats
- Depends on their past experience

# How will people respond?

**The first time they hear the message to:**

***“go home, remove their clothes, put them in a plastic bag, take a shower and come to a Community Reception Center if they’d like to be monitored for radiation”***

**They are instructed to “go to a Community Reception Center”, but that term is new to them**

**They are instructed to “shelter in place” but they don’t know what that means**

# What about the first responders/first receivers?

Will they **really** listen and believe us when we say:

“For life threatening injuries, treat without regard to contamination”

“It is OK to use the ambulance to transport injured people that are contaminated”

“It is OK for hospitals to treat severely injured people first, and then decontaminate”

Especially if this is the **first time** they hear that message?

If the question is not “IF”, but “WHEN” we would have to respond to an RDD/IND, then:

Why haven't we started a campaign to educate the public on what it is, what it is not, what actions they need to take to protect themselves and their families, etc...?

# Is it because:

- People have too many things to worry about already, they don't need another one?
- We would be creating unnecessary fear?
- We are concerned that we'll have a repeat of the failed “duct tape and plastic” message?

# What has CRCPD done to address this?

- Developed library of messages that States have used during nuclear power plant drills, fact sheets, Q&As that can be adapted to an RDD/IND event (especially during the intermediate/late phase) and made them available to the membership
- Will be developing messages specific to address RDD/IND events

# What has CRCPD done to address this?

- Working with Public Health Organizations to develop an Alliance to work together to address radiological issues
- With funding from CDC, encouraging states to participate in developing a “Radiation Volunteers” program (similar to the Medical Reserve Corp).

# How will this help address the Gap?

- We hope that by building partnerships with local public health organizations we can use our combined expertise to reach out and educate the public/volunteers, etc.
- We can share tools that have been used to effectively communicate a new message to the public, for example, the public education campaign about H1N1

# But we need to do a lot more!

- Convening this meeting is a great step in addressing a huge need, and it is bringing the issue to the front and center
- It is bringing together people with the right expertise to the table so we can come up with ways to address this issue



# Informing & Engaging the Public in Emergency Preparedness and Response Efforts: The Israeli Experience

Bruria Adini, PhD  
Ministry of Health  
Israel

# Introduction

- Israel has faced a wide range of terror threats and terror attacks in recent decades
- One thing that has become abundantly clear from this difficult experience is the crucial importance of building the resilience of the civilian population (“population resilience”)

# Some Key Lessons Learned

- Need to strengthen the ability of individuals and communities to deal with a blow or series of blows and bounce back
- Importance of public education and training before an emergency occurs
- Need to be able to provide continuous and reliable real-time information to the population during an emergency
- Value of carrying out real-time monitoring of resilience during emergencies
- Important of effective leadership in fostering population resilience

# Enhancing Resilience

- Today, population resilience is seen as an integral component in crisis management in Israel
- It is also considered a crucial part of the decision-making process
- In enhancing population resilience, one of the most essential steps involves informing and engaging the public in every aspect of preparedness efforts

# Involving and Engaging the Public: Three Phases



# Preparedness Phase

# Training & Education

- Annual national drill – “Turning Point”
  - Total population is involved in drill
  - Not just superficial involvement, no just “window dressing”
  - Practice tuning in for information
  - Practice entering shelters
  - Practice implementing protective measures

# Training & Education

- Annual school intervention programs
  - Aimed at facilitating & preparing children to cope with emergency situations
  - Based on the assumption that trained teachers are the most effective mediators for children
  - Also brings message back to the home

# Resilience Centers

- Deployed geographically in municipalities in conflict zones
- Main tasks:
  - Support of population
  - Guidance for mental health personnel
  - Detection, identification & primary intervention with victims of emergencies or sensitive populations

# Dissemination of Information Before an Emergency

- Relay of information regarding emergencies along with routine activities (electricity bill)

# Civil Defense Custodians

- Any facility with >10 employees nominates civil defense custodians
- Over 3,000 custodians have been trained so far
- Main responsibilities:
  - Serve as “core knowledge group”
  - Coordinate protection of plant and employees

# Emergency phase

*Achieve “emergency routine”*

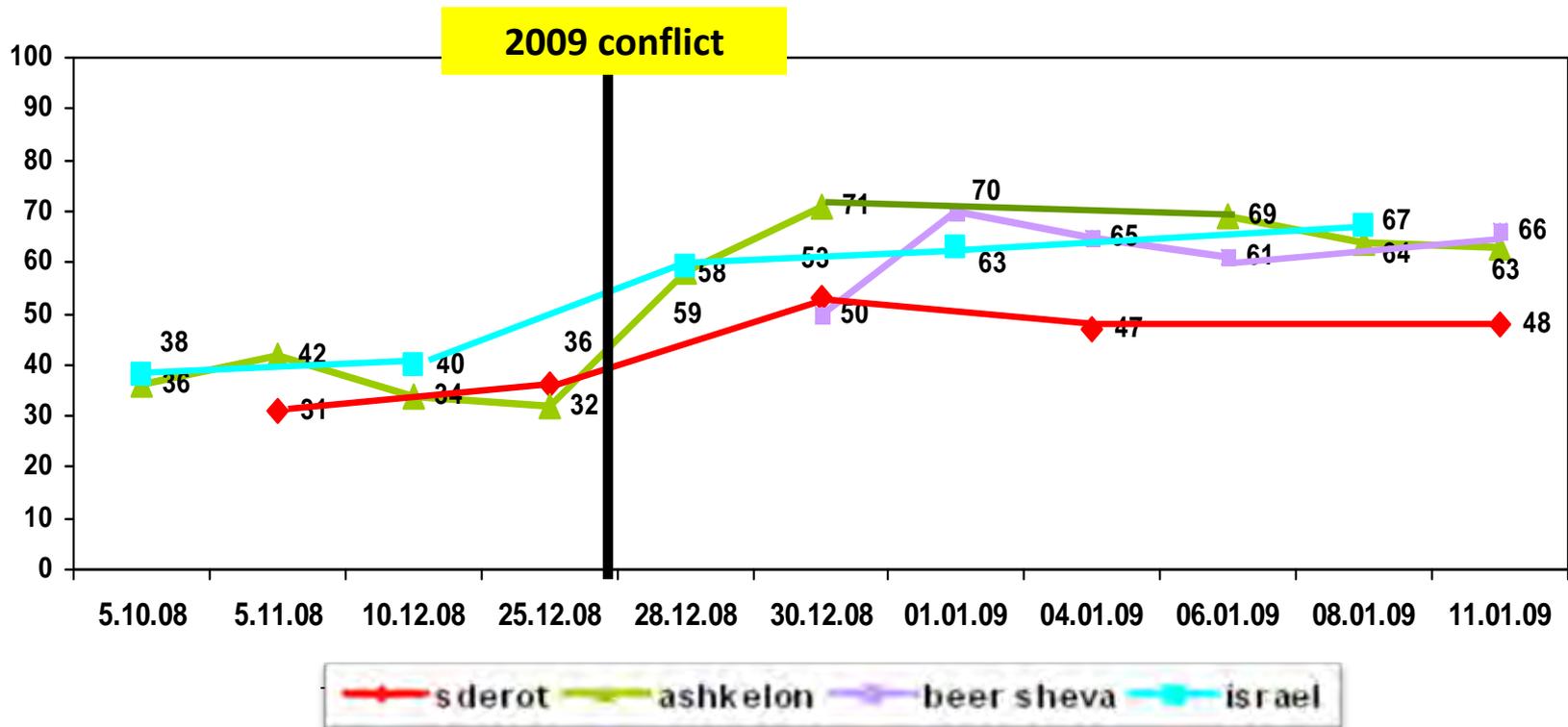
# Utilization of Trained National Spokespersons

- Stationed in major media channels
- Inform the public regarding the emergency & its implications

# Continuous Resilience Assessment: Surveys of the Population and Its Needs

- Monitor impact of emergency on the public
- Impact on the process of decision-making

*How would you grade your capability to deal with the current security situation ?*



High categories responders rate in percent

# Impact on Decision-Making

- Evacuation of psychiatric hospital
- Along with such threats as suicide bombings, Israel – like other nations – also faces radiological and other unconventional threats
- Publicizing potential non-conventional threat

# Operation of Information Centers

- Operating public information centers
  - Home Front Command
  - Local municipalities
  - Hospitals
- Manned by senior personnel that offer immediate responses
- Refer frequently asked questions to the national spokespersons

# Rehabilitation & Recovery phase

# Recovery Phase

- Formulating policies based on population needs
  - Research based
- Partnering with volunteers
- Connectivity between national & municipal bodies

# Conclusions

- A key lesson from Israel's experience dealing with terrorism is that population resilience is crucial
- To enhance resilience, the public must be treated as a partner and feel like a partner in preparedness efforts
- Involving the public in the response to emergencies alleviates fear, elevates confidence and maintains trust in leadership

**COMMUNICATION OF  
BENEFITS AND RISKS OF  
MEDICAL RADIATION:**

**A HISTORICAL PERSPECTIVE**

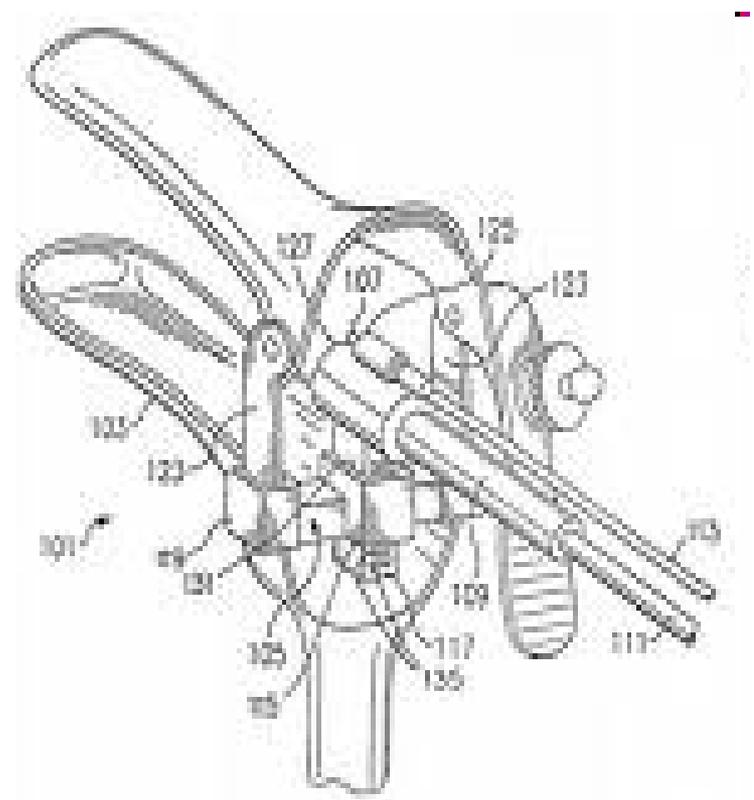
**Julie K. Timins, MD**

- Developing the Knowledge Base
- Radiation Protection
- Radiology as a Medical Specialty
- Decision Making: Paternalism v. Patient  
Autonomy
- Recent Changes in Education
- Educating Different Constituencies
- Current Issues & Controversies

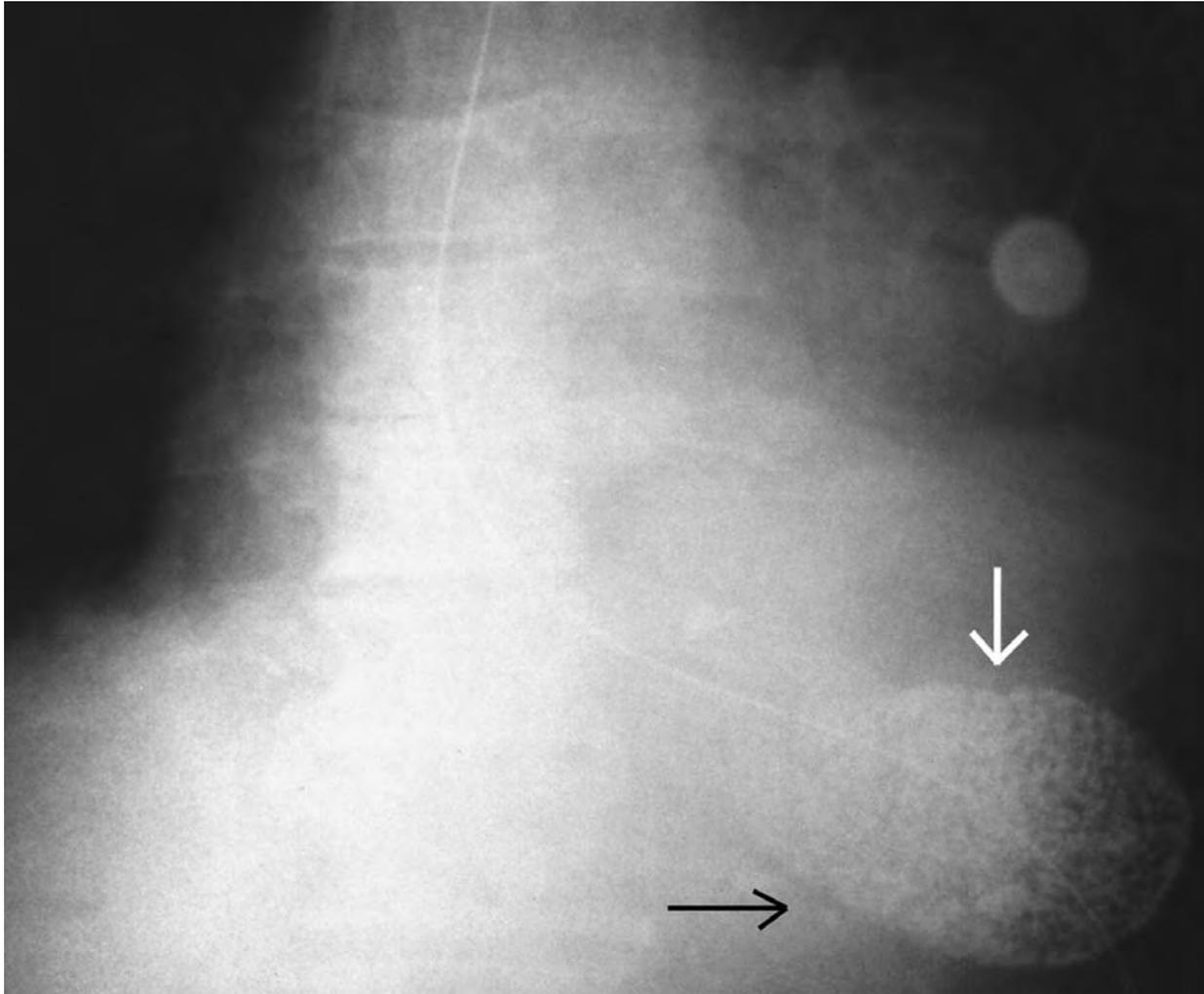
# X-ray taken by Röntgen in 1896



# Brachytherapy Afterloading Device



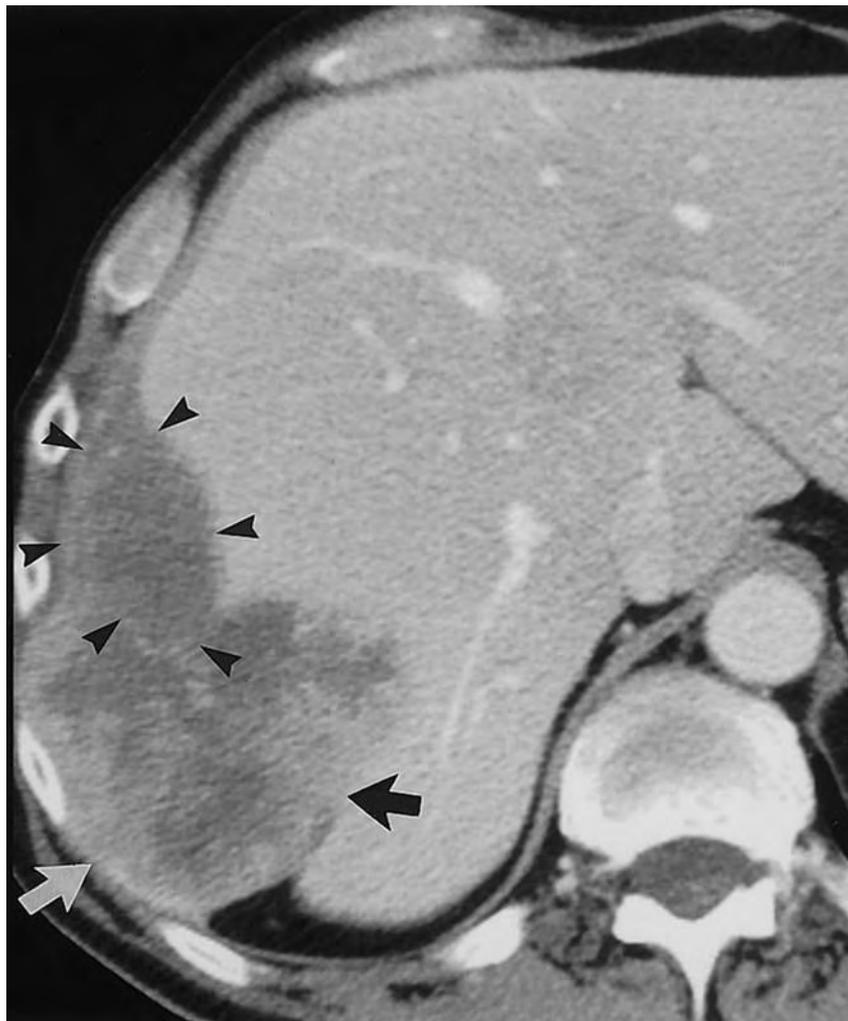
## Thorotrast Deposition in the Spleen of a 57-year-old Man



Hunter T B, Taljanovic M S Radiographics 2005;25:503-523

RadioGraphics

## Angiosarcoma with Chronic Subcapsular Hematoma



Koyama T et al. Radiology 2002;222:667-673

Radiology

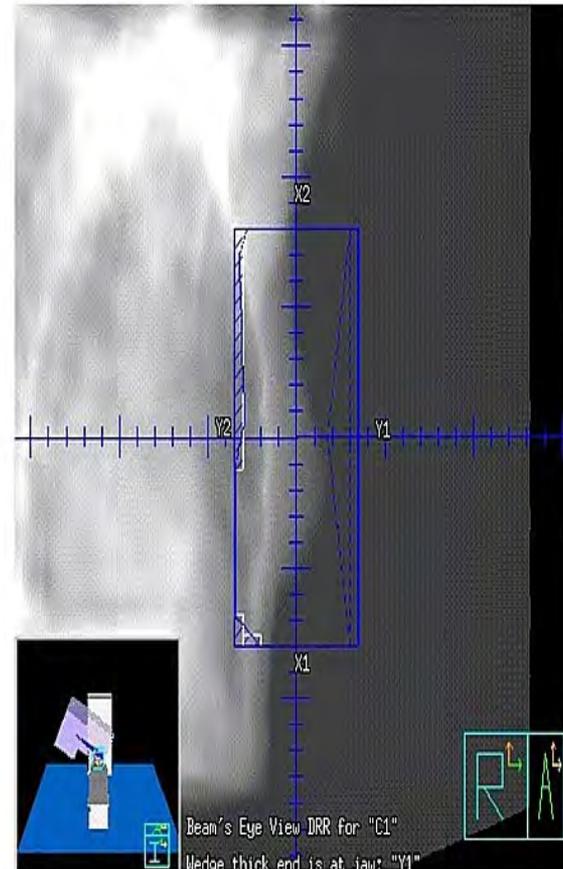
## Planung Radiotherapie - 4

Common Radiation Fields

Mantle

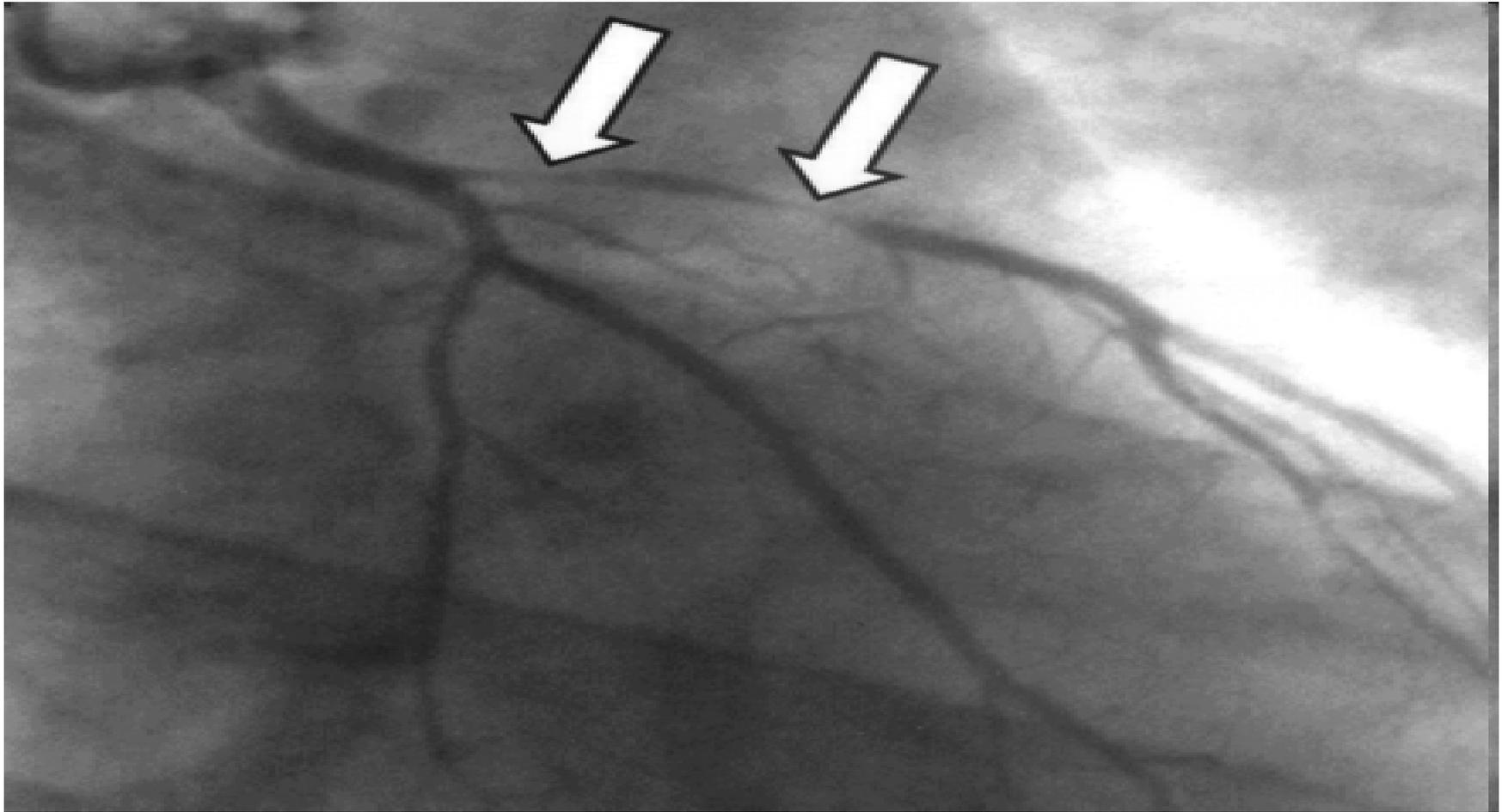
Abdominal

Pelvic



Einstrahlfeld aus der Sicht des Therapiegeräts (von oben rechts)  
für linke Brust

# Coronary Artery Disease



# Therapy v. Diagnosis



# Sample Lay Report

## BI-RADS® 4-5 (Abnormal)

- **Name of Facility, Address and Phone Number**  
**Name of Patient/ID**  
**Date of Breast Imaging**
- Dear Patient:
- As we discussed at your recent visit, your [mammography or breast ultrasound or breast MRI] examination showed an **abnormality** that requires a biopsy. The only way that you can be sure that the abnormality is benign (not cancer) is to sample or surgically remove the area of concern and send these samples for pathological analysis. When these results are available, your health care provider or our facility will contact you concerning the results and any follow up tests or appointments that may be required.
- A report of your results was sent to: [referring health care provider]. He/she has been informed about the need for this biopsy. You should contact your physician or other health care provider as soon as possible (if you have not already done so).
- Your images will become part of your medical file here at [facility name] and will be available for your continuing care. You are responsible for informing any new health care provider or breast imaging facility of the date and location of this examination.
- Although mammography is the most accurate method for early detection, not all cancers are found through mammography. A breast finding of concern should **never be ignored**. If you notice any new changes in your breast(s) you should bring them to your health care provider's attention immediately.
- Thank-you for allowing us to help in meeting your health care needs.
- Sincerely,
- Jane Smith, M.D.  
Interpreting Radiologist

### Radiation-Emitting Products

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

<b>Radiation-Emitting Products and Procedures</b>
<b>Medical Imaging</b>
<b>Medical X-Rays</b>
▶ <a href="#">Computed Tomography (CT)</a>
<a href="#">Fluoroscopy</a>
<a href="#">Mammography</a>
<a href="#">Radiography</a>

## Computed Tomography (CT)

- What is CT?
- What are the Radiation Risks From CT?
- Should I get "whole body" CT?
- How does FDA regulate CT?
- Other Resources
- Radiation Quantities and Units
- Contact Us

Currently some medical imaging facilities are promoting a new use of computed tomography (CT), also called computerized axial tomography (CAT) scanning. This use is referred to as whole-body CT scanning or whole-body CT screening, and it is marketed as a preventive or proactive healthcare measure to healthy individuals who have no symptoms or suspicion of disease. **At this time the FDA knows of no data demonstrating that whole-body CT screening is effective in detecting any particular disease early enough for the disease to be managed, treated, or cured and advantageously spare a person at least some of the detriment associated with serious illness or premature death.** Any such presumed benefit of whole-body CT screening is currently uncertain, and such benefit may not be great enough to



# RADIOLOGYINFO™

The radiology information resource for patients

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## ACR RSNA

- ▶ Diagnostic Radiology
- ▶ Interventional Radiology
- ▶ Nuclear Medicine
- ▶ Radiation Therapy

Procedures A to Z

Radiology in Motion



Image Gallery



Downloads for physicians



Procedures

## Welcome to RadiologyInfo

*RadiologyInfo* is designed to answer your questions related to the many radiologic procedures and therapies available to you and your family. The Web site provides you with information whether you're preparing for a baseline mammogram, learning more about your child's x-ray, or researching radiation oncology (cancer therapy) procedures.

*RadiologyInfo* tells you how various x-ray, CT, MRI, ultrasound, radiation therapy and other procedures are performed. It also addresses what you may experience and how to prepare for the exams. The Web site does not yet cover all radiologic procedures and therapies, but is updated frequently with new information.

All material on the *RadiologyInfo* Web site is reviewed and approved by experts in the field of radiology from the ACR and RSNA, as well as other professional radiology organizations.

To locate a medical imaging or radiation oncology provider in your community, you can search the ACR-accredited facilities database.

**New Developments in Radiology**



What does a Radiologist do?

Current News...

**Response to Recent Mammography Recommendations**

**Radiation Safety**

**Helpful Links**

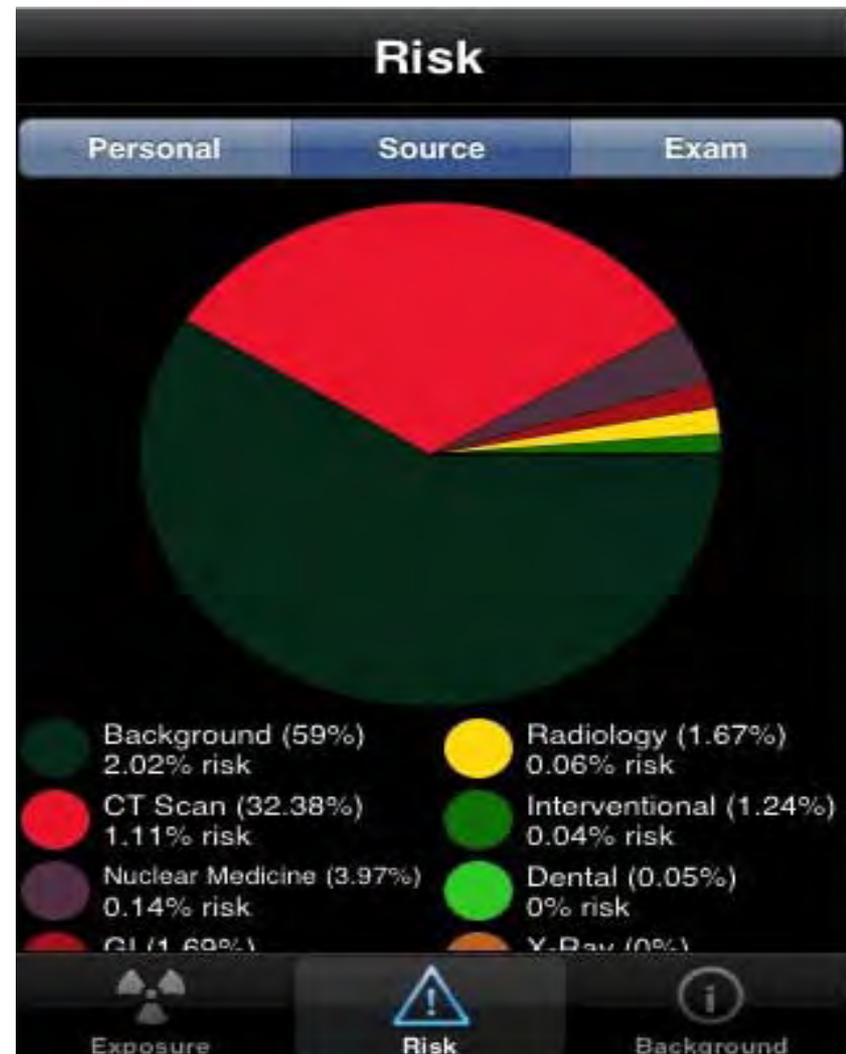
# IMAGE GENTLY

## One Size Does NOT Fit All



- Brenner, Hall. Computed Tomography – An Increasing Source of Radiation Exposure. *NEJM* 2007; 357-2277
- Berrington de Gonzalez, et al. Projected Cancer Risks From CT Scans Performed in the US in 2007. *Arch Intern Med.* 2009;169:2071
- Smith-Bindman, et al. Radiation Dose Associated with Common CT Exams and Associated Lifetime Attributable Risk of Cancer. *Arch Intern Med.* 2009; 169(22):2078
- Lee, et al. Diagnostic CT Scans: Assessment of Patient, Physician, and Radiologist Awareness of Radiation Dose and Possible Risks. *Radiology* 2004; 231:393
- iPhone Application Tracks Radiation Exposure, Risk: Dr. Mark Baerlocher. *RSNA News*, December 2009
- McBride, *American Roentgen Ray Society*, Spring 2009

# iPhone Radiation Passport



# Current Issues & Controversies

- Communication on Mammography - Risk:Benefit v. Cost:Benefit
- Estimating Risks of Medical Radiation - Linear Non-Threshold Model?
- Appropriateness Criteria
- Imaging Protocols
- Justification, Optimization, Dose Limits

# Toward a Holistic Approach in the Presentation of Benefits and Risks of Medical Radiation

(in less than 15 minutes)

**Louis K. Wagner, Ph.D**



THE UNIVERSITY *of* TEXAS  
HEALTH SCIENCE CENTER AT HOUSTON  
MEDICAL SCHOOL



**Goal:**

**To improve delivery of the message  
about benefit/risk in medical  
radiography**

# The Message of Communication depends on:

- Audience (Large, small, level of education, etc.)
- Perspective (Biased or fairly presented)
- Tone (Positive vs Negative)
- Believability of the Message
- Deliverer's Credibility & Trustworthiness
- Deliverer's respect for the audience

# **The message is not necessarily in the words**

Reference from former employer to prospective employer:

**“You will be very lucky if you can get Bill to work for you.”**

# The message is not necessarily in the words

**After a pelvic CT scan of a pregnant woman, which statement delivers the most appropriate message about risk?**

**A. the study that you had two weeks ago has perhaps doubled the risk that your child will develop cancer before age 19. [0.6% vs 0.3%]**

**B. the risk of adverse outcome is very small and the likelihood of normal development is nearly the same as it is for any child. [96.7% vs 96.4%]**

**“Benefits must be balanced  
against the risks”**



**“Benefits must outweigh the  
risks” or  
“Benefits must exceed the risks”**



# Another misused phrase

“I guess that study was unnecessary, it was negative”

**Negative is not synonymous with unnecessary!**

**Negative is important and new information. It steers medical care.**

**If all studies are positive, the physician is probably not ordering enough studies!**

# Bias in Presentation

## Physicians

- Know a lot about medical benefit
- Know very little about radiation risk
- Express benefit/risk in terms of medical results

## Epidemiologists & Radiobiologists

- Know a lot about radiation risks and effects
- Know very little about benefit
- Often express risk in terms of possible effects in a healthy population

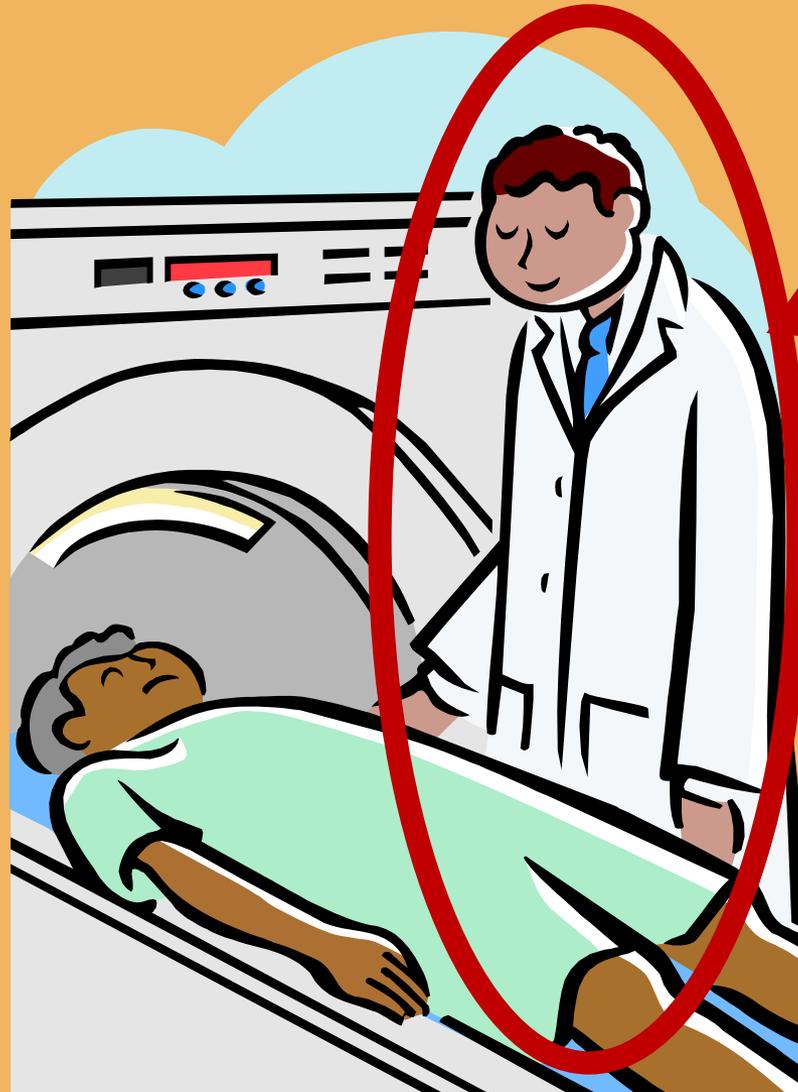
## Physicists

- Know a lot about imaging and radiation delivery
  - Focused mostly on ALARA
- Knowledge about benefits and risks is mixed

# What message does ALARA send regarding medical radiation?

1. Medical radiation is good for you
2. Medical radiation is bad for you
3. Medical radiation can be bad, but might be good
4. Medical radiation can be good, but might be bad

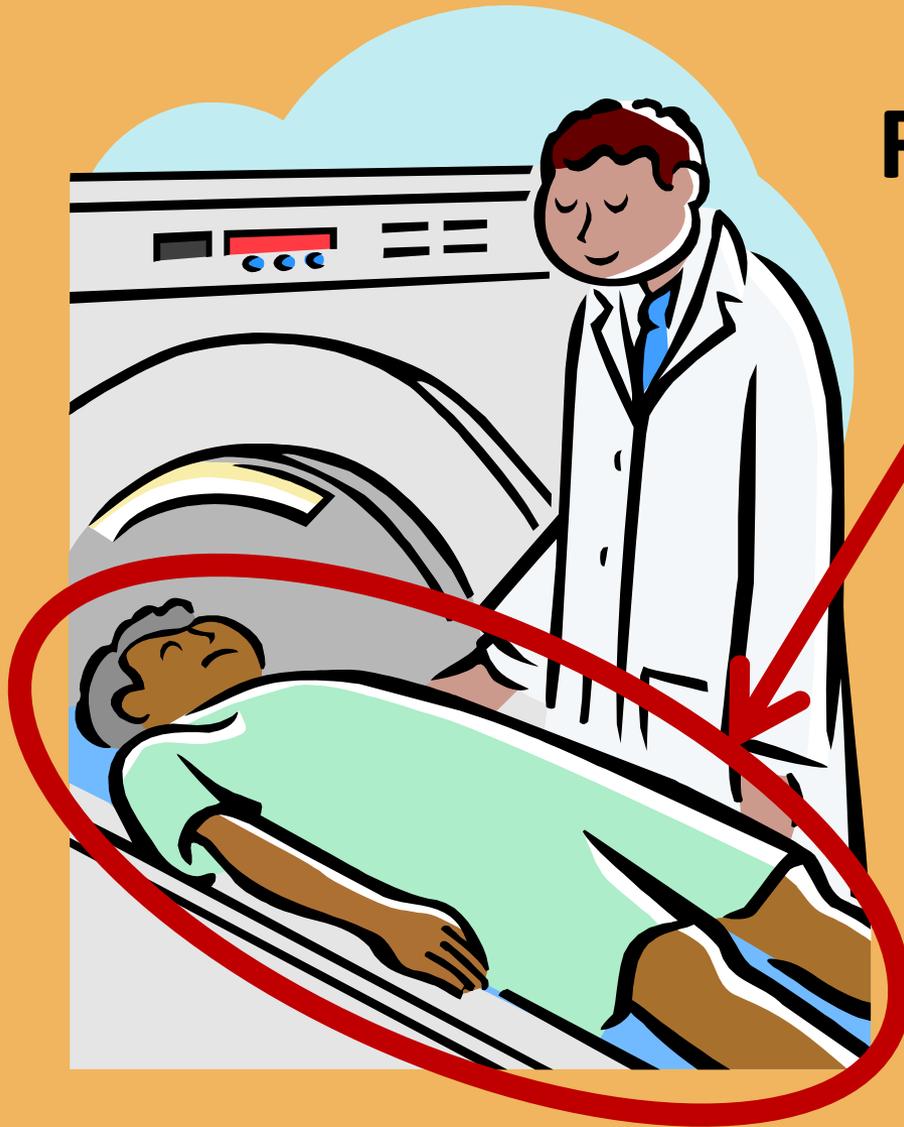
**ALARA is a perfect mantra!**



**For this guy**



# ALARA is an inadequate mantra!



For this guy

ALARA speaks only to risk of radiation, not to medical benefit which is our **primary** goal.

An incomplete focus sends an incomplete message!

# **Benefit/Risk should be AHARA**

**Within reason, choose and design the examination to provide the highest medical benefit-to-risk for the patient.**

**ALARA is included in AHARA but is only one aspect of medical management.**

**“Within reason” takes into account availability, efficiency, effect on care of others, cost, etc.**

# Differences between Radiation Industries

	<b>Health Physics</b> 	<b>Medical Diagnosis and Intervention</b> 
<b>Radiation Exposure</b>	<b>Unintentional</b>	<b>Intentional</b>
<b>Radiation Effect</b>	<b>Risk</b>	<b>Benefit/Risk</b>
<b>Radiation Mantra</b>	<b>ALARA</b>	<b>AHARA, Image Gently, Image Wisely</b>
<b>Radiation Control</b>	<b>Radiation Protection</b>	<b>Radiation Management</b>
<b>Radiation Limit</b>	<b>Regulated</b>	<b>As necessary</b>

# Example of incomplete (Radiation-focused)

message:

**NCRP 2007: uses of medical radiation have increased six-fold since 1980 – primarily due to increases in CT and Nuclear Cardiology**

Is the message received as:



or

B



Choose one:

Yippee! I survived my stroke!

Yippee! I survived my heart attack!

Yippee! I survived my injury!

Yippee! They found my cancer early!

# Here's some of what you got for that six-fold increase in radiation exposure

- More effective surgeries
- Elimination of many exploratory surgeries
- Better/earlier treatment of cancer
- Minimally invasive diagnoses of serious health conditions
- More efficient treatment after injury
- Better management of stroke
- Better management of your cardiac conditions

# Example of the complete issue :

NCRP 2007: uses of medical radiation have increased six-fold since 1980.

Has the increase in nuclear cardiology procedures improved heart health to justifiably outweigh the potential increases in radiation-induced cancers?



# Can we do better?

Of course we can ---

And we have:

**Pelvimetry**

**Scoliosis**

**Mammography dose**

**Initiative on Pediatric dose management**

**Initiative on Pediatric injury management**

# Examples of Benefit/Risk that are acceptable

- Signing the Declaration of Independence
- Lewis and Clark
- Invasion at Normandy
- U S Airways landing in the Hudson
- Rescue Efforts in Haiti
- Living in Galveston (Hurricanes)
- Living in California (Earthquakes, fires, mudslides)
- Living in Denver (extra 1 mGy per year of radiation)

# Credibility and Trustworthiness

*The British Journal of Radiology*

## Survey of awareness of radiation dose among health professionals in Northern Ireland

J A SOYE, MRCP, FRCR and A PATERSON, MRCP, FRCR, FFR, RCSI

*Department of Radiology, Royal Belfast Hospital for Sick Children, 180 Falls Road, Belfast BT12 6BE, Northern Ireland*

**ABSTRACT.** Increasing concern has recently been expressed in the literature that referring doctors' knowledge of radiation doses incurred during radiological

## Health Policy and Practice

**Radiology**

Christoph I. Lee, AB  
Andrew H. Halms, MD  
Edward P. Monico, MD  
James A. Brink, MD  
Howard P. Forman, MD,  
MBA

Index terms:  
Computed tomography (CT),  
radiation exposure  
Radiations, exposure to patients and  
personnel

Published online before print  
10.1148/radiol.2312030767

## Diagnostic CT Scans: Assessment of Patient, Physician, and Radiologist Awareness of Radiation Dose and Possible Risks<sup>1</sup>

**PURPOSE:** To determine the awareness level concerning radiation dose and possible risks associated with computed tomographic (CT) scans among patients, emergency department (ED) physicians, and radiologists.

# **To improve our message of benefit/risk we must:**

- **Change our mindset from radiation or risk-focused to benefit/risk focused**
- **Change the perspectives of the uses of medical radiation in a sick or injured population, not in a healthy population**
- **Develop medically oriented mantras or slogans that give credit to medical need**
- **Improve our credibility**

# Recommendations

In communicating Benefit/Risks remember:

- **Our goal is to improve health, emphasize that**
- **We image people who are already injured or at risk for disease, not Joe Plummer**
- **Challenge your bias**
- **Invite constructive criticism on how to improve benefit/risk**
- **Avoid emphasizing risk to the detriment of benefit, stress benefit/risk**



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**The end**

# **Communicating the Benefits/Risks of Radiation Therapy: Maintaining Context, Perspective and Reassurance**

**Lawrence B. Marks, M.D.**

**Professor and Chairman**

**University of North Carolina at Chapel Hill, NC**



# Disclosures

## Active

NIH

Lance Armstrong Foundation

Siemens Medical

## Recent

Dept of Defense

Varian Medical Systems

# Summary

- Communicating risks of RT challenging
- RT: Bad Press
- Tailoring the message (?)
  - Patients and family, medical community, hospital administration, general public
- Key points
  - Acknowledge the risks
  - Context: Cancer risks > RT risks
  - Reassure: minimizing risks
  - Build trust and confidence

# Uphill Battle: Bad Press!

# Riverside Methodist Hospital Co-60 (1975-76)

## THE PLAIN DEALER

NEWSSTAND/SENDING MACHINE \$1.00

OHIO'S LARGEST NEWSPAPER

CLEVELAND, SUNDAY, DECEMBER 13, 1992

HOME DELIVERY: Sunday 75¢  
Daily & Sunday for seven issues (Monday through Sunday) \$1.75  
Prices may vary in designated areas

FIRST OF A SERIES **LETHAL DOSES** RADIATION THAT KILLS

### Dangerous medicine, deadly mistakes



“Scores of Americans have met horrible deaths due to medical blunders and overdoses of radiation.”

- Co-60 Decay error
- 243 dead**

Courtesy of Eric Klein

## Misuse of software made here caused radiation overdoses, agency finds

5 cancer patients died in incidents in Panama, officials say

The problem first came to light about two weeks ago when Panamanian Health Minister Fernando Garcia released a report that said health officials at Panama City's National Oncology Institute had given 28 patients radiation overdoses between August and December last year. In addi-

### INVESTIGATION OF AN ACCIDENTAL EXPOSURE OF RADIOTHERAPY PATIENTS IN PANAMA

Report of a Team of Experts, 26 May-1 June 2001



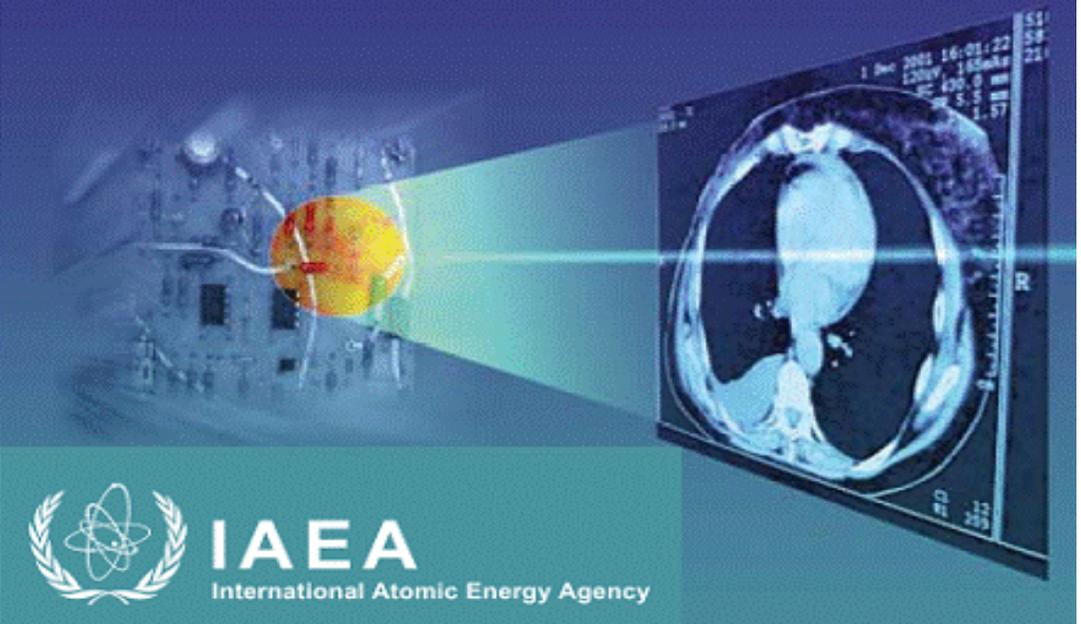
INTERNATIONAL ATOMIC ENERGY AGENCY

UNC

# Accidental Overexposure of Radiotherapy Patients in San José, Costa Rica



## Accidental Overexposure of Radiotherapy Patients in Białystok



**IAEA**  
International Atomic Energy Agency

# Karmanos Treats Wrong Side Of Patient's Brain

POSTED: 5:53 pm EDT October 29, 2007

UPDATED: 1:18 pm EDT October 30, 2007



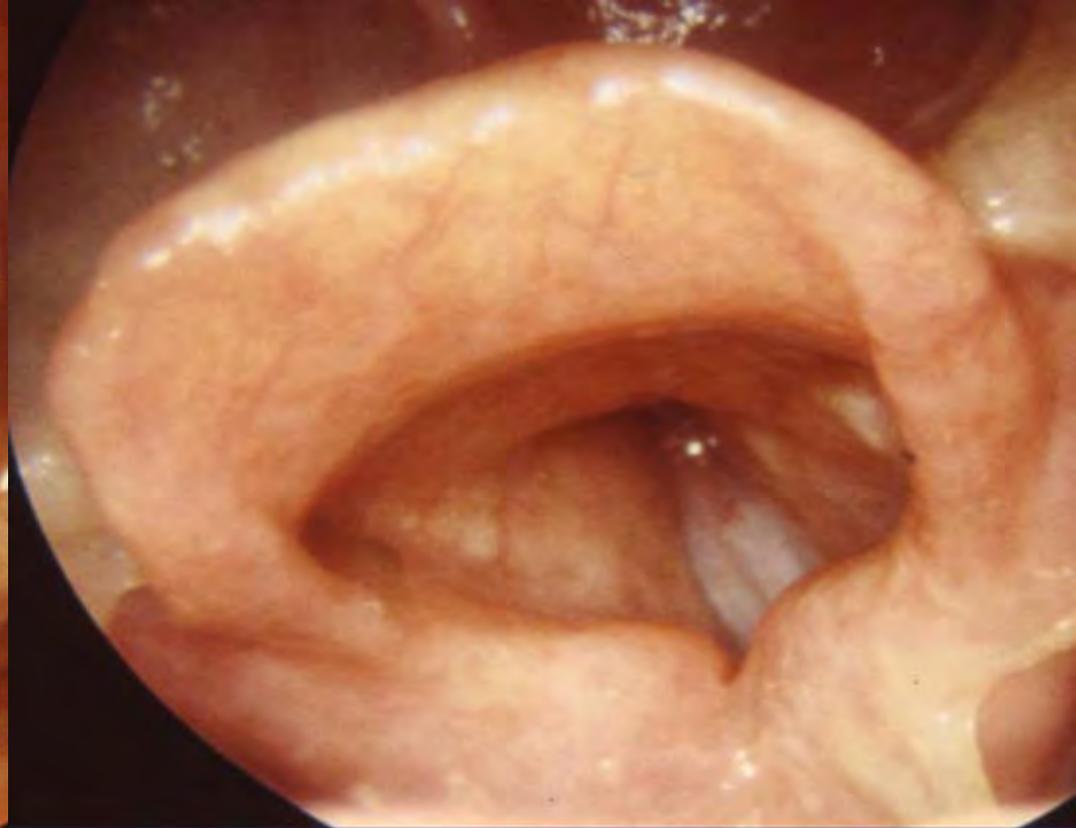
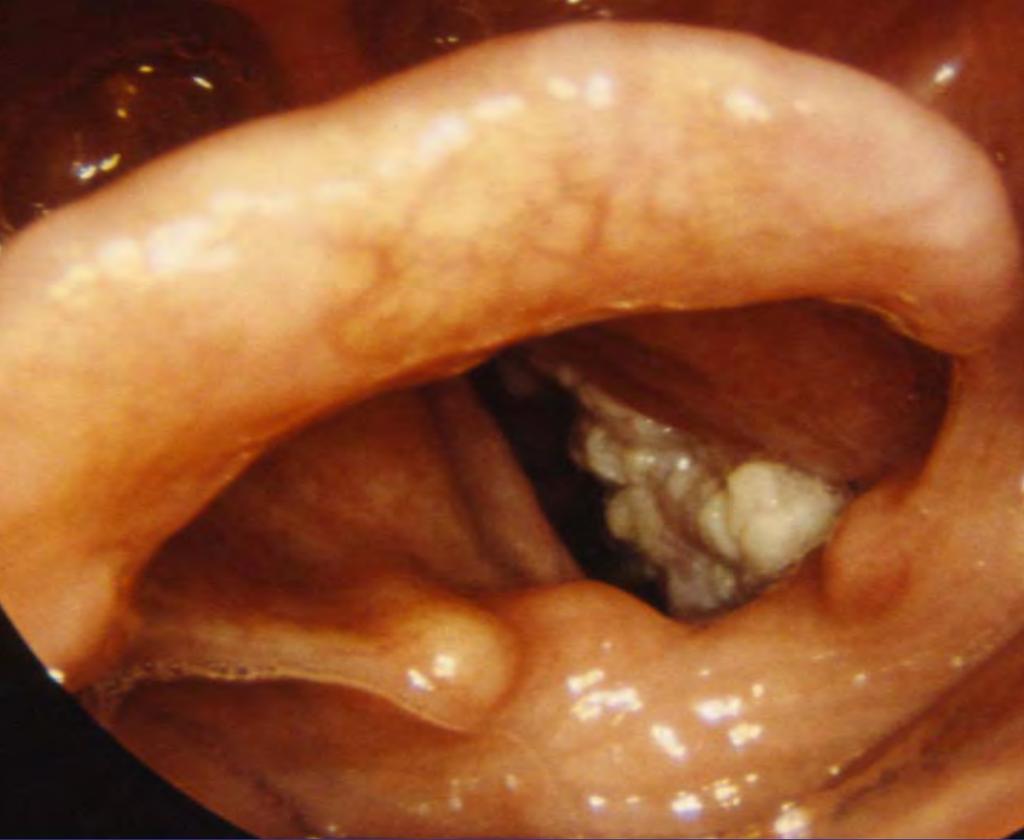
**DETROIT** -- A patient undergoing treatment at the Karmanos Cancer Institute in Detroit received a dose of radiation on the wrong side of the brain, according to a report filed with the United States Nuclear Regulatory Commission.

According to the report, a crucial piece of information was misread prior to treatment with a gamma knife which delivers a targeted form of radiation therapy that zeros in on specific locations in the brain.

The patient went through a routine magnetic resonance imaging (MRI) scan of the brain just before the procedure, but went into the scanner "feet first," rather than the standard practice of head first, the document said.

# Nevertheless: Radiation Therapy Works

- **Main curative therapy**
  - Head and neck cancers, gynecologic, prostate...
- **Adjunct to surgery**
  - Breast, rectum, sarcomas, prostate....
- **Good palliative therapy**
  - Bone pain, metastases to any area,...



T3N1 Right True Vocal Cord  
7440 cGy RT in 6 weeks

14 Months  
Post-RT



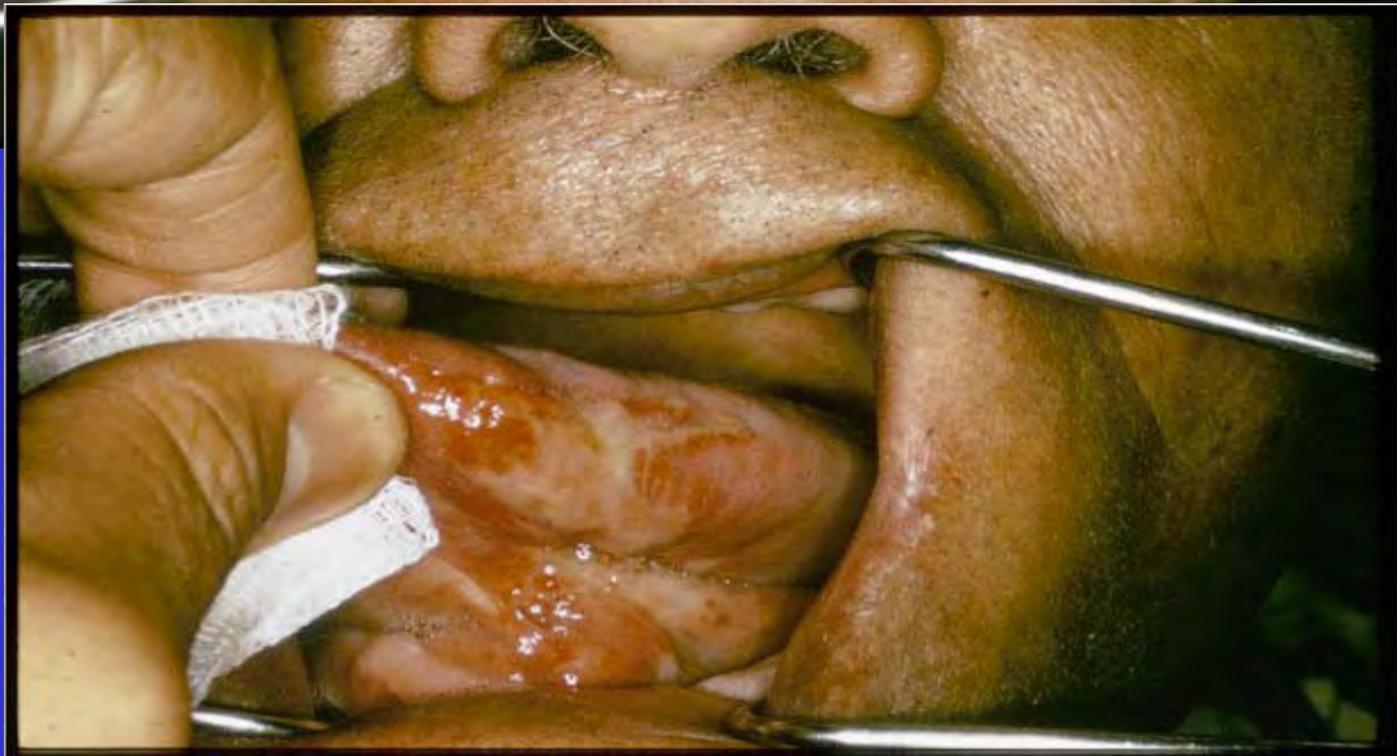
**Skin Cancer**



**2 Years Post-RT**



**Tongue**



**2 Months  
Post-RT**

# **Patient with cancer and their family**

- **Scared. Likely not absorbing much.**
- **Imagine**
  - **Day 0: thinking about football and fishing**
  - **Day 1 am: headache and first-ever seizure**
  - **Day 1 pm: hospital, head scan**
  - **Day 2: seen by a neurosurgeon**
  - **Day 3: surgery (anesthesia, intensive care..)**
  - **Day 5: radiation therapy consultation**

**Digesting risks/benefits in this scenario?** UFC

# Delivering the message to patients/family

- Sit down, speak clearly, in English (avoid jargon)
- Look the patient in the eye
  - Do not look at the (damn) computer
  - Physical contact +/-
- **Acknowledge:** *“Yes, there are risks..”*
- **Context:** *“...but there are the benefits”*
- **Reassure:** *“this is what we do to minimize risks..”*
- **Repeat.** *“What questions do you have for me?”*
  
- **Give written materials, your phone number for questions (rarely call, but appreciate the offer)**

# **Radiation Therapy for Breast Cancer**

## **Department of Radiation Oncology**

### **UNC Clinical Cancer Center**

#### **Introduction**

**Breast cancer is a complex disease. This information sheet will:**

- Explain how radiation therapy is used to treat breast cancer**
- Review the possible side effects from therapy**

**Possible side effects include...**

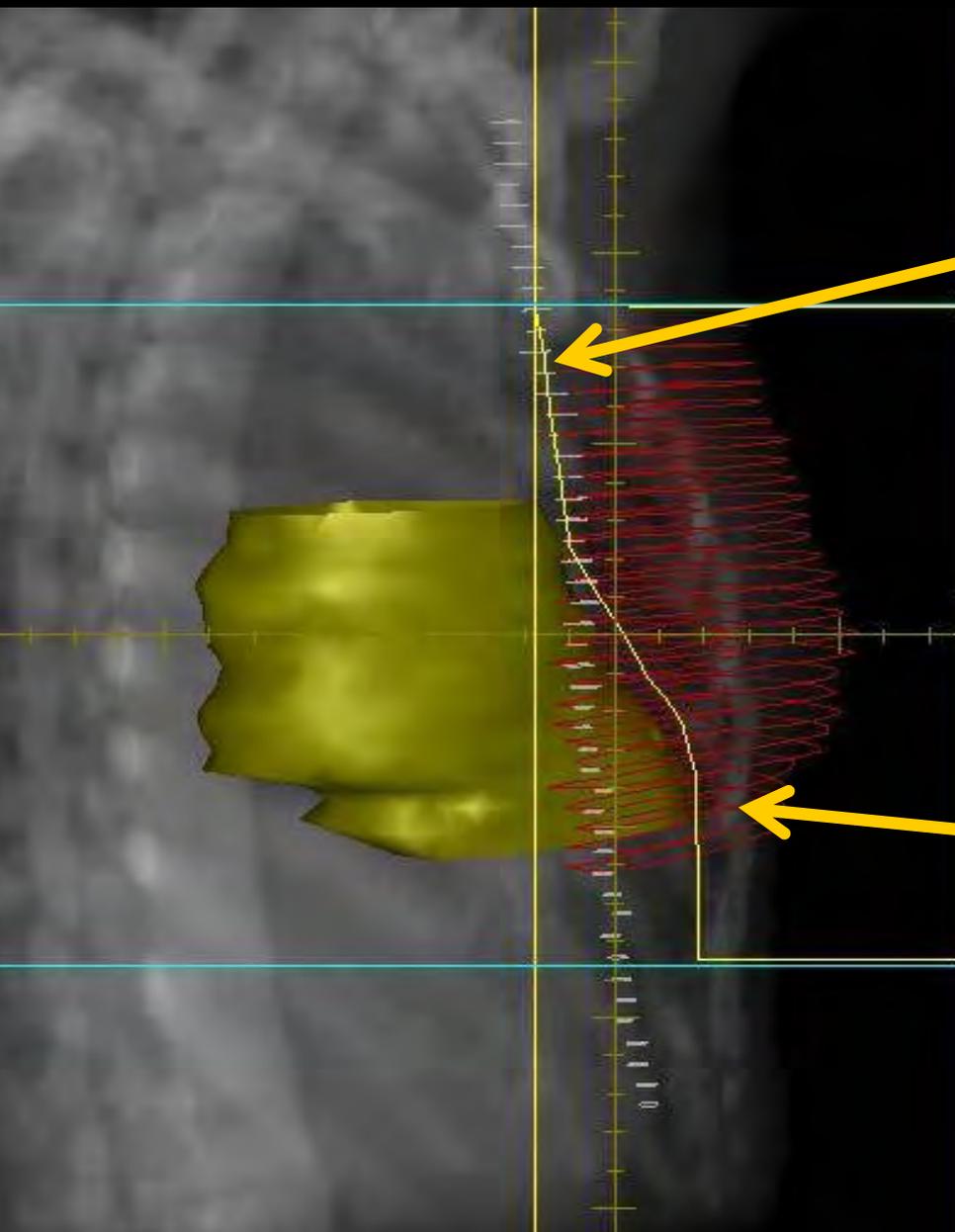
•Speak clearly. **Avoid this!!**

•Parent asks: *“Will the radiation to my child’s head hurt their brain?”*

•MD replies: *“One would hope that in the modern era the texture of the tissues post-radiation will be of acceptable quality”*

# Ongoing process with patients

- RT given daily for many weeks
- During week
  - Show patient their radiation plan
  - *“This is the amount of your heart in the field... this is what I did to minimize it..”*
- Acknowledging their **ongoing concerns**
- Reassure by
  - Explaining what is going on
  - Addressing ACUTE toxicities



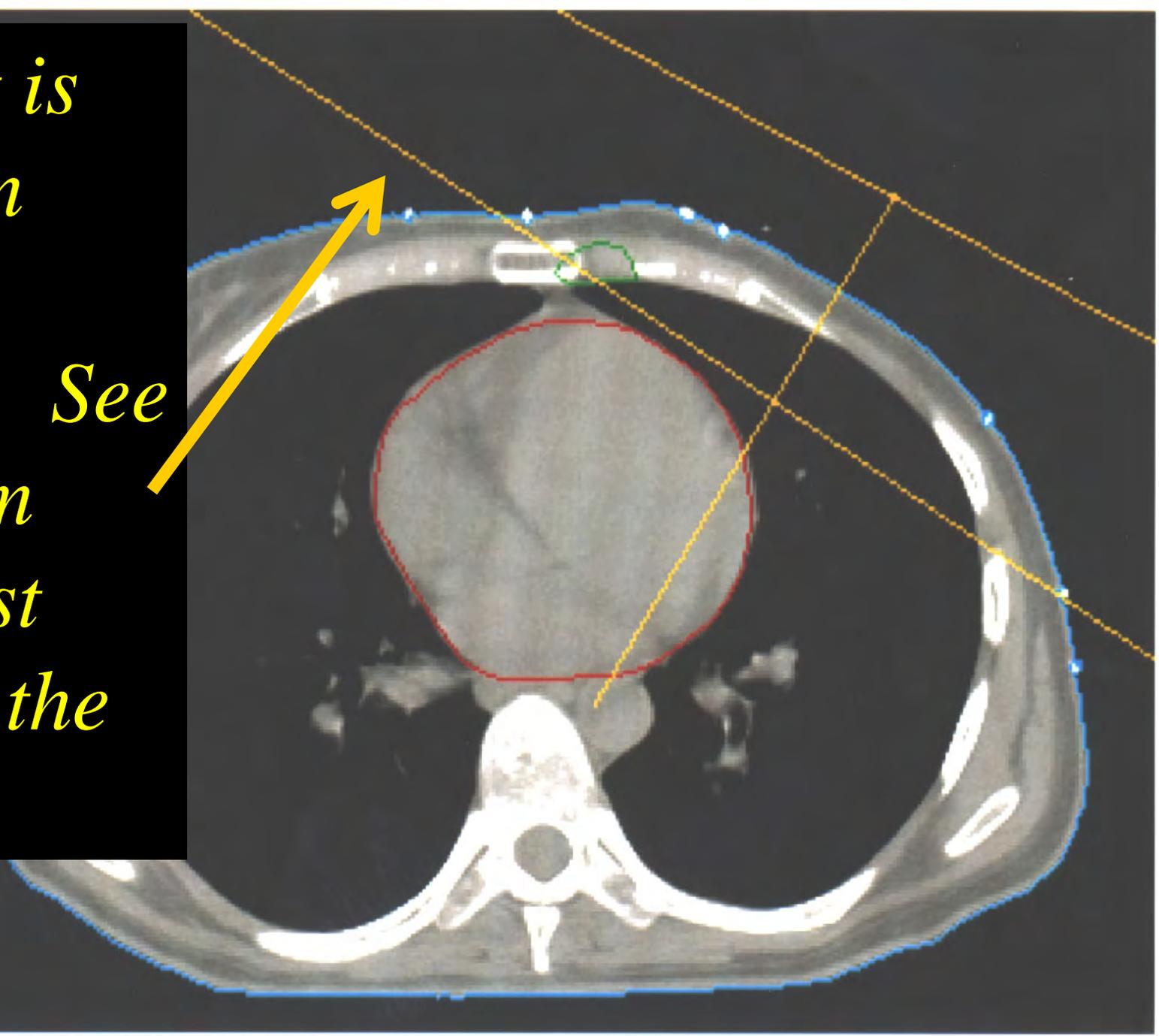
***“This picture shows the shape of the radiation beam.***

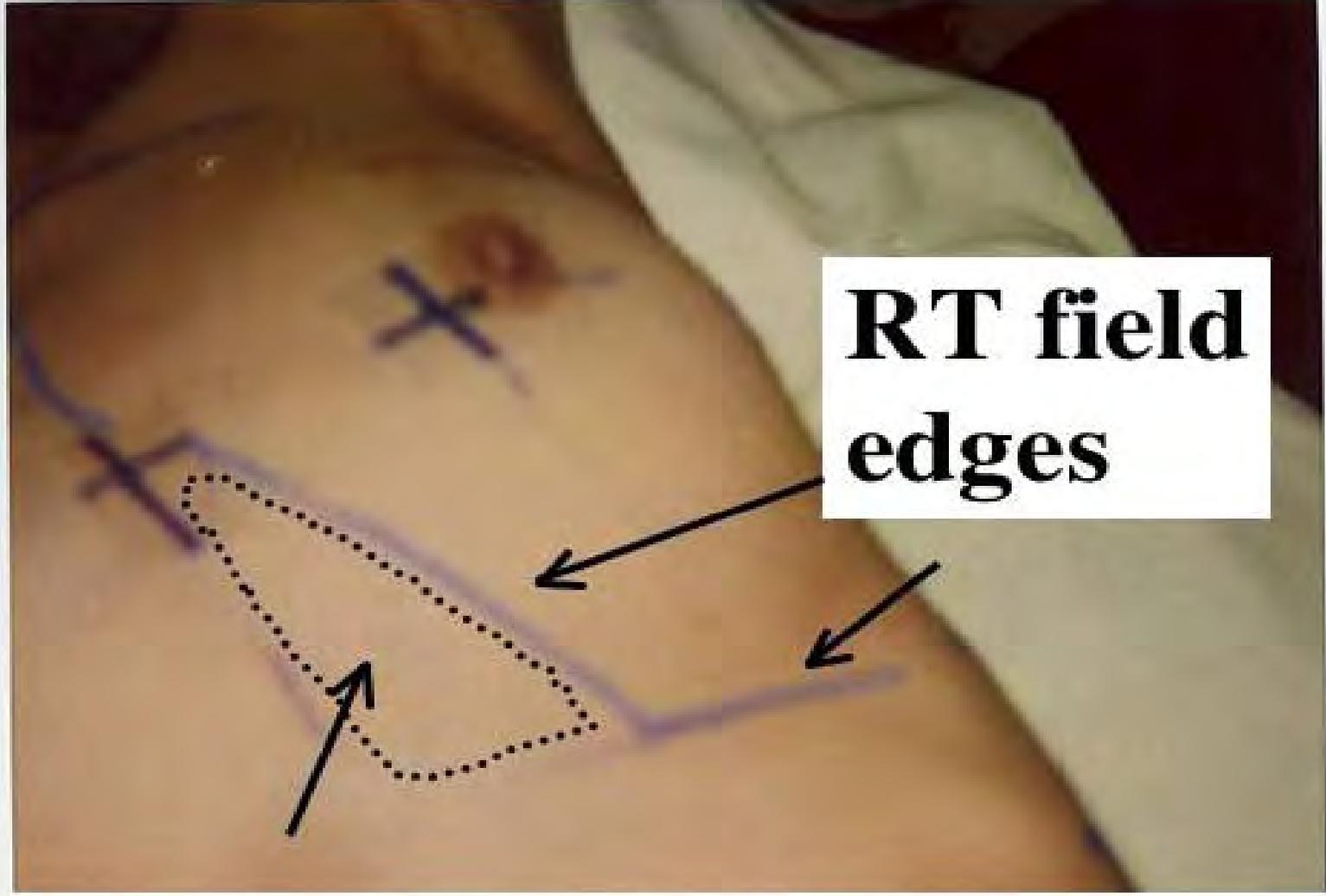
***The beam is close to the heart (acknowledge)....***

***It needs to be close since the breast is also close to the heart (context)***

***See how we shape the beam to reduce the amount of the heart in the beam (reassure)***

*“Here it is again on another image... See the beam path, just missing the heart.”*





*“The marks on your skin are the outline of the radiation beam. This part is is angled to avoid the heart.”*

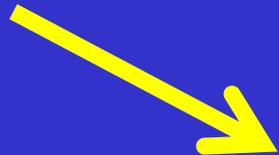
# What is the goal?

Educate, and  
inform the patient

Acknowledge

Context

Reassure



Build trust and  
confidence



## Involve/empower the patient

*“The machine takes pictures of you to assure correct positioning... The pictures take time.. That’s one reason why the treatment takes so long. **It’s important you lie still during treatment to minimize risks.** The head cast helps to increase accuracy. It’s uncomfortable, but is helpful.”*

# Time horizon is key!

- Risks: short-term & long-term
  - What is patient's prognosis?
- Time course of radiation-induced benefits??
  - Can be years!!
- Risk/benefit discussion = f (prognosis)
  - Hard part: *“you do not need to worry about this risk since you are unlikely to live long enough to experience the toxicity”*

# In our Information Sheets

- “Short-term risks that are common”

- “Long-term risks that are very uncommon”

# Administrators, Health Care Workers, and General Public

- Acknowledge
- Context
  - more abstract, based on population estimates vs. individual patient-specific risks
- Reassure
  - *“We need to have that new device as it will allow us to reduce the risks to our patients”*
- Uphill battle: Consent for chemotherapy?

# Left Sided Breast RT

Intact Breast

Mastectomy

Tumor Location

Superior

Inferior

Heart  
Block

Adjust Gantry  
Electron patch  
if thin

**Breath hold**

Tangents with heart block  
electron patch?

electrons to medial chest

**breath hold**

# Summary

- Communicating risks of RT challenging
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- Tailoring the message (?)
  - Patients and family, medical community, hospital administration, general public
- Key points
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# Acknowledgements

**James Tulsy, MD**

**Mark Kostich, CMD**

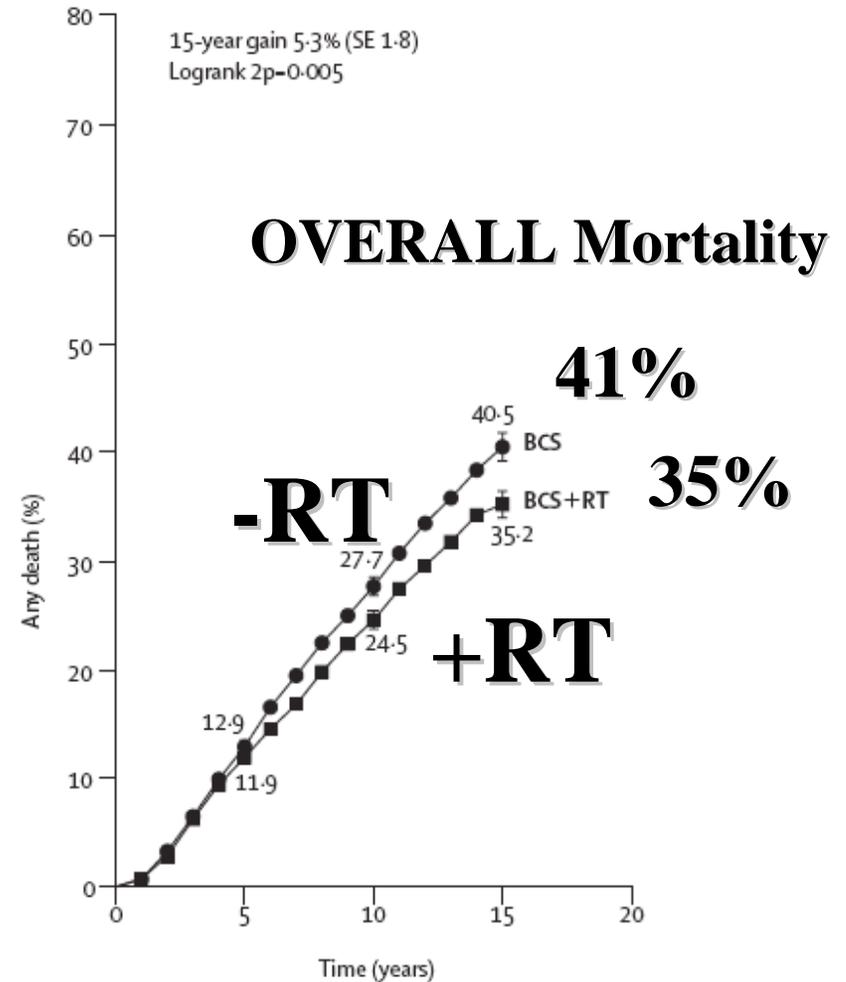
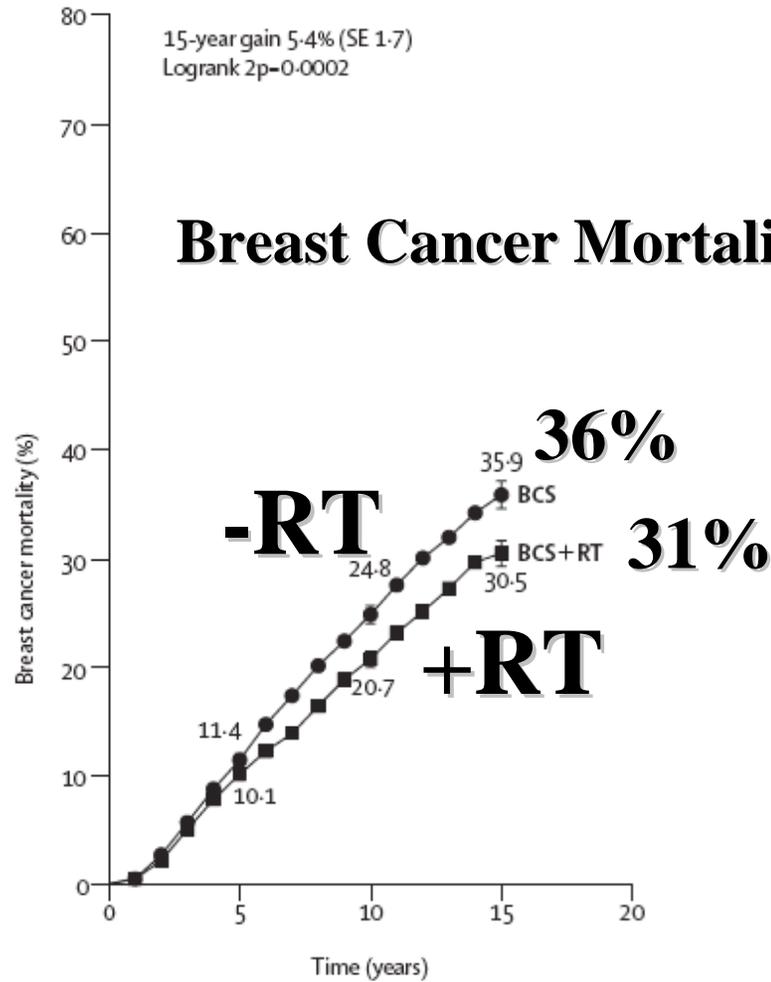
**David Fried, BS**

**Janet Bailey, MS**

**Bhisham Chera, MD**

# Lumpectomy + / - RT (N=7311)

RT after BCS, generally with AC: 7311 women, 17% with node-positive disease



*Lancet* 366:2087-2106, 2005

**DOES COMMUNICATING – OR  
FAILING TO COMMUNICATE – RADIATION  
RISKS TO PATIENTS ENGENDER  
MALPRACTICE RISKS FOR PHYSICIANS?**

**2010 NCRP Annual Meeting on  
Communication of Radiation Benefits and Risks in  
Decision Making**

**National Council on Radiation Protection and  
Measurements, March 8-9, 2010**

**Bethesda, MD**

Leonard Berlin, MD, FACR  
Department of Radiology  
NorthShore University HealthSystem  
Skokie Hospital, Skokie, IL  
Professor of Radiology  
Rush University Medical College  
Chicago, IL

# Informed Consent

“Any human being of adult years and sound mind has a right to determine what shall be done with his own body.”

Schloendorff v Soc. of N.Y., Hos NE92 (NY 1914)

# Two Types of Consent

- Implied Consent, given by patient's actions rather than spoken words, e.g., voluntarily climbing on exam table, drinking liquid barium, extending arm for IV injection
- Express Consent, explicitly stated, required for patients about to undergo procedures that are not considered "simple"

Reuter, AJR 1987; 148:219

# Informed Consent

- Must include benefits, risks, alternative measures, and risks of not performing the exam or procedure.

Reuter, AJR 1987; 148:219

# When Is Informed Consent Required?

- All severe risks, e.g., death, paralysis, loss of cognition; even if probability is negligible
- Less-severe risks, if their occurrence is frequent
- Nominal risks with low probability need not be disclosed

Mayo Clin Proc 2008;83:313

Although the courts generally do not require full disclosure of all possible risks or complications, there are no clearly defined rules governing what needs and does not need to be divulged to patients.

One may not know what should have been disclosed as part of a medical consent until a lawsuit is filed and resolved.

Mayo Clin Proc 2008;83:313

Medical practice has shifted “from paternalistic to consultative, in which the physician lays the possibilities before the patient, with the potential pluses and minuses of each, and the patient makes a choice.”

Mayo Clin Proc 2008;83:313

# Communication of Radiation Risks

Conveying information in a positive, rather than a negative, format helps patients understand an accurate perspective of risk. Rather than saying there exists certain likelihood that cancer could develop later in life, the message with a positive, accurate perspective is that “the cancer risk is small,” and that the likelihood the patient will remain healthy with no adverse radiation effects is only slightly different from any other patient.

ACR PG for Imaging Pregnant or Potentially Pregnant Women with Radiation, 2008

# Radiation Safety and Imaging

Radiologists have a responsibility to minimize radiation dose to individual patients, to staff, and to society as a whole, while maintaining the necessary diagnostic image quality. This concept is known as “As Low As Reasonably Achievable (ALARA)”

ACR PG for Excret Urography, 2007

Twenty-five years ago radiation physicist Lauriston Taylor described the public's perceptions regarding radiation exposure and hazards as a "cloud of ignorance or misunderstanding...and there is a common feeling among the uninformed public and news media that radiation is so mysterious that even the scientists don't know what's happening."

# Public's Concern Regarding Radiation Risks Are Nothing New

"Media hyperbole about radiation risks may make a positive public perception of CT difficult to achieve and sustain, and illicit fear from the public....Patients who undergo CT should receive information about the estimated increase in cancer risks, in order to avoid unnecessary legal confrontations in the future should such patients develop cancer. Given a 10-30 latency time for cancer induction, policies need to be adopted now to avoid problems in the future."

# CT Causes Cancer: The 2007 Salvo I

- Typical CT dose ranges 15-30 mSv (1.5 – 3 rads)
- Atomic-bomb survivors who received radiation doses in range of 5-150 mSv showed significant increase in cancer occurrence
- 53% of radiologists and 91% of ED MDs do not believe CT increases lifetime risk of CA

Brenner, NEJM 2007;357:2277

# CT Causes Cancer: The 2007 Salvo II

“Overuse of diagnostic CT scans  
may cause 3 million excess  
cancers in USA over next 2-3  
decades”

USA Today, 11-29-07

# CT Causes Cancer: The 2007 Salvo III

“Cancers have never been detected in animals or in humans from doses below 100 mSv; cancer risk projections based on the linear no-threshold model in this dose range are highly debatable.”

Tubinana, NEJM 2008;358:850

# Cancer Risks from X-ray Scans Used for Airport Screening I

"Backscatter scanners deliver radiation dose equivalent to 1% or less of radiation in a dental x-ray. Amount is so small that risk to individual is negligible.

But collectively, radiation doses incrementally increase risk of fatal cancers among the thousands or millions of travelers who will be exposed.

We cannot exclude the possibility of a fatal CA attributable to radiation in a very large population of people exposed to very low doses of radiation."

# Cancer Risks from X-ray Scans Used for Airport Screening II

“The health effect of small doses of radiation is not observed, but inferred from the visible effects of higher doses. If a million passengers were screened, 10 more cancer deaths a year would occur.”

Wald, NYT 1-9-10

# **Cedars-Sinai Hospital, LA, and Jacoby Roth**

“Jacoby has not shown any ill-effects yet, but effects of radiation can take years to develop, and prognosis is uncertain. Expert predicts child will develop cataracts in three years and possibly radiation-induced cancer. The parents are subjected to worry for the rest of their lives - - forever.”

Bogdanich, NYT, 10-16-09

# CT Radiation and Cancer

No studies have verified the linear, no-threshold assumption about cancer arising from low doses used in dx imaging. Hiroshima data are extrapolated down to lowest doses, and no-threshold theory is invoked by scientific professionals and the media to cause fear about even routine imaging.

Mezrich, NEJM 2009;361:2290

# CT Radiation and Cancer I

“Exposure to radiation is of concern because evidence has linked exposure to low-level radiation at doses used in imaging to development of cancer....Increased risk of cancer has occurred among long-term survivors of Hiroshima and Nagasaki atomic bombs, who received 10-100 mSv, a dose equivalent to CT scans....CT may cause more cancers than it prevents....”

Smith-Bindman, Arch Intern Med 2009;169:2078

# CT Radiation and Cancer II

“Our estimates suggest approx 29,000 future cancers could be related to CT scan use in the US in 2007....There is direct evidence from atomic bomb survivors, nuclear workers, and patients receiving x-ray exams that radiation doses of 5-10 rad can cause cancer.

deGonzalez Arch Intern Med 2009;169:2071

# Radiation and Cancer I

Literally billions of dollars have been spent on researching the possible carcinogenic effects of low-dose radiation, and the answer is still not in. However, ask the media and most doctors, "Do we know that diagnostic x-rays cause cancer? The answer will likely be, Yes."

There is no way for us to absolutely know whether low doses of background or diagnostic radiation are dangerous. In fact, some scientific evidence suggests low doses are potentially beneficial.

Brant-Zawadzki, Medscape, 8-14-06

# Radiation and Cancer II

Relationship between carcinogenesis and radioactivity is still evolving, and our so-called “knowledge” lies somewhere between myth and established scientific fact. In the meantime, “indisputable facts” are indeed disputable.

Brant-Zawadzki, Medscape, 8-14-06

# Not The Way To Communicate

“The benefit of catching a serious brain injury may be outweighed by the dangers of exposure to radiation from a CT scan.”

“One in 1100 children who receive CT scans may eventually die from a cancer caused by excess radiation.”

“A 45-yr-old woman with history of kidney stones who had 70 CT scans over 22 yrs has had her lifetime risk of cancer raised by 10%.”

“Even the lowest amount of exposure to radiation has some risk.”

# Not The Way To Communicate II

“Pts with a median age of 70 who were inadvertently exposed to 8x the expected level of radiation due to a faulty CT scanner, carry a 1-in-600 risk of developing a brain tumor.”

“A 2-yr-old boy who underwent 151 CT images of the brain instead of the prescribed 25 images has a lifetime increased risk of fatal cancer of 39%.”

# The Way to Communicate

A fundamental precept of the physician is to “do no harm.”

Physicians are healers, but they are also educators and teachers. Thus, we must encourage rather than discourage public attention and discussion regarding radiologic imaging and associated radiation exposure.

# The Way to Communicate

“We have to talk sense to the American people.”

Adlai Stevenson, 1952

“There’s only one thing about which I am certain, and that is there is very little about which one can be certain.”

W. Somerset Maugham

# Cedars-Sinai Finds More Patients Exposed to Excess Radiation

- 260 pts had been exposed to high doses of radiation, during CT brain scans, up from the hospital's original estimate of 206
- 80 pts temporarily lost patches of hair as a result of the scans, which delivered 8x the necessary radiation.

Cruz, LA Times, 11-10-09

# Four Patients Say Cedars-Sinai Did Not Tell Them They Had Received a Radiation Overdose

The hospital says it contacted all pts affected by the CT scan error. But some tell *The Times* they were only asked about hair loss, and not told of the mistake or its potential cancer risk.

One pt said, "I'm scared. I don't want brain cancer. I want to get my life back."

Zarembo, LA Times, 10-15-09

# FDA: CT Scans Exceeded Proper Doses

- 250 patients, 4 facilities, 2 states
- Received 8x expected dose of radiation during CT perfusion scans
- Not clear whether human error or design flaws in GE and Toshiba machines contributed to these adverse events
- All of exposed pts may be at increased risk of developing certain cancers in the months or years following their scans.

Kuehn, JAMA 2010;303:124

# Cell Phone Radiation Aids Sick Mice

- Radiation associated with cell phone use appears to protect against and reverse Alzheimer's-like symptoms in mice
- After 7 months of 2-hr daily exposure to cell phone radiation, mice fared better on cognitive tests than their unexposed littermates
- Older mice which had already developed Alzheimer's symptoms also performed better than non-exposed mice
- More studies needed, and results must be extrapolated to humans with caution

Wall Street Journal, 1-12-10

One thing I learned during my years as CEO is that perception matters. And in these times when public confidence and trust have been shaken, I've learned the hard way that perception matters more than ever.

Jack Welch, WSJ, 9-16-02

There Is No Radiation When  
You Don't Do The Exam.

# Conclusion

- It is the responsibility of the clinicians to ensure that each CT scan is indicated, to order the least invasive modality with the highest certainty of success, and to discuss case with radiologist when unsure.
- It is the responsibility of the radiologist to understand radiation doses, review requests involving high-dose studies, use appropriate technical factors and discuss case with clinicians when required.

# Image Gently Campaign

- Launched January 2008 by Society for Pediatric Radiology, American College of Radiology, American Society of Radiologic Technologists and American Association of Physicists in Medicine
- National initiative to educate providers regarding radiation doses generated by diagnostic imaging, especially in children

# The Jacoby Roth Case

- In January 2008, 23-month boy fell out of bed, taken to ED in Arcata near San Francisco
- MD ordered CT of cervical spine
- Scan took 68 minutes, included 151 scans
- Estimated dose 2800mSv and possibly as high as 11,000 mSv (normal range 1.5-4 mSv)

Aunt Minnie, 9-18-09

# Class Action Lawsuit Filed Against Cedars-Sinai Medical Center and G.E.

- Filed 10-19-09 in L.A. Court
- Plaintiff Trevor Rees underwent two CT scans for stroke in Dec 2008, received 8x expected dose
- Suffered hair and eyebrow loss and scalp burn
- Allege med malpractice, strict product liability, breach of warranty
- Google web-ads already soliciting pts who have been scanned at Cedars during same period

Aunt Minnie 10-20-09

# Over-radiated at Cedars-Sinai

- Columbia Rad Physicist Brenner calculated each overdose carried 1-in-600 risk of causing brain tumor

Zarembo, LA Times, 10-14-09

# ACR Statement

## Airport Full-body Scanners

- *Millimeter wave technology* uses low-level radio waves that cover the passenger with low-level RF energy
- *Backscatter technology* uses extremely weak x-rays delivering less than 10 microRem, equal to flying in aircraft for two minutes at 30,000 ft.
- National Council on Radiation Protection and Measurement states traveler would have to undergo 100 backscatter scans per year to reach “negligible individual dose.” I.e., traveler would have need to undergo 1000 such scans in a year to reach the same dose as a standard chest x-ray.
- ACR is not aware of any evidence that either of the scanning technologies used for security screening will present significant biological effects for passengers.

# ACR Statement Regarding CT Scan Increased Cancer Risk

No published studies show that radiation from imaging exams causes cancer. Statements to the contrary rely on data which equates radiation exposure and effects experienced by atomic bomb survivors to present day patients who receive CT scans. CT delivers limited radiation to small portion of the body. Bomb survivors experienced instant full-body radiations including x-rays, neutrons, and other radioactive materials. Cancer assumptions based on this paradigm should not be accepted as medical fact.

# “Significant Incidence” of Complications

Not all risks need to be disclosed to a patient, only the material risks. Evidence was presented that 1 in 100,000 patients will die as result of IVP contrast media injection. Court concluded that no prudent juror could reasonably have considered this risk to be material requiring consent.

Pauscher v Iowa Med Cntr, 408 Nw2d 355, Iowa 1987

# Talking Sense to the American People

“Let’s talk sense to the American people. Let’s tell them the truth, that there are no gains without pains.”

Adlai Stevenson 1952

# Litigation

- Courts are open to any aggrieved individual who wishes to file a lawsuit
- Even if lawsuit is later voluntarily withdrawn or dismissed, defense costs can be significant
- “One of the privileges of being an American is having the right to defend oneself in a lawsuit”

# Radiation, Thyroid Cancer, and Michael Reese Hospital

- From mid-1940s to mid-1950s many children received radiation treatment for enlarged tonsils and adenoids, therapy considered acceptable at the time
- Many later developed thyroid cancer
- 70 malpractice lawsuits were filed, majority alleging they *might* develop cancer
- Eventually all were dismissed by Illinois Supreme Ct. which ruled that medical community did not possess reasonable knowledge that radiation could cause cancer during period of treatment

Is there currently sufficient knowledge in medical community to reasonably conclude that cancer can develop from diagnostic radiologic procedures?

Eventually state and possibly federal supreme courts will have to decide this issue.

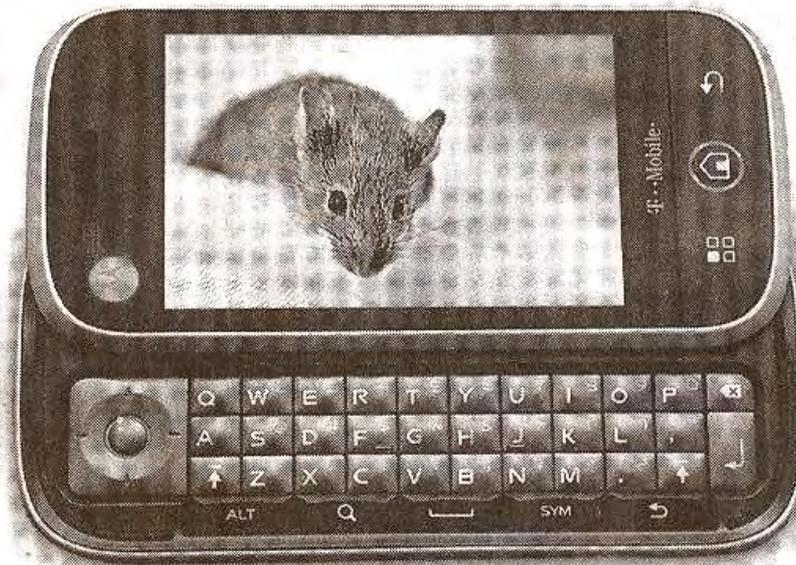
## HEALTH & WELLNESS

THE RESEARCH REPORT | *New Medical Findings*

WSJ 1-12-10  
D4

# Cellphone Radiation Aids Sick Mice

Radiation associated with long-term cellphone use appears to protect against and reverse Alzheimer's-like symptoms in mice, according to a study in the *Journal of Alzheimer's Disease*. Mice genetically engineered to develop brain impairments similar to Alzheimer's in humans were divided into two groups. One group was exposed for two hours each day to electromagnetic fields akin to those created during cellphone use. Mice in the other group were not exposed to the radiation. After seven months, young mice in the first group fared significantly better on cognitive tests than their unexposed littermates. Older mice, which had already developed symptoms of Alzheimer's, exposed to the radiation for eight months in a subsequent experiment also



European Pressphoto Agency (mouse), Reuters (phone) composite by WSJ

Mice seem to reap cognitive benefits from cellphone electromagnetism.

# FDA Warning: CT Scans Exceeded Proper Doses

JAMA  
1-13-10  
303:124

Bridget M. Kuehn

**M**ORE THAN 250 PATIENTS treated at 4 or more facilities in 2 states received up to 8 times the expected dose of radiation during computer-assisted tomography perfusion scans, according to an ongoing investigation by the US Food and Drug Administration (FDA).

In early October, the FDA warned health care workers that it had received reports of 206 patients receiving excess doses of radiation from computed tomographic (CT) scans used to diagnose stroke over an 18-month period at Cedars-Sinai Medical Center in Los Angeles (<http://www.fda.gov/Safety>

and Toshiba machines contributed to these adverse events, said Jeffrey Shuren, MD, JD, acting director of the FDA's Center for Devices and Radiological Health (CDRH), during a media briefing. "We wouldn't be surprised to hear there were similar occurrences in other states," Shuren said.

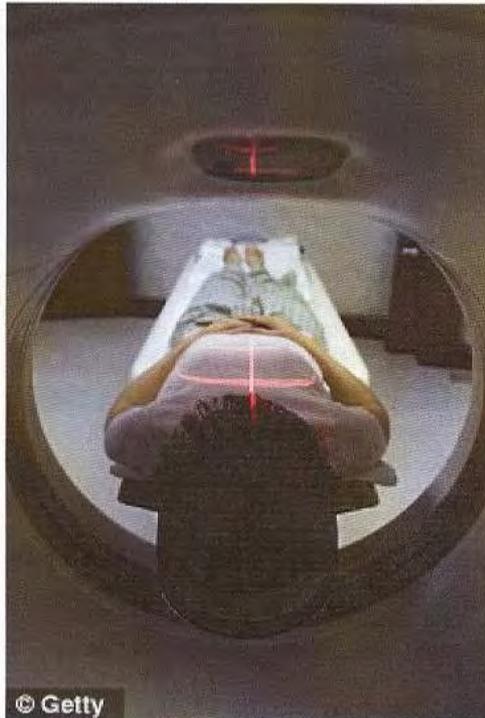
Some of the overexposed patients developed skin redness or experienced hair loss, and all of the exposed patients may be at increased risk of developing certain cancers or cataracts in the months or years following their scan, said Charles Finder, MD, associate director of the division of mammography quality and radiation programs at the FDA's CDRH.

## CAT scan cancer fear: Radiation 'could trigger the disease in one in 80 patients'

By Jenny Hope

Last updated at 9:17 AM on 15th December 2009

LONDON DAILY MAIL  
12-15-09



**Women are at particular risk from CAT scans as they are more sensitive to the effects of radiation**

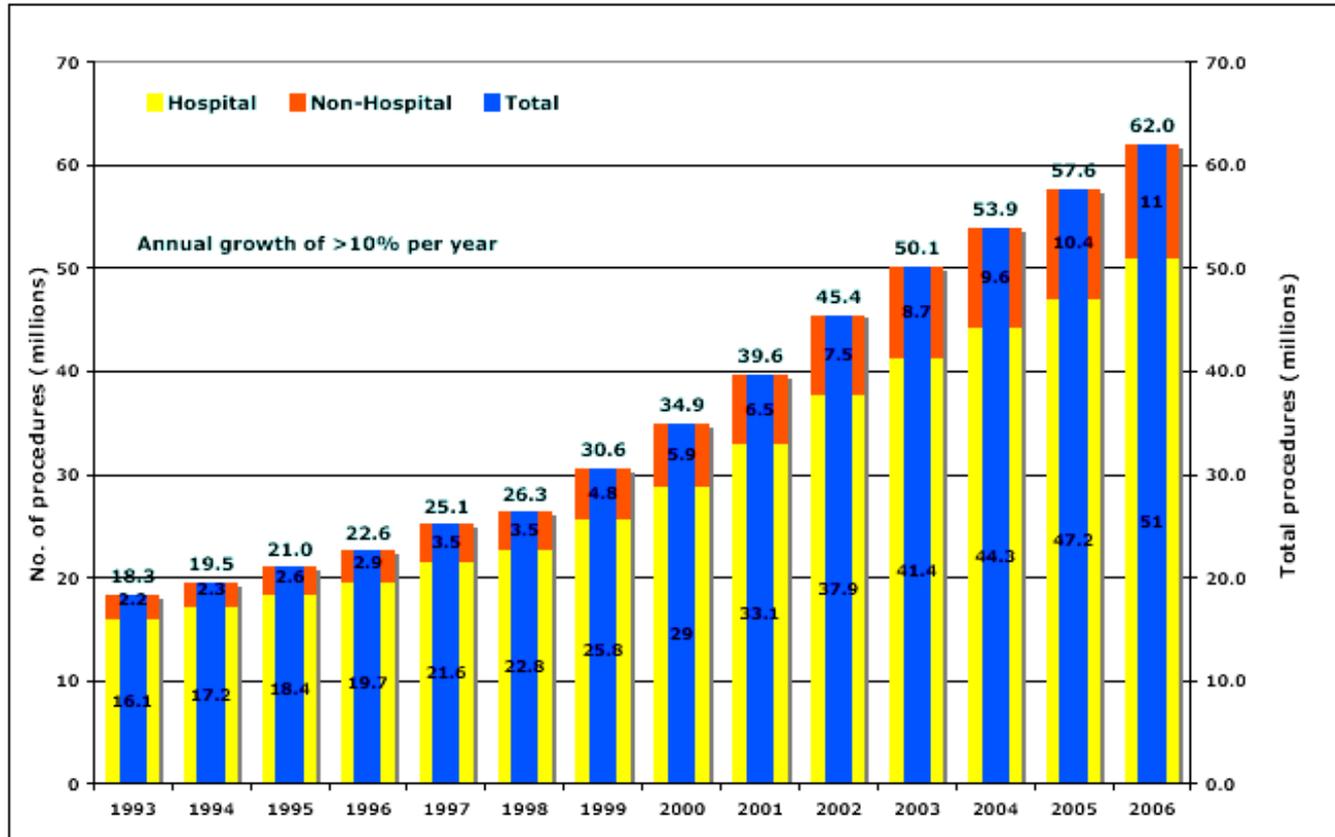
Having a CT - or CAT - scan puts patients at far greater risk of developing cancer than previously thought, scientists claim.

The radiation generated by the scans - an increasingly popular diagnostic tool - may trigger the disease in as many as one in 80 patients.

# Computed Tomography Radiation and Population Dose

Fred A. Mettler Jr. M.D., M.P.H.  
Radiology & Nuclear Medicine  
New Mexico VA Medical Center  
University of New Mexico  
[fmettler@salud.unm.edu](mailto:fmettler@salud.unm.edu)

# Remarkable growth in number of CT scans



Now about 70 million CT scans annually

Growth CT > 10% annually US population < 1% annually

# U.S. 2006

CT is 17 % of all procedures and half of all dose

	Number procedures	%	Collective dose (Person-Sv)	%	Per capita (mSv)
Radiography	293 million	74	100,000	11	0.33
Interventional	17 million	4	128,000	14	0.43
CT	67 million	17	440,000	50	1.5
Nuclear Medicine	18 million	5	231,000	26	0.8
Radiotherapy	1 million pts	NA	NA	--	--

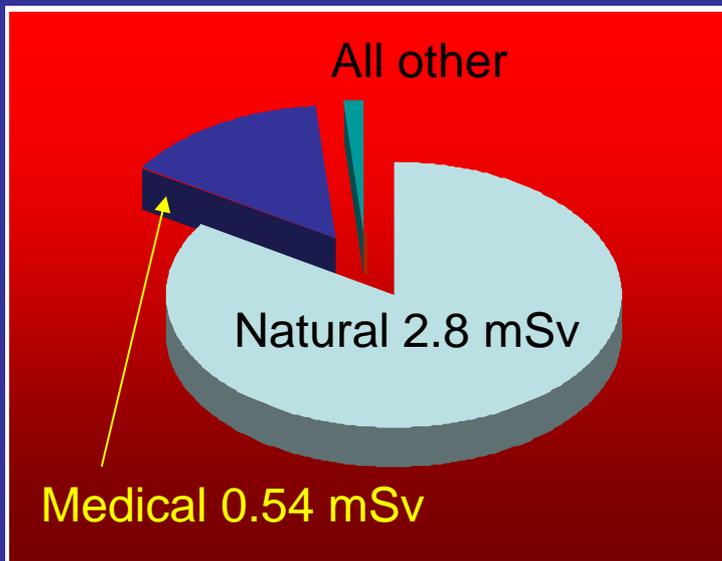
**Total x-ray + NM = ~ 395 million**

**~ 900,000**

**~ 3.0**

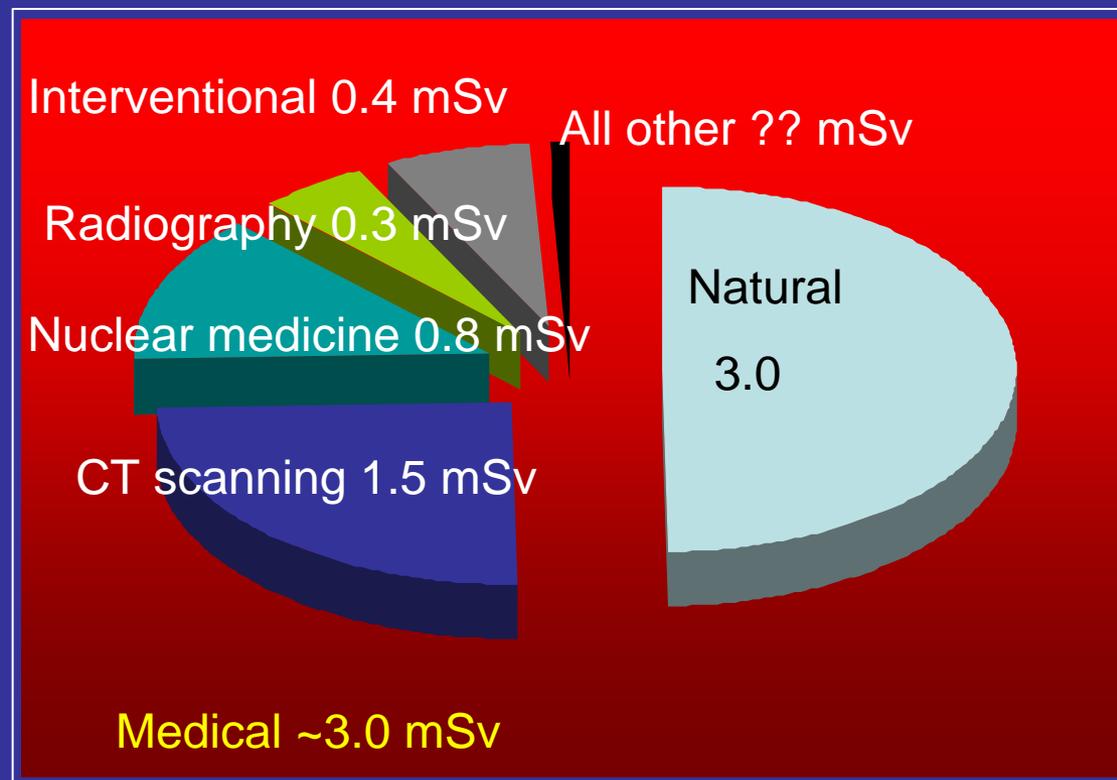
# Changes in total U. S. radiation dose

U.S. 1980



Total 3.6 mSv per capita

U.S. 2006



Total ~ 6.0

Lots of recent attention  
Issue actually recognized in 1998

*The* NEW ENGLAND  
JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

AUGUST 27, 2009

VOL. 361 NO. 9

Exposure to Low-Dose Ionizing Radiation  
from Medical Imaging Procedures

Reza Fazel, M.D., M.Sc., Harlan M. Krumholz, M.D., S.M., Yongfei Wang, M.S., Joseph S. Ross, M.D.,  
Jersey Chen, M.D., M.P.H., Henry H. Ting, M.D., M.B.A., Nilay D. Shah, Ph.D., Khurram Nasir, M.D., M.P.H.,  
Andrew J. Einstein, M.D., Ph.D., and Brahmajee K. Nallamothu, M.D., M.P.H.

# Wall Street Journal March 1, 2010

## THE INFORMED PATIENT

# Radiation Risks Prompt Push to Curb CT Scans

BY LAURA LANDRO

For millions of patients, a CT scan can mean the difference between life and death, detecting a brain tumor, blood clot or burst appendix in seconds.

But federal regulators, radiology groups and hospitals are launching efforts to scale back use of the scans, also called CAT scans, amid growing evidence that they are exposing millions of patients to radiation that may elevate the risk of cancer in the future. A third or more of scans may be unnecessary or repetitive, studies show, and in scans that are medically appropriate, radiation doses could be dramatically reduced without hurting the quality of images.

Combining special X-ray

### Exposure Levels

Here are typical doses, in millirems, of radiation an average patient would receive in various medical procedures:

Exam	Effective Dose (mrem)
Dental X-ray	2
Chest X-ray	10
Mammogram	70
CT spine	600
CT pelvis scan (multiple exposures)	1,000
Angioplasty	750-5,700

Source: American College of Radiology

WHITE PAPER

# WHERE CAN \$700 BILLION IN WASTE BE CUT ANNUALLY FROM THE U.S. HEALTHCARE SYSTEM?

**“CT, MRI and PET is a has ballooned to a  
\$100 billion a year industry”**

ROBERT KELLEY  
VICE PRESIDENT,  
HEALTHCARE ANALYTICS  
THOMSON REUTERS

**“\$ 26.5 billion in  
unnecessary CT and  
MRI”**

OCTOBER 2009

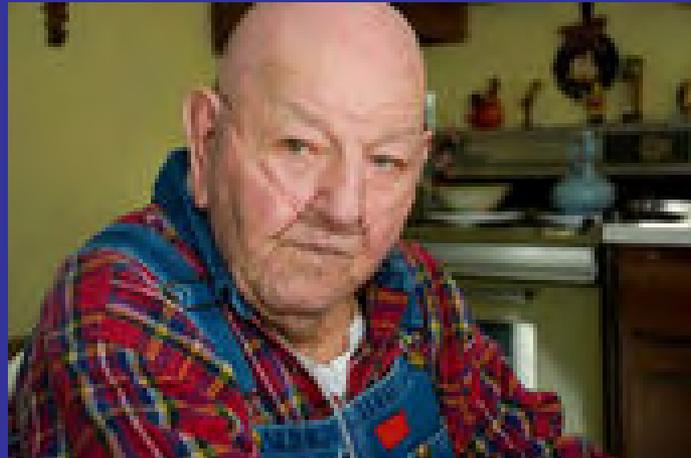
# Rates of CT scanning

(scans per 1000 persons annually)

- Well developed countries 116 (average)
- UK 21
- Spain 51
- Sweden 70
- Austria 75
- Switzerland 91
- Norway 99
- Germany 111
- **United States 223**
- Japan 349

Benefit/Risk communication is really for the purpose of acceptance of risk etc.

- Who accepts the risk ????
- The patient..... Isn't that obvious ??



# Can we really communicate to any normal patient the risks/ benefits and uncertainties that are associated with CT scanning?

Calcium score

Effective dose

AEC

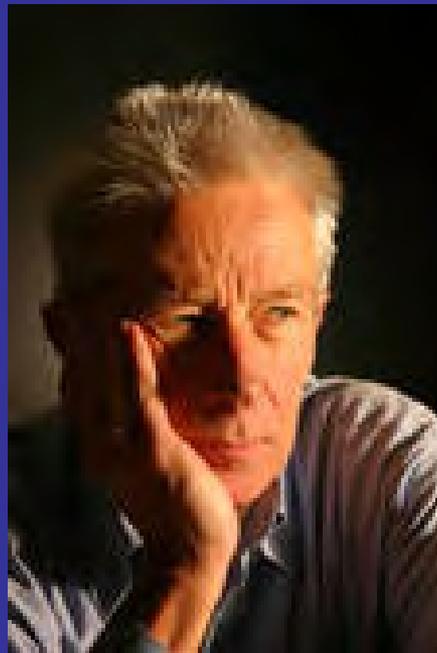
CT angiogram

64-slice

Dual tube

DLP

Triple-phase liver scan



Contrast reaction

GFR

CT fluoroscopy

CTDI

Cancer risk

Equivalent dose

PET/CT

Bowtie filters

Virtual colonoscopy

A large part of benefit/risk acceptance is not really done by the patient at all

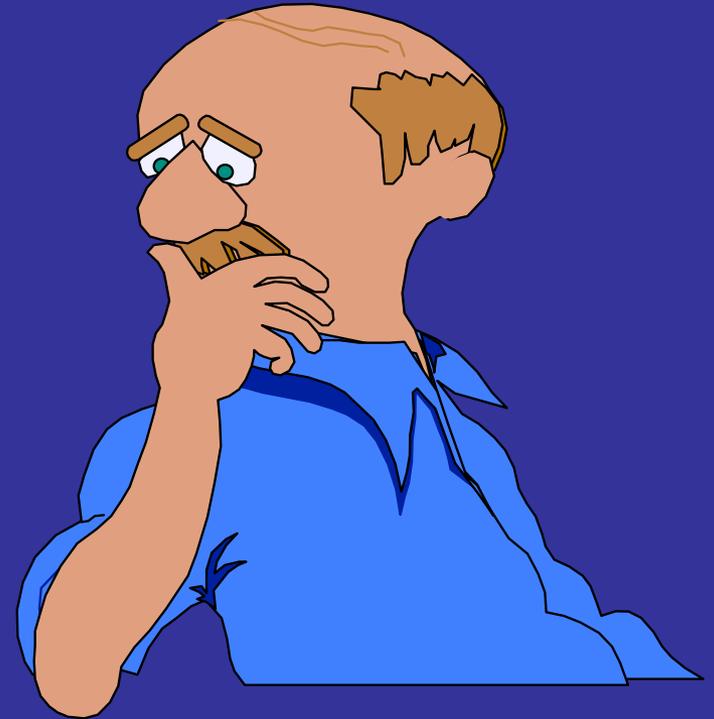
But by .....

- Patient
- Family
- Physician
- Institution
- Manufacturers
- Regulators
- Society



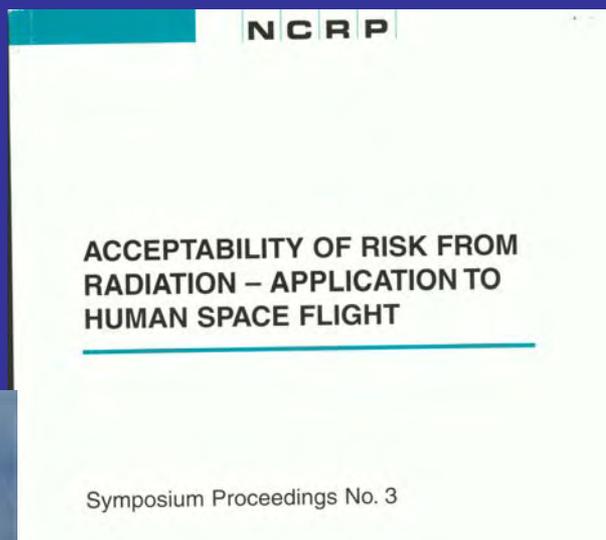
A point not to be lost...

Benefit/risk  
communication in  
medicine covers a lot  
more than just radiation



Can we find an example of radiation and other complex risk situations.....

to see what the affected people think ?



# The radiation protection philosophy and risk acceptability views of an astronaut

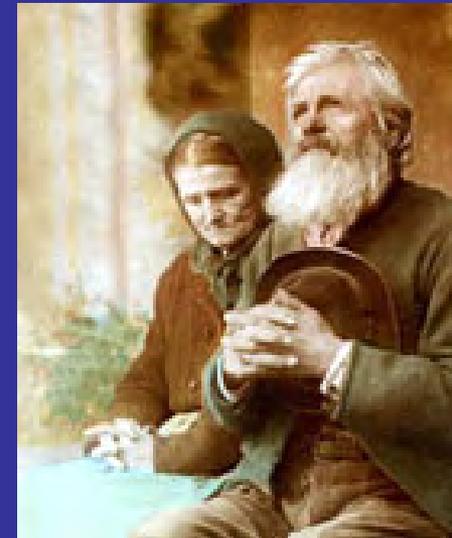
Ellen Baker, NASA

- “As astronauts our mission risks are high but that does not mean that we should also accept high levels of radiation risk”
- “We still do not understand the full range of radiation risks”
- “Therefore we rely on you to provide us with the latest information and provide us with the most up-to-date techniques to reduce or minimize radiation risks”

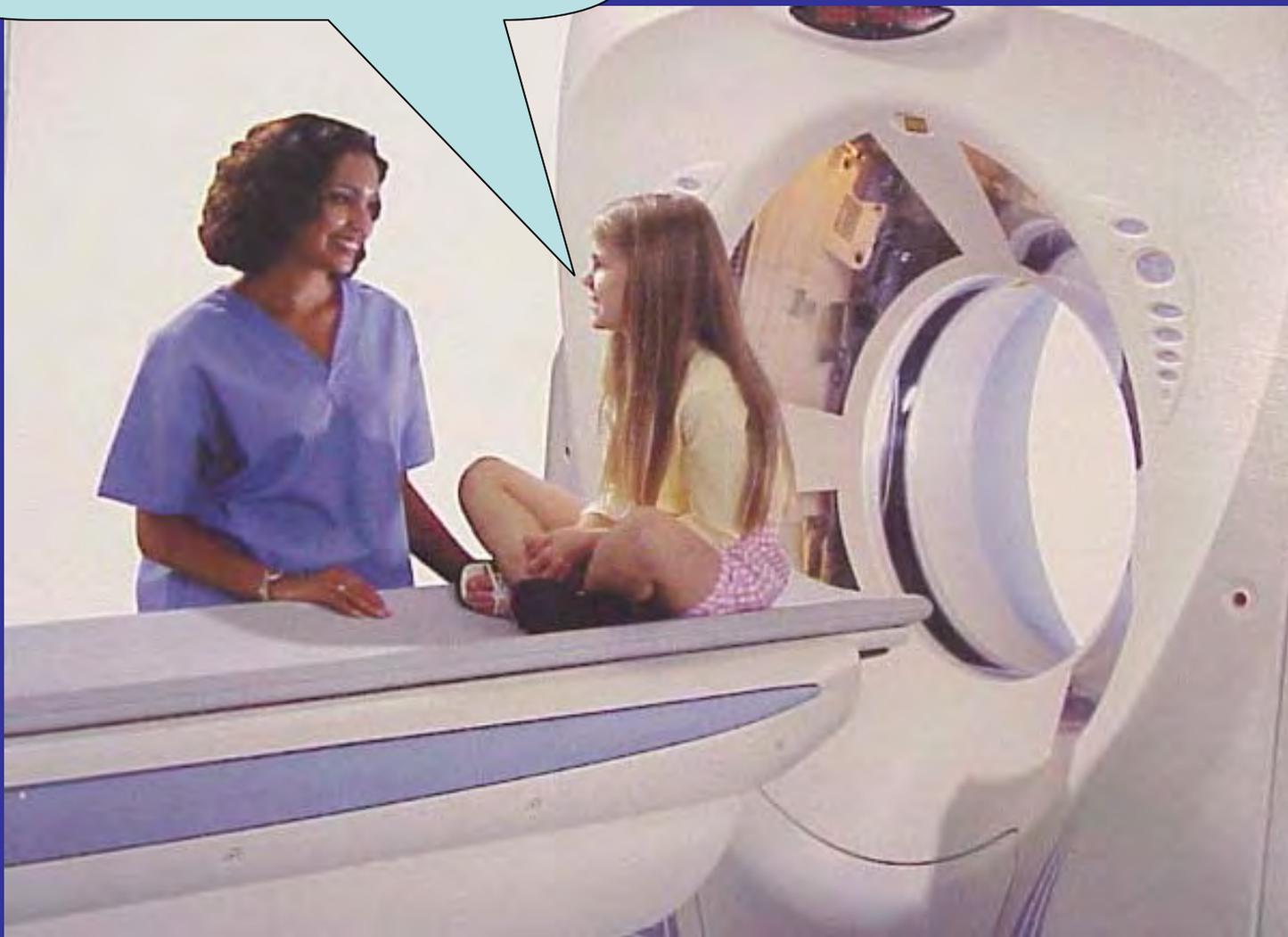


# Philosophy of protection (astronaut) patient

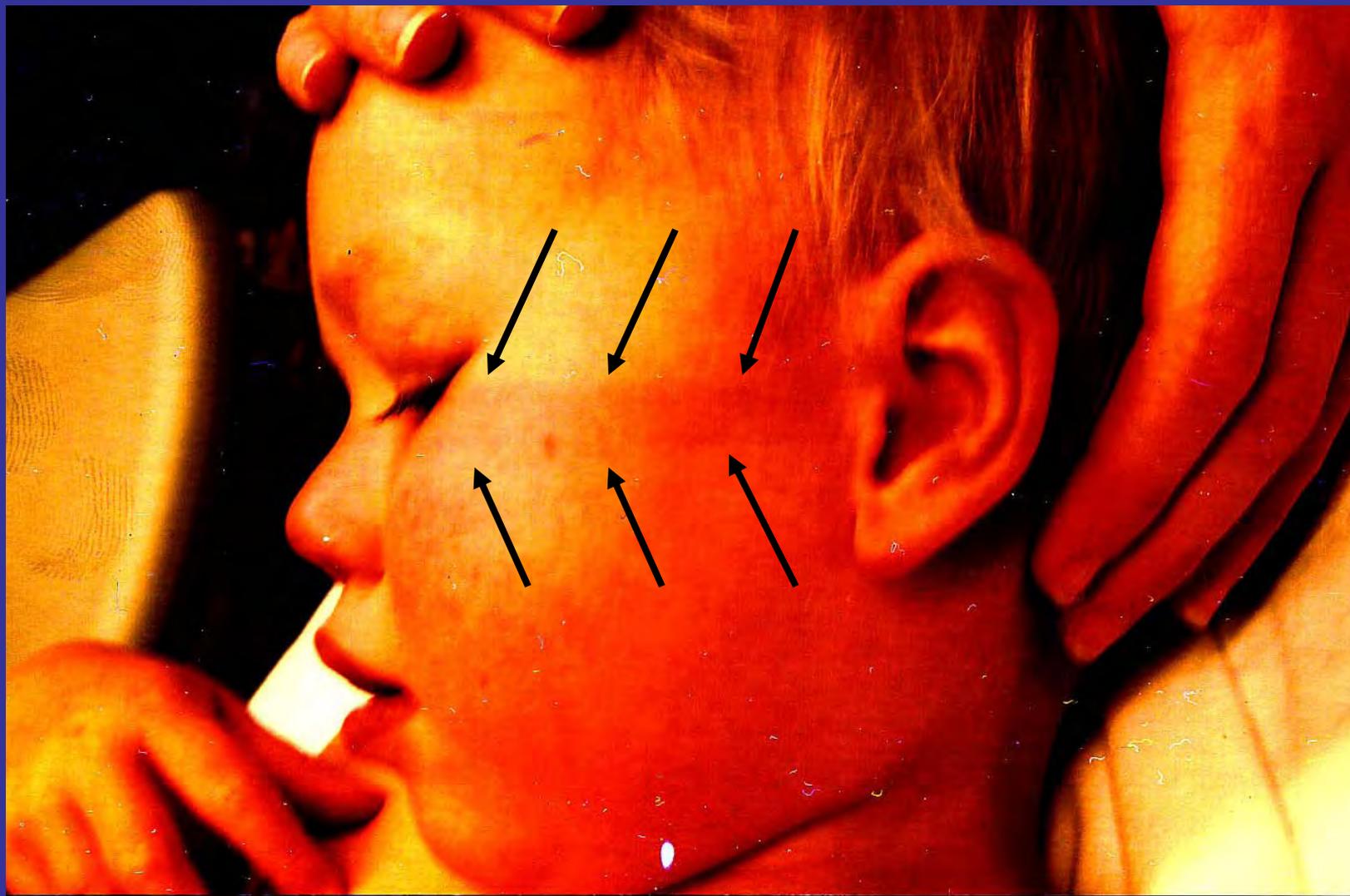
- “As (astronauts) patients our (mission) risks are high but that does not mean that we should also accept high levels of radiation risk”
- “We still do not understand the full range of radiation risks”
- “Therefore we rely on you to provide us with the latest information and provide us with the most up-to-date techniques to reduce or minimize radiation risks”



What do you mean you don't know what CTDI is associated with this exam ??



# CT overexposure: slice repeated 151 times: A communications disaster



# ***Image Gently: The Use of Social Marketing to Promote Radiation Protection for Children***

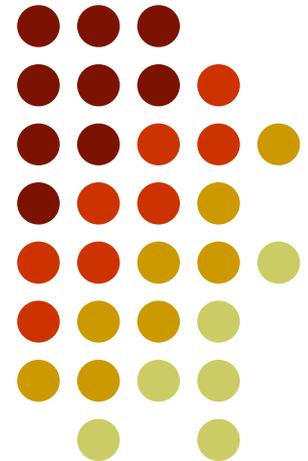
**Marilyn J. Goske, MD**

Chair, Alliance for Radiation Safety in Pediatric Imaging

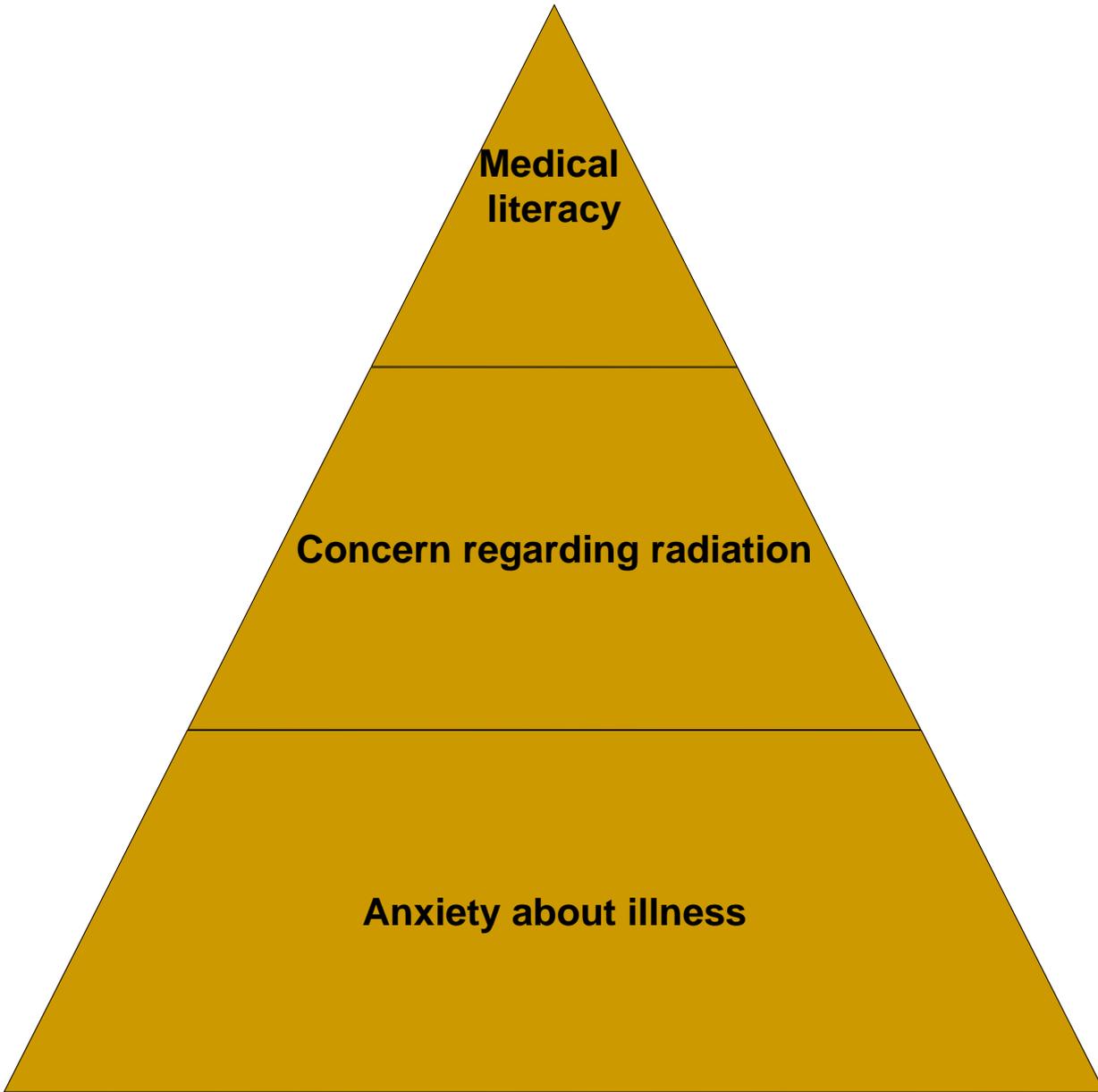
Silverman Chair for Radiology Education

Professor of Radiology

Cincinnati Children's Hospital Medical Center



**“Is the scan safe  
for my child?”**



# HOW WILL WE ANSWER PARENTS?

## CT scans in children linked to cancer later

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 University says. "Most people got a tenth or a hundredth of the dose of a CT."

Both studies appear in February's *American Journal of Roentgenology*, the nation's leading radiology journal. The first, by Brenner and colleagues, is the first to estimate the risks of "radiation-induced fatal cancer" from pediatric CT scans. Until a decade ago, CT scans took too long to perform on children without giving them anesthesia to keep them still. Today's scanners spiral around the patient in seconds, providing cross sections, or "slices," of anatomy.

Doctors use CT scans on children to

search for cancers and ailments such as appendicitis and kidney stones.

"There's a huge number of people who don't just receive one scan," says Fred Mettler of the University of New Mexico, noting that CT scans are used for diagnosis and to plan and evaluate treatment. "The breast dose from a CT scan of the chest is somewhere between 10 and 20 mammograms. You'd want to think long and hard about giving your young daughter 10 to 20 mammograms unless she really needs it."

Mettler recently published a study showing that 11% of the CT scans at his center are done on children younger

than 15, and they get 70% of the total radiation dose given to patients. Children have more rapidly dividing cells than adults, which are more susceptible to radiation damage. Children also will live long enough for cancers to develop.

Researchers led by Lane Donnelly at Cincinnati's Children's Hospital found that children often get radiation doses six times higher than necessary. Cutting the adult dose in half would yield a clear image and cut the risk a like amount, Brenner says. "Radiologists genuinely believe the risks are small," he says. "I suspect they've never been confronted with numbers like this."

**“Why don’t you just tell them  
... to lower dose ?”**

## Helical CT of the Body: Are Settings Adjusted for Pediatric Patients?

Anne Paterson<sup>1</sup>  
Donald P. Frush<sup>2</sup>  
Lane F. Donnelly<sup>3</sup>

**OBJECTIVE.** Our objective was to determine whether adjustments related to patient age are made in the scanning parameters that are determinants of radiation dose for helical CT of pediatric patients.

**SUBJECTS AND METHODS.** This prospective investigation included all body (chest and abdomen) helical CT examinations ( $n = 58$ ) of neonates, infants, and children ( $n = 32$ ) referred from outside institutions for whom radiologic consultation was requested. Information recorded included tube current, kilovoltage, collimation, and pitch. Examinations were arbitrarily grouped on the basis of the individual's age: group A, 0–4 years; group B, 5–8 years; group C, 9–12 years; and group D, 13–16 years old.

**RESULTS.** Thirty-one percent (18/58) of the CT examinations were of the chest and 69% (40/58) were of the abdomen. Sixteen percent (9/58) of the CT examinations were combined chest and abdomen. In 22% (2/9) of these combined examinations, tube current was adjusted between the chest and abdomen CT; in one (11%) of these examinations, the tube current was higher for the chest than for the abdomen portion of the CT examination. The mean tube current setting for chest was 213 mA and was 206 mA for the abdomen, with no evident adjustment in tube current based on the age of the patient. Fifty-six percent of the examinations of neonates, infants, or children 8 years old or younger were performed at a collimation of greater than 5 mm and 53% of these examinations were performed using a pitch of 1.0.

**CONCLUSION.** Pediatric helical CT parameters are not adjusted on the basis of the examination type or the age of the child. In particular, these results suggest that pediatric patients may be exposed to an unnecessarily high radiation dose during body CT.

Helical CT is an important and increasingly used imaging technique in the pediatric population [1]. Although helical technology provides additional opportunities for CT in children, scanning techniques have become more sophisticated and complicated, and radiologists are faced with an expanding array of options, including the selection of scanning parameters [2]. These parameters include tube current, kilovoltage, collimation, and pitch. There is great variability in body size in the pediatric population, so adjustments of these parameters are necessary and important because these parameters are the main determinants of radiation dose received by the child. Although some technical recommendations are available for helical CT of children [1, 3–6], to the best of our knowledge, no information regarding adherence to these recommendations has been published.

There are several methods by which information about the common practice of helical CT techniques in pediatric patients can be obtained. One method is by a survey [7, 8]. Among the difficulties with this kind of sampling is assessing the validity of responses. We approached the issue of the practice of pediatric helical CT by another method in part to minimize this potential reporting bias. We collected and reviewed all chest and abdomen helical CT examinations in children 16 years old or younger performed at referring institutions or practices and submitted to our department for review. The objective of this type of survey was to determine what, if any, adjustments were made for CT examinations of children compared with adults and for CT examinations of pediatric patients of different ages. We focused on the adjustable scan parameters that primarily contribute to the amount of radiation the patient receives.

## National Conference on Dose Reduction in CT, with an Emphasis on Pediatric Patients

Wendy R. Libbey and Fred A. Mettler, Jr.<sup>1</sup>

The national conference on dose reduction in CT that was held in Washington, DC, in October 2000 was a landmark event in the history of CT. It was the first time that a national conference on CT dose reduction was held. The conference was held in Washington, DC, at the National Institutes of Health (NIH) on October 11–12, 2000. The conference was held in Washington, DC, at the National Institutes of Health (NIH) on October 11–12, 2000.

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Received July 3, 2000; accepted after revision October 11, 2000.

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AJR 2001;176:297–301

0361-803X/01/1762-297

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# What can we do in medicine when we want to improve patient care and safety?

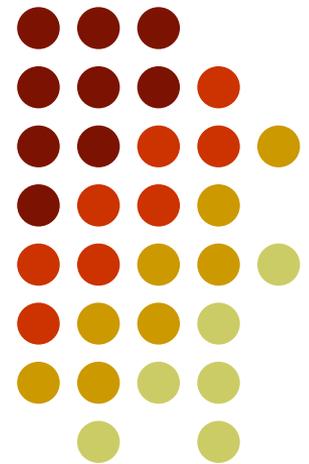
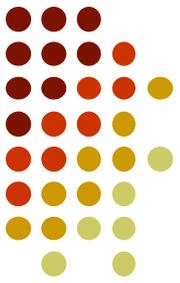


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gently<sup>SM</sup>

# ACCELERATE CHANGE

## Communication campaign

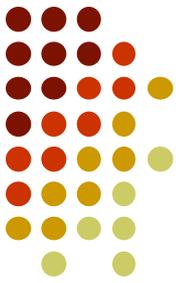


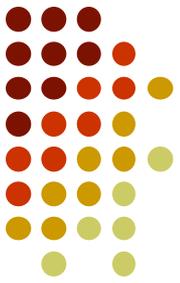
- Alter societal attitudes
- Increase knowledge
- Change behavioral at point of care



# PURPOSE

- What is social marketing ?
- Image Gently as an example
- Update on Campaign
- Educational tools





“Effective communication is essential to the practice of high quality medicine.”

Kurtz S. Teaching and Learning Communication Skills in Medicine.  
1<sup>st</sup> ed. Oxford, Radcliff Medical Press;1998

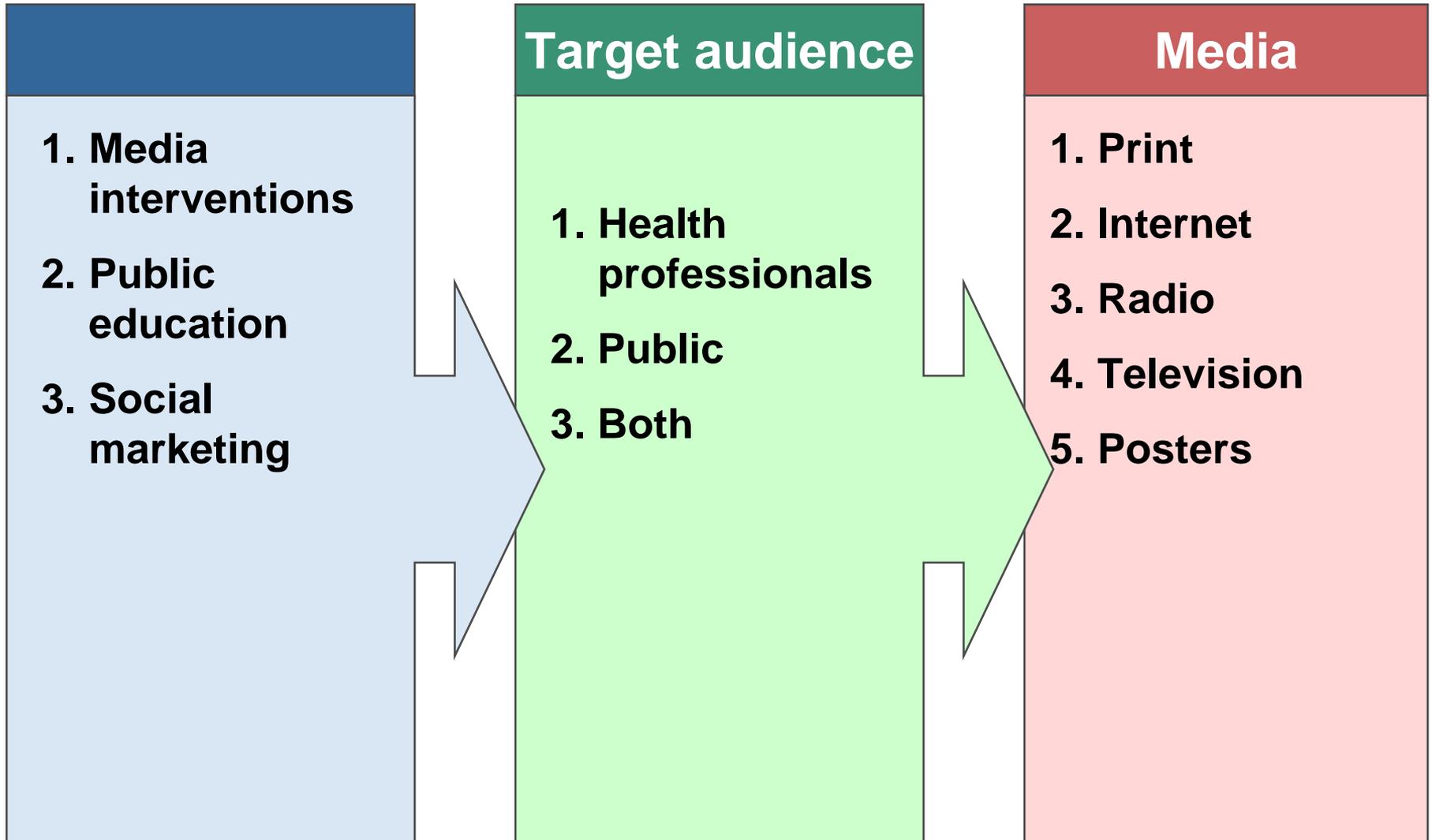


# Social marketing

- Use public media
  - Use commercial marketing techniques
- “.....to promote behavior changes that will improve the health of the population”

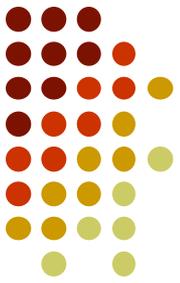
Buckbinder R. Understanding the characteristics of effective mass media campaigns for back pain and methodological challenges in evaluating their effects. Spine2008;33:74-80

# Social marketing



# 1980's

- Altering attitudes



# 1990's

Social marketing is not so much about changing attitudes as

## influencing behavior

Woby S et al Eur J Pain 2004;8:200210



MANY STUDIES ARE ACCUSED OF BIAS.

This one is admittedly anti-death.

**D**espite a growing effort, there is an epidemic that continues to rage, killing one-third of the people it infects.

The Institute of Medicine (IOM) has recently released a landmark study, "Ending the Tobacco Problem: A Blueprint for the Nation." It outlines a number of recommendations that can greatly reduce the huge toll of death and disease that tobacco crags up every year.

**YOUTH PREVENTION.** First, the IOM recommends that a national youth-oriented media campaign be a permanent part of the nation's strategies to reduce tobacco use. Prevention is key to ending this epidemic. Every day 4,000 kids try their very first cigarette, and one-third of youth smokers will die prematurely.

**CESSATION.** There is a huge gap between the number of

**LUNG CANCER KILLS NEARLY 160,000 PEOPLE IN THE U.S. EVERY YEAR. MORE THAN ANY OTHER CANCER. OTHER TOBACCO-RELATED ILLNESSES LIKE EMPHYSEMA AND STROKE HELP TAKE THE DEATH TOLL TO 400,000 A YEAR.**

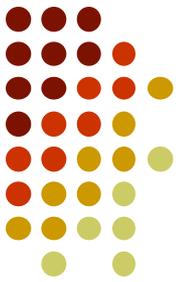


partnership deliver resources to quit smoking to the people who need them.

**COVERAGE.** Because studies have shown that investments in smoking cessation have a substantial payoff, the IOM has recommended that every health insurance plan, including Medicare and Medicaid, cover reimbursement for effective smoking cessation programs. This is recommended as a lifetime benefit.

**HIGH-RISK POPULATIONS.** For those high-risk segments of the population hit hardest by the tobacco epidemic, minorities, and people who live below the

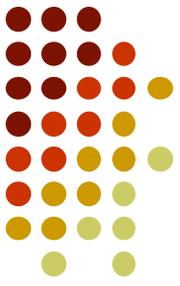
# 2000's



- New theoretical framework
- Testable programs to evaluate interventions

Does the campaign make an impact?



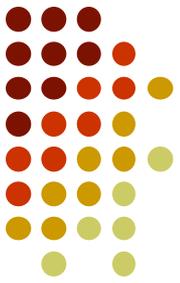


# Need a systematic process

Step 1. Identify the problem



# The problem



CT scans in *children*

are often performed

using “adult” techniques

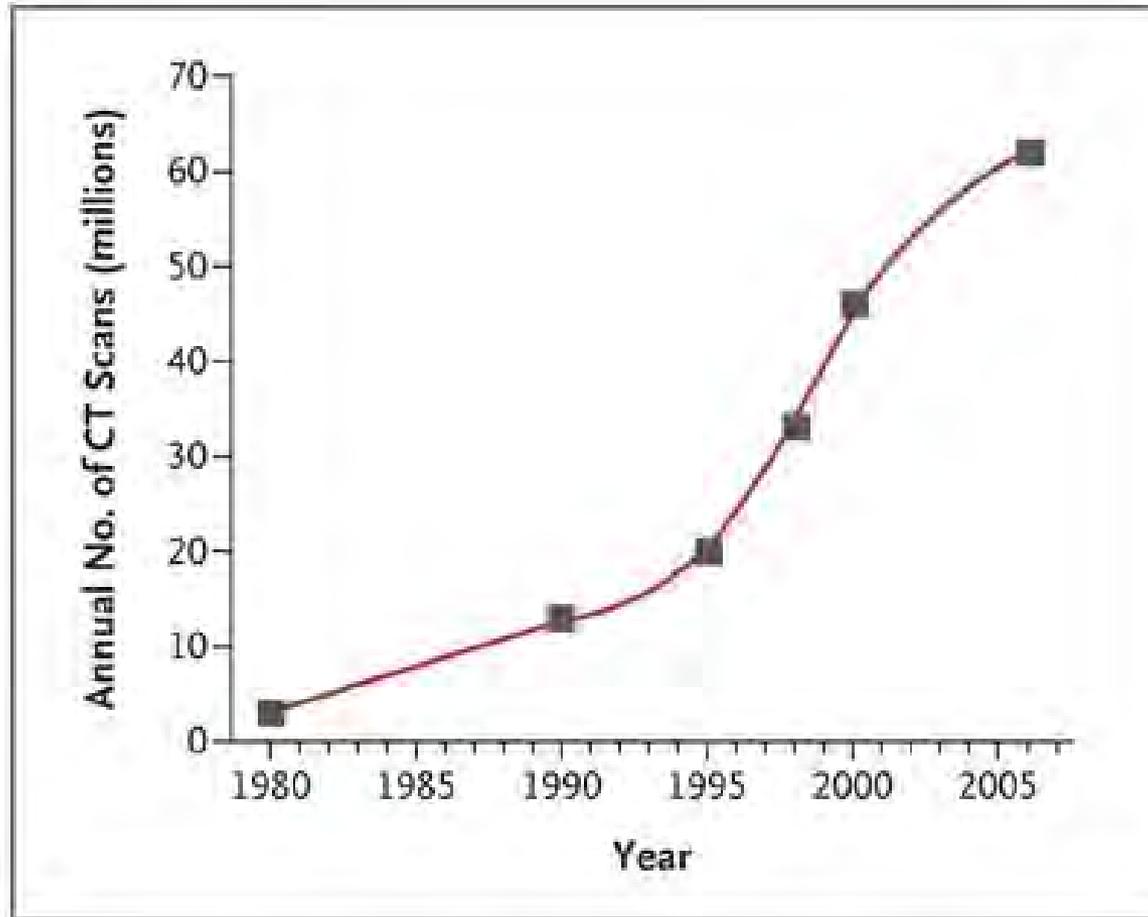
resulting in higher radiation dose





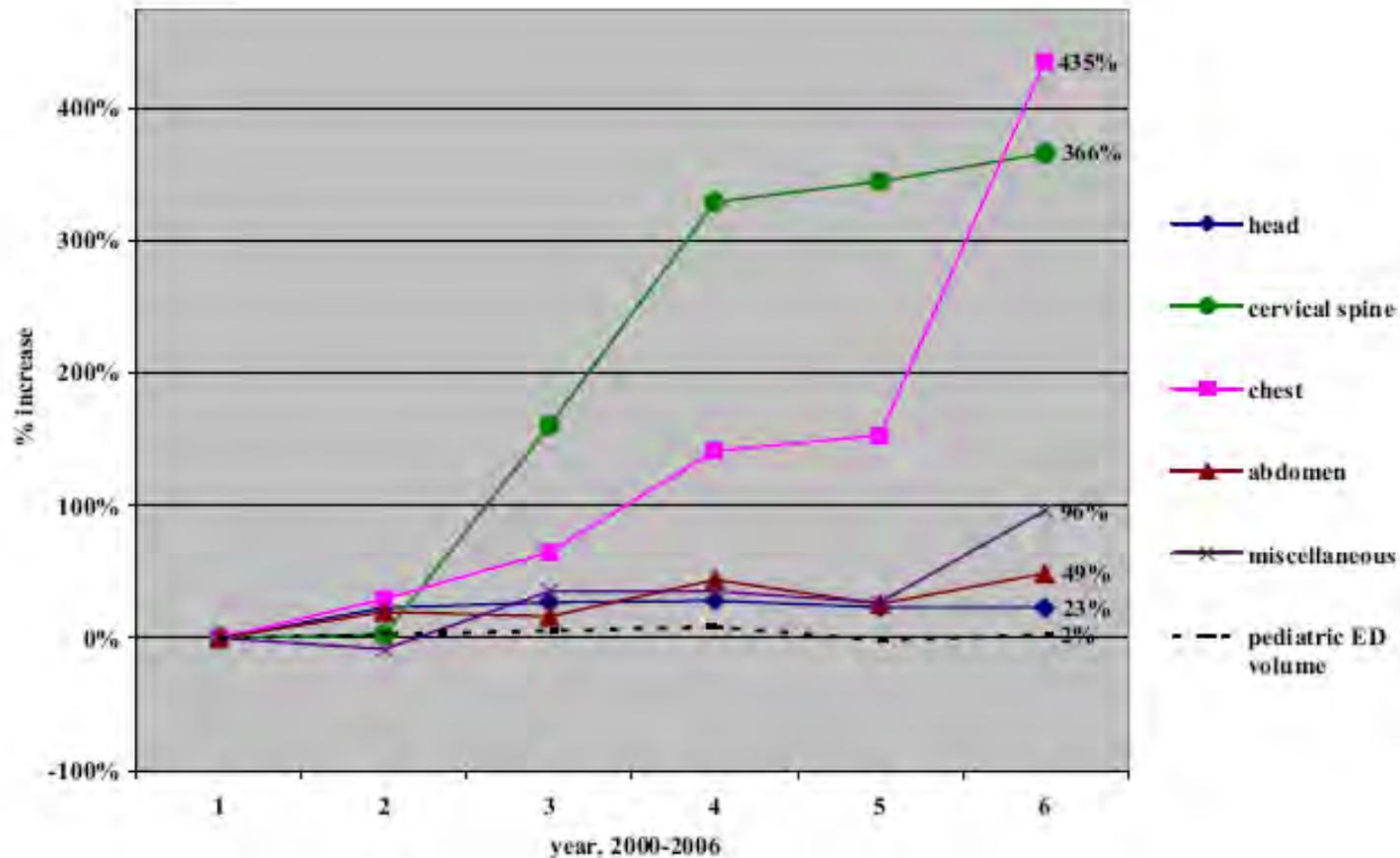
- **Are more sensitive to radiation**
- **Have a longer life to express those changes**
- **We assume radiation dose is cumulative:**
  - large number of CT exams of the same body part increase dose**

## Increasing Use of CT scans in the United States



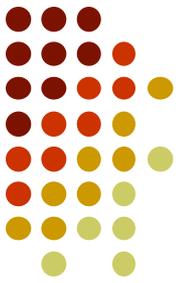
Brenner DJ, Hall EH. Computed Tomography-An Increasing Source of Radiation Exposure  
2007 Vol 357:2277-2284

# Increased Pediatric CT in the Emergency Department



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

# We can't measure patient dose

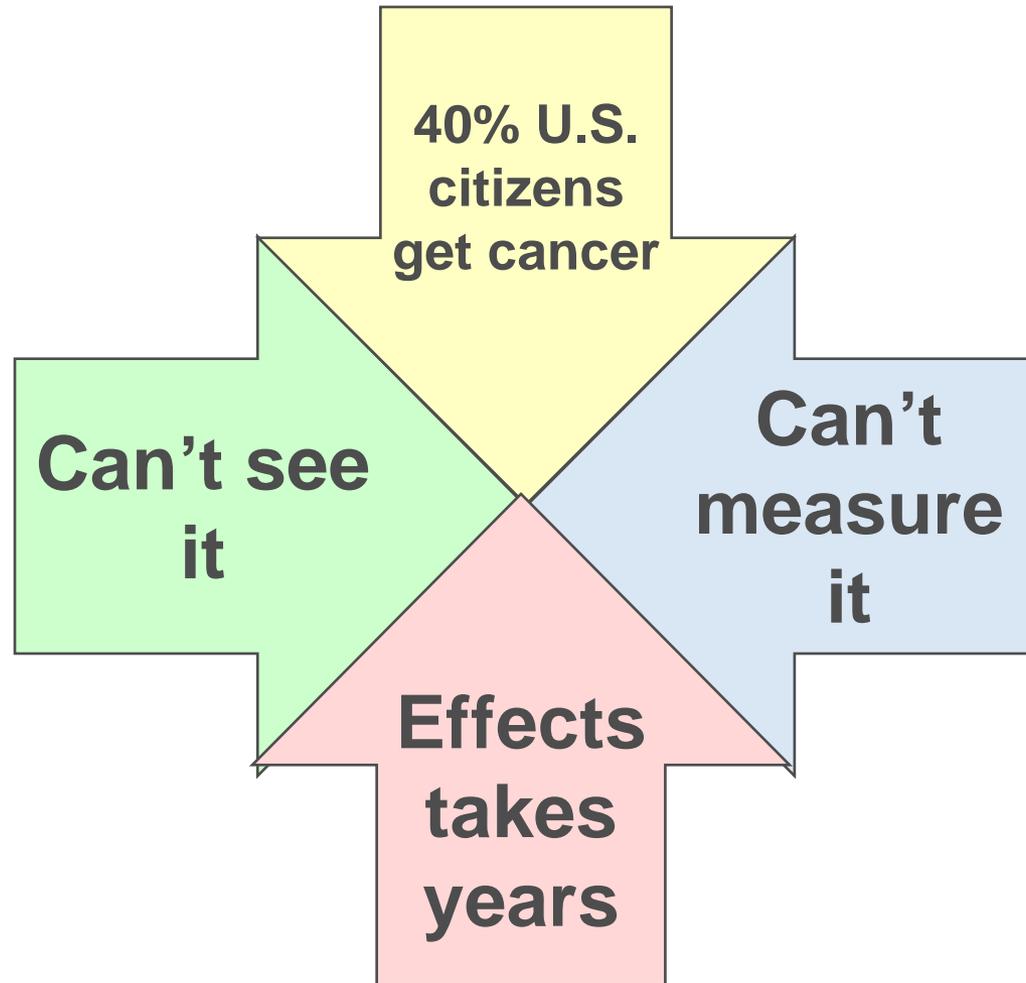


**“The determination of ionizing radiation dose to a living human from an x-ray exam is very complex.....”**



JACR 2007 May 4(5) 272

# WHY IS RADIATION A DIFFICULT TOPIC TO DISCUSS?



## What physicians think about the need for informed consent for communicating the risk of cancer from low-dose radiation

Tijen Karali · Manudeep K. Kalra · Julie L. Self · Jason Anders Rosenfeld · Susan Butler · Stephen Simonneau

Received: 19 January 2009 / Revised: 17 April 2009 / Accepted: 6 May 2009 / Published online: 26 June 2009  
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### Abstract

**Background** The National Institute of Environmental Health Sciences, a subsidiary of the Food and Drug Administration, has declared that X-ray radiation at low doses is a human carcinogen.

**Objective** The purpose of our study was to determine if informed consent should be obtained for communicating the risk of radiation-induced cancer from radiation-based imaging. **Materials and methods** Institutional review board approval was obtained for the prospective survey of 456 physicians affiliated with three tertiary hospitals by means of a written questionnaire. Physicians were asked to state their subjec-

tivity, number of years in practice, frequency of re CT scanning, level of awareness about the risk of radiation-induced cancer associated with CT, knowledge of such information is provided to patients under and opinions about the need for obtaining informed consent as well as who should provide information of radiation-induced cancer risk to patients. Physicians also asked to specify their preference among formats of informed consent for communicating potential risk of radiation-induced cancer. Statistics were performed using the chi-squared test.

**Results** Most physicians stated that informed consent be obtained from patients undergoing radiation-based (71.3%, 325/456) and the radiology department should inform about the risk of radiation-induced cancer patient (54.6%, 249/456). The informed consent for most physicians agreed with included modification National Institute of Environmental Health Sciences cancer risk from low-dose radiation (20.2%, 92/456) or information on the risk of cancer from background compared to that from low-dose radiation (39.5%, 18). **Conclusion** Most physicians do not know if patients informed about cancer risk from radiation-based in their institutions. However, they believe that informed consent for communicating the risk of radiation-induced cancer be obtained from patients undergoing radiation-based

**Keywords** Radiation · Cancer · Consent · Survey · CT

### Introduction

In medical practice, X-rays are used in computed tomography, fluoroscopy, and CT, whereas gan-

## Improving health literacy: informed decision-making rather than informed consent for CT scans in children

Marilyn J. Goske · Dorothy Bulas

Received: 17 May 2009 / Accepted: 27 May 2009 / Published online: 26 June 2009  
© Springer-Verlag 2009

Health literacy is described as “The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate decisions” [1].

In the paper titled “What physicians think about the need for informed consent for cancer risk with low-dose radiation,” the authors contend that physicians are aware of the risk of cancer with low-dose radiation examinations and that radiology departments should consider obtaining informed consent from patients undergoing radiation-based low-dose examinations [2]. The paper makes a compelling argument based on scientific reports from governmental agencies and multiple scientific papers that provide a strong rationale based on the extrapolated data using the linear no-threshold theory of radiation-induced cancer from Hiroshima after the atomic bomb [3].

Although the authors’ intent of providing informed consent to patients prior to performance of CT scans is laudable, this approach might present more questions than answers for both the physician and the patient. As Finelli asked in a letter to the editor, “Do we obtain consent from a 1-year-old, maybe a 40-year-old, but not an 80-year-old? Is the consent different for a child who has undergone CT once versus a child who has undergone 12 CT examinations? Do we begin to obtain consent after 50 chest radiographs?” [4]. Who would obtain the consent? The

referring physician who understands the indication for the medical imaging or the radiologist who performs the imaging? How do we measure cumulative dose or even track examinations in today’s mobile society?

With these problematic issues, we propose a different concept to foster informed participation of patients in their health care decisions: that is informed decision-making. Informed decision-making calls for “a meaningful dialogue between physician and patient instead of unidirectional, dutiful disclosure of alternatives, risks, and benefits by the physician” with informed consent [5]. The two concepts, informed consent and informed decision-making, can be quite different in their intent and outcome.

### Informed consent is fraught with problems

Informed consent is defined as “consent by a patient to a surgical or medical procedure or participation in a clinical study after achieving an understanding of the relevant medical facts and the risks involved” [6]. Informed consent is a worthy goal but fraught with difficulty for the patient. As Cassileth et al. [7] ask in their paper on informed consent, “why are its goals imperfectly realized?” They report their study of 200 cancer patients who were asked to fill out informed consent for chemotherapy, radiation therapy or surgery. One day later, patients were asked to fill out a questionnaire based on their recall. Only 60% understood the nature of the procedure, and only 57% listed one potential complication. The forms were viewed as “legalistic” and an attempt to “protect the physician’s rights,” not the patient’s rights. Often these forms are difficult to comprehend and provide limited understanding of the procedure under consideration. In another study, consent forms from medical research studies were evaluated.

A commentary on this article is available at doi:10.1007/s00247-009-1322-6

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**Does medical radiation cause cancer?**

**We don't know**

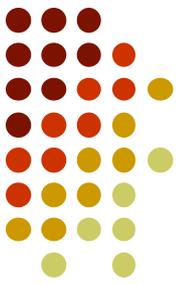
**We should act as if it does**

# **Alliance**

---

## **For Radiation Safety In Pediatric Imaging**

- Education
  - Awareness
  - Advocacy
- 
- Radiation protection for children
  - 52 health care organizations/agencies
  - > 700,000 radiologists, technologists, physicists



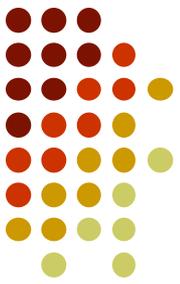
# The Alliance for Radiation Safety in Pediatric Imaging

## the *Image Gently* Alliance

is a coalition of health care organizations dedicated to providing safe, high quality pediatric imaging worldwide. The primary objective of the Alliance is to raise awareness in the imaging community of the need to adjust radiation dose when imaging children.

**The ultimate goal of the Alliance is to change practice.**





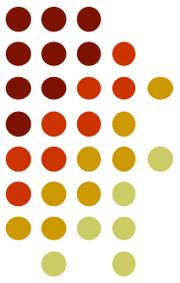
# Background

- 2006 - The Society for Pediatric Radiology
- 2007 - ASRT, ACR, AAP founding partners
- Fall 2007 - Alliance partnership
- January 2008 – CT Rollout
- August 2008 – CT Vendor summit
- January 2009 – Parent brochure
- Fall 2009 – Pediatric Interventional
- February 2010 – Digital Radiography Vendor summit

image  
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# Founding Organizations



- The Society for Pediatric Radiology
- American Society of Radiologic Technologists
- American Association of Physicists in Medicine
- American College of Radiology



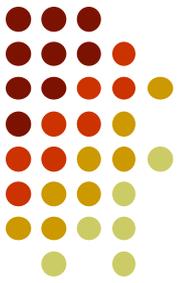
# Alliance for Radiation Safety in Pediatric Imaging



- [Academy of Radiology Research](#)
- [American Academy of Pediatrics](#)
- [American Board of Radiology](#)
- [American Board of Radiology Foundation](#)
- [American Institute of Ultrasound in Medicine](#)
- [American Osteopathic College of Radiology](#)
- [American Registry of Radiologic Technologists](#)
- [American Roentgen Ray Society](#)
- [American Society of Emergency Radiology](#)
- [American Society of Head and Neck Radiology](#)
- [American Society of Pediatric Neuroradiology](#)
- [Asia-Oceania Federation of Organizations for Medical Physics \(new 9/16/2009\)](#)
- [Asian-Oceanic Society for Paediatric Radiology](#)
- [Association of Collegiate Educators in Radiologic Technology \(new 8/27/2009\)](#)
- [Association of University Radiologists](#)
- [Australian & New Zealand Society for Paediatric Radiology](#)
- [Canadian Association of Medical Radiation Technologists](#)
- [Canadian Association of Radiologists](#)
- [Canadian Interventional Radiology Association](#)
- [Canadian Organization of Medical Physicists](#)
- [Coalition for Imaging and Bioengineering Research](#)
- [College of Radiology, Academy of Medicine of Malaysia](#)
- [Conference of Radiation Control Program Directors](#)
- [European Society of Paediatric Radiology](#)
- [Health Physics Society \(new 10/8/2009\)](#)
- [Indian Society of Pediatric Radiology \(new 9/25/2009\)](#)
- [International Atomic Energy Agency \(new 9/14/2009\)](#)
- [International Radiology Quality Network \(IRQN\)](#)
- [International Society of Radiographers and Radiological Technologists](#)
- [International Society of Radiology \(new 8/20/2009\)](#)
- [National Council on Radiation Protection and Measurements](#)
- [North American Society for Cardiovascular Imaging](#)
- [Radiological Society of North America](#)
- [The Royal Australian and New Zealand College of Radiologists](#)
- [Society of Interventional Radiology](#)
- [Sociedad Latino Americana de Radiología Pediátrica](#)
- [Sociedad Mexicana De Radiologia E Imagen](#)
- [Sociedad Española de Protección Radiológica \(new 10/23/2009\)](#)
- [Society for Pediatric Interventional Radiology](#)
- [Society of Computed Body Tomography and Magnetic Resonance](#)
- [Society of Gastrointestinal Radiologists](#)
- [The Society of Nuclear Medicine](#)
- [The Society of Nuclear Medicine - Technologist Section](#)
- [Society of Radiographers of Trinidad and Tobago](#)
- [Society of Radiologists in Ultrasound](#)
- [Society of Uroradiology](#)
- [Southeast Asia Federation of Organizations for Medical Physics](#)



# Message



CT helps us save Kids' lives!

But, did you *also* know...

When you image, radiation matters!

Children are more sensitive to radiation

What *we* do now lasts for *their* lifetime

So, when you image, *image gently*

- More scanning is usually not better
- When CT is the right thing to do:
  - Child size the kV and mA
  - One scan (single phase) is usually enough
  - Scan only the indicated area



image  
gently<sup>SM</sup>

# *image gently* campaign PR efforts

Growing more every day.

**Be wise. Adjust for size.**

Kids have a long way to go before they're grown-ups. There are kid-sized meals and kid-sized bikes – so, when we can achieve a clear CT scan with a smaller dose, why not ensure we're only giving children a kid-sized dose?

Imaging experts agree that performing a CT scan on a child requires a true understanding of what's needed for a safe and accurate diagnosis. Part of that understanding includes having knowledge of children's sensitivity to dose as well as its lifetime effects as children grow.

When you image children, *Image Gently* – adjust the protocols to control dose. In our efforts to diagnose and treat children, please keep in mind the importance of kid-sizing the procedures. For more information on pediatric radiation safety or to ask an expert, please visit us online at [www.imagegently.com](http://www.imagegently.com).



Brought to you by the Alliance for Radiation Safety in Pediatric Imaging.

Made possible by grants from GE Healthcare.

# image gently campaign PR efforts



## “Image Gently” Pediatric Campaign Underway

Educates Providers of Pediatric Imaging on the Need to “Child-Size” Radiation Dose

On Jan. 22, 2008, the charter members of the Alliance for Radiation Safety in Pediatric Imaging — the Society for Pediatric Radiology, the American College of Radiology, the American Society of Radiologic Technologists and the American Association of Physicists in Medicine — launched the highly anticipated Image Gently campaign, a national initiative that will educate providers of pediatric imaging care about the importance of “child-sizing” radiation doses.

The campaign’s central message is that children may be more sensitive to radiation received from medical imaging scans than adults, and that cumulative radiation exposure to their smaller bodies could, over time, have adverse effects. Therefore, radiologists who perform imaging exams on children are urged to:

- “Child-size” the scan: this often reduces the amount of radiation used
- Not overscan:
- Scan only when necessary
- Scan only the indicated region
- Scan once; multi-phase scanning (pre- and post-contrast, delayed exams) is rarely helpful
- Be a team player:
- Involve medical physicists to monitor pediatric CT techniques
- Involve technologists to optimize scanning

During the campaign’s rollout phase, the message will focus on computed tomography (CT) scans. In 2006, U.S. physicians performed approximately 4 million pediatric CT scans — triple the number from five years ago. CT is a powerful modality that continues to replace more invasive and costlier non-CT techniques, but as technology evolves, the Image Gently campaign will help to ensure that medical protocols for pediatric imaging are keeping pace.

“CT is a great imaging modality that has revolutionized medical practice and saved countless lives, but it’s also among the higher dose examinations we perform,”

said Donald P. Frush, M.D., chair of the ACR Pediatric Commission. “We want to ensure that children are imaged using kid-sized, not adult-sized, radiation doses.”

“A national campaign is important,” said Marilyn Goske, M.D., chair of the Alliance for Safety in Pediatric Imaging and chair of the Board of Directors of the Society for Pediatric Radiology. “Medicine evolves; as we increase our knowledge, we have to change our practice.”

Radiologic technologist Allen Croat, R.T. (R)(CT), chair of ASRT’s CT Chapter, said the campaign’s message is needed. “Technologists are the ones who are actually imaging these children, so we welcome the campaign’s emphasis on the ALARA format: As Low as Reasonably Achievable. We have to be protocoling our patients with our radiologists and imaging only what is necessary for the diagnosis.”

The campaign’s “radiation matters” theme drives home two fundamental concepts. One, more imaging is usually not better, and two, the effects of pediatric imaging last a lifetime. Correct dosage is key, Frush said. “Just as the appropriate dose of an antibiotic given to a child differs from the dose given to an adult, a small child needs a much smaller radiation dose than an adult.”

The focus on children makes sense. “The relative risk to a young pediatric patient is higher compared to a 70-year-old adult because the child typically has a much longer lifespan after being imaged,” said James M. Hevezí, Ph.D., medical physicist and chair of the ACR Commission on Medical Physics. An overdose by medicine may produce obvious, immediate symptoms, but radiation is an invisible medium whose effects from overdose might not be seen for years.

Frush sees radiologists as having a special duty to young patients. “They entrust their care to their parents and to us as health care providers. We need to guard their welfare. We don’t know what’s going to happen, but at age 40 or 50 they may need a dozen or more CT scans. If they were scanned five scans as a kid, that’s a cumulative dose that doesn’t go away.”

The Image Gently campaign will target three audiences, Goske said. The first are radiologists, medical physicists

and technologists who primarily work in adult hospitals or imaging centers and who image children as a very small part of their patient volume. Second, it will target referring ER physicians, pediatricians, pediatric orthopedists and other physicians. Last, and once the medical core is educated, the campaign will reach out to parents.

Radiation exposure is a serious matter, but Frush and Goske counsel perspective. All medical procedures entail some degree of risk, they said. Studies have repeatedly shown CT to be highly accurate and have a positive impact on patient care.

Imaging stakeholders can visit the Image Gently Alliance Web site ([www.imagegently.org](http://www.imagegently.org)) for the latest research and educational materials including information on optimizing CT protocols in pediatric patients. The campaign has been funded in part by an unrestricted educational grant from GE Healthcare. ■

**“We want to ensure that children are imaged using kid-sized, not adult-sized, radiation doses.”**



# The *Image Gently* Campaign: Working Together to Change Practice

Marilyn J. Goske, Kimberly E. Applegate, Jennifer Boylan, Priscilla F. Butler, Michael J. Callahan, Brian D. Coley, Shawn Farley, Donald P. Frush, Marta Hernanz-Schulman, Diego Jaramillo, Neil D. Johnson, Sue C. Kaste, Greg Morrison, Keith J. Strauss and Nora Tuggle

Chair, Society for Pediatric Radiology Chair, Alliance for Radiation Safety in Pediatric Imaging [mgr4414@aol.com](mailto:mgr4414@aol.com)

## COMMENTARY

### The 'Image Gently' campaign: increasing CT radiation dose awareness through a national education and awareness program

Marilyn J. Goske • Kimberly E. Applegate • Jennifer Boylan • Penny F. Butler • Michael J. Callahan • Brian D. Coley • Shawn Farley • Donald P. Frush • Marta Hernanz-Schulman • Diego Jaramillo • Neil D. Johnson • Sue C. Kaste • Gregory Morrison • Keith J. Strauss • Nora Tuggle

Received: 18 December 2007 / Accepted: 20 December 2007 / Published online: 17 January 2008  
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**Keywords** ALARA • Radiation safety • Computed tomography • Alliance • Healthcare

#### Introduction

ALARA (As Low As Reasonably Achievable) has been a guiding principle for pediatric radiologists for decades. The Society for Pediatric Radiology (SPR) has long been a

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leader in promoting safety in radiology. However, the ALARA principle has in the past several years as the number of children has skyrocketed. For example, since the 1980s when CT was begun, there has been up to an 800% increase in the use of CT. However, increased use requires ensuring that only indicated exams are

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S. C. Kaste

THE NEW ENGLAND JOURNAL OF MEDICINE

## CORRESPONDENCE



### Computed Tomography and Radiation Exposure

**TO THE EDITOR:** Computed tomographic (CT) scans deliver a radiation dose of about 20 mSv. Brenner and Hall (Nov. 29 issue)<sup>1</sup> assess the risk associated with CT radiation exposure by using the linear no-threshold extrapolation model, which assumes that cancer induction is proportional to dose even for the smallest doses. An excess of cancers has never been detected in laboratory animals or in humans for doses below 100 mSv. This model is used for analyzing data from cohorts including persons who have received doses higher than 100 mSv. This method is exposed to strong bias.<sup>2</sup> Defense mechanisms against radiocarcinogenesis are much more effective at low doses, and the use of the linear no-threshold model in this dose range is highly debatable<sup>3,4</sup>; it greatly overestimates the risk. After repeated x-ray examinations, induction of cancer has been observed

Maurice Tubiana, M.D.

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1. Brenner DJ, Hall EJ. Computed tomography— an increasing source of radiation exposure. *N Engl J Med* 2007;357:2277-84.
2. Breckow J. Linear-no-threshold is a radiation-protection standard rather than a mechanistic effect model. *Radiat Environ Biophys* 2006;44:257-60.
3. Tubiana M, Aurengo A, Averbeck D, Masse R. The debate on the use of linear no threshold for assessing the effects of low doses. *J Radiol Prot* 2006;26:317-24.
4. Tubiana M, Aurengo A, Averbeck D, Masse R. Low-dose risk assessment: comments on the summary of the International Workshop. *Radiat Res* 2007;167:742-4.
5. Rubino C, de Vathaire F, Shamsaldin A, Labbe M, Lè MG. Radiation dose, chemotherapy, hormonal treatment and risk of second cancer after breast cancer treatment. *Br J Cancer* 2003; 89:840-6.
6. Le Pogam MA, Rubino C, Diallo I, et al. Radiation dose fractionation and second cancer risks after breast cancer treatment. *Radiat Prot Dosimetry* (in press).

# Radiologic Technologists



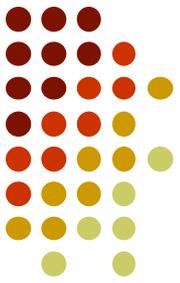
image gently<sup>SM</sup>

**Module 1 - Enhancing Radiation Protection in Computed Tomography for Children**

Robert Orth, M.D., Ph.D.  
Marilyn J. Goske, M.D.  
Cincinnati Children's Hospital Medical Center  
Cincinnati, OH

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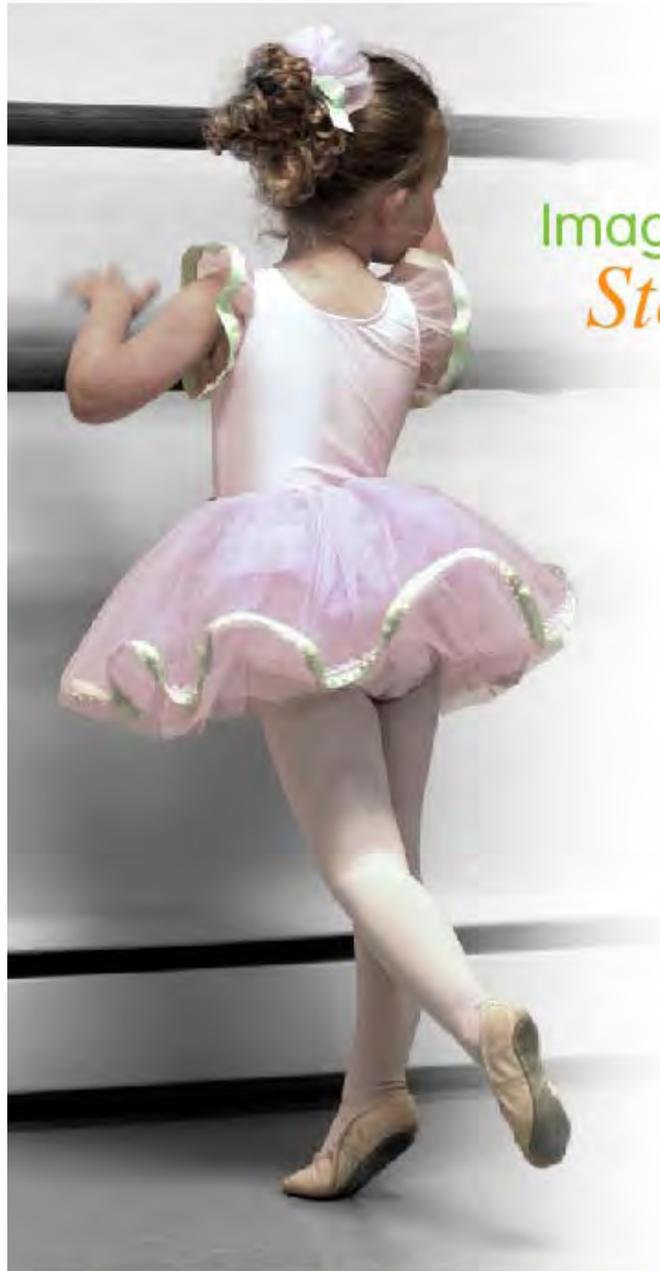


# “Universal” CT Protocols

Abdomen Baseline:		kVp= 120	mA= 200	Time= 0.5 sec	Pitch Abdomen= 1	Pitch Thorax = 1
PA Thickness (cm)	Approx Age	Abdomen		Thorax		
		mAs Reduction Factor (RF)	Estimated mAs = BL x RF (fill in)	mAs Reduction Factor (RF)	Estimated mAs = BL x RF (fill in)	
9	newborn	0.31	31	0.29	29	
12	1 yr	0.36	36	0.34	34	
14	5 yr	0.61	61	0.57	57	
16	10 yr	0.71	71	0.63	63	
19	15 yr	0.77	77	0.69	69	
22	small adult	0.91	91	0.84	84	
25	med adult	Baseline (BL)	100	0.93	93	
31	large adult	1.33	133	1.21	121	

Head Baseline:		kVp= 140	mA= 400	Time= 0.5 sec
		Pitch= 1		
PA Thickness (cm)	Approx Age	Head		
		mAs Reduction Factor (RF)	Estimated mAs = BL x RF (fill in)	
12	newborn	0.47	94	
16	2 yr	0.83	166	
17	6 yr	0.93	186	
19	med adult	Baseline (BL)	200	





## Image Gently... *Step Lightly*

Interventional radiology  
helps us save kids' lives!

But, when we treat patients,  
radiation matters!

Children are more sensitive  
to radiation.

What we do now lasts  
their lifetimes.

Treat kids with care:

- *Step lightly* on the fluoroscopy pedal.
- Stop and child-size the technique.
- Consider ultrasound or MRI guidance.

image  
gently<sup>SM</sup>



For more information about pediatric radiation safety, visit [www.imagegently.org](http://www.imagegently.org).

The Alliance for  
Radiation Safety in  
Pediatric Imaging  
invites you to place  
this sticker on your  
fluoroscopy pedal or  
monitor as a reminder  
to promote radiation  
protection for children  
when performing  
interventional studies  
in your practice. For  
more information  
about what you can do  
to “step lightly” visit  
[www.imagegently.org](http://www.imagegently.org).

Image Gently...



[www.imagegently.org](http://www.imagegently.org)

\_\_\_\_\_  
Patient's Name

\_\_\_\_\_  
MR#

\_\_\_\_\_  
Date of exam

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## Step Lightly Checklist

Review steps below before starting the procedure.

**Safety is a team effort:** don't be afraid to ask the necessary questions to ensure you are working as a team to keep radiation dose to patients and staff as low as possible.

Reducing radiation dose must be balanced with safe, accurate and effective completion of the procedure. Not all the steps below may be possible in each case, depending on patient size, technical challenge and critical nature of the procedure. Overall patient safety is most important. The goal is to minimize the dose to the patient while providing important and necessary medical care.

- Ask patient or family about previous radiation ([record card downloadable at this link](#)). Answer questions about radiation safety ([parent/patient brochure downloadable here](#))
- Use ultrasound when possible
- Position hanging table shields and overhead lead shields prior to procedure with reminders during the case as needed
- Operators and personnel wear well fitted lead aprons, thyroid shield and leaded eye wear
- Use pulse rather than continuous fluoroscopy when possible, and with as low a pulse as possible
- Position and collimate with fluoroscopy off, tapping on the pedal to check position
- Collimate tightly. Exclude eyes, thyroid, breast, gonads when possible
- Operator and personnel hands out of beam
- Step lightly: tap on pedal and review anatomy on last image hold rather than with live fluoroscopy when possible; minimize live fluoroscopy time
- Minimize use of electronic magnification, use digital zoom whenever possible
- Acknowledge fluoroscopy timing alerts during procedure
- Use last image hold whenever possible instead of exposures
- Adjust acquisition parameters to achieve lowest dose necessary to accomplish procedure: use lowest dose protocol possible for patient size, lower frame rate, minimize magnification, reduce length of run
- Plan and communicate number and timing of acquisitions, contrast parameters, patient positioning and suspension of respiration with radiology and sedation team in advance to minimize improper or unneeded runs
- Move table away from X-ray tube in both planes. Move patient as close to detector in both planes
- Use a power injector, or extension tubing if injected by hand
- Move personnel away from table or behind protective shields during acquisitions
- Minimize overlap of fields on subsequent acquisitions
- After procedure: record and review dose



## What Parents Should Know

### About Medical Radiation Safety in Pediatric Interventional Radiology

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[www.imagegently.org](http://www.imagegently.org)

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The Alliance for Radiation Safety in Pediatric Imaging

What Can I Do?

Resources

FAQ

Let's image gently when we care for kids! The image gently Campaign is an initiative of the Alliance for Radiation Safety in Pediatric Imaging. The campaign goal is to change practice by increasing awareness of the opportunities to lower radiation dose in the imaging of children.

Do you often interact with children in your work? Do you work in a hospital or clinic? Do you work in a school or community center?

Parents

Currently Radiologists

Radiologists

Radiologic Technologists

Medical Physicists

Other

What's new: CT Protocol Guidance and Checklist

It's time to take the image gently pledge



### ONE SIZE DOES NOT FIT ALL

There's no question: CT helps us save lives. It's real.

But, when we image, radiation matters.  
• Children are more sensitive to radiation  
• What we do now, lasts their lifetime

So, when we image, let's image gently.  
• More is often not better  
• When CT is the right thing to do  
• Child-size the hip and neck  
• One scan (single phase) is often enough  
• Scan only the indicated area

Let's image gently.

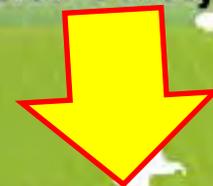


# Imagegently.org

image  
gently<sup>SM</sup>



## The Alliance for Radiation Safety in Pediatric Imaging



International Resources

What Can I Do?

Resources

FAQ

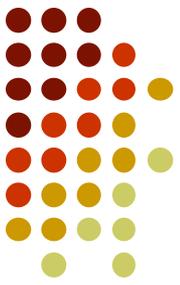
Let's *image gently* when we care for kids! The *image gently* Campaign is an initiative of the Alliance for Radiation Safety in Pediatric Imaging. The campaign goal is to change practice by increasing awareness of the opportunities to lower radiation dose in the imaging of children.

## RESOURCES



- ✦ [Image Gently Practice Quality Improvement Module in Computed Tomography \(CT\) Scans in Children](#)
- ✦ [Alternatives to CT](#)
- ✦ ASRT White Paper - [Computed Tomography in the 21st century: Changing Practice for Medical Imaging and Radiation Therapy Professionals](#)
- ✦ [RadiologyQuality.com](#) - This site provides ABR-certified practice quality improvement projects to fulfill Maintenance of Certification Part IV requirements.
- ✦ From the Pediatric Emergency Physician community: [ALARA: is there a cause for alarm? Reducing radiation](#)

# Digital Radiography summit February 4, 2010



**Standardization of dose index across vendors  
Unify IEC and AAPM standard  
National registry**

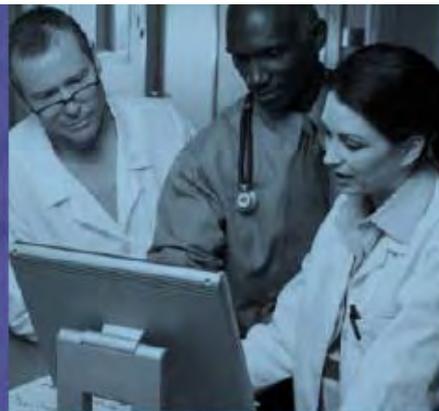




**SAFE**

**Safe Practice 34:  
Pediatric Imaging**

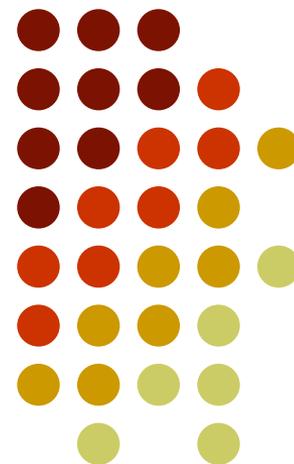
When CT imaging studies are undertaken on children, "child-size" techniques should be used to reduce unnecessary exposure to ionizing radiation.



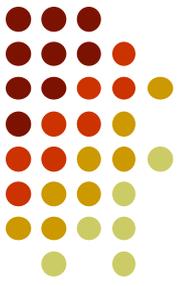
# ***Image Gently INTERNATIONAL: An Educational Campaign for Everyone***

**Kimberly E. Applegate, MD, MS**

Steering Committee Member,  
Alliance for Radiation Safety in Pediatric Imaging  
Vice chair of quality and safety  
Professor of Radiology  
Emory University School of Medicine



**Acknowledgement: Dr. Marilyn Goske, Chair IGC**



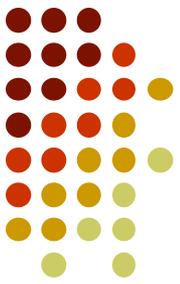
# ***Image Gently is....***

*an Educational, Awareness, and Advocacy  
Campaign  
to Promote Radiation Protection for Children  
Worldwide*

**Nobody is as smart as everybody**



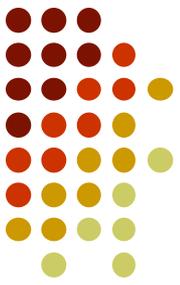
# Background



- **2008--present: Early outreach to national and international radiology, medical physics, and technologist/radiographer organizations**
  - **At least 16 of 53 member organizations are international**



# Learning from Int'l Members



- Asia-Oceania Federation of Organizations of Medical Physics
- Indian Society of Pediatric Radiology
- International Atomic Energy Agency
- International Radiology Quality Network (IRQN)
- International Society of Radiographers and Radiological Technologists (ISRRT)
- International Society of Radiology
- Ontario Association of Radiologists
- Sociedad Mexicana De Radiologia E Imagen
- Society of Radiographers of Trinidad and Tobago
- Australian Institute of Radiography
- Spanish Radiation Protection Society (Jefe de Servicio de Radiofísica y Protección Radiológica)

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# The ultimate goal of the Alliance is to change practice GLOBALLY

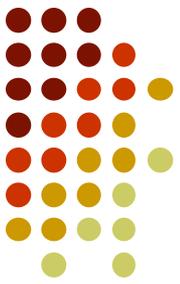


- **How? Educational Risk Communication via:**
  - National and international meetings
  - The Internet
  - Collaborations with global organizations
- Sharing best practices
- Harmonization of messages
  - Learning from each other, cultural sensitivities



# Meetings

- SPR 2010: international perspectives panel on radiation protection (...IPR 2011 London)
- Brazilian Radiology Congress, Rio, 2009
- World Congress on Medical Physics and Biomedical Engineering, Munich, 2009
- WHO
  - Busan, Korea 2009, 3<sup>rd</sup> Intl Children's Health & Environment Mtg
  - Global Initiative on Radiation Safety in Health Care Settings (GI)
  - IRQN Referral Guidelines for Appropriate Use of Radiation Imaging in Children
- IRPA- Helsinki 2010



BOLETIM DO  
**CBR**



INFORMATIVA DO COLÉGIO BRASILEIRO DE RADIOLOGIA E DIAGNÓSTICO POR IMAGEM - Nº 139 - SETEMBRO 2009

# CBR apoia

Campanha Mundial  
de Redução das Doses  
de Radiação em Crianças



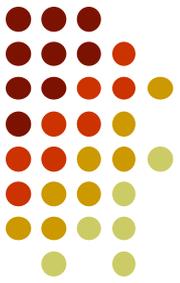
**CBR 09**  
XXXVIII CONGRESSO BRASILEIRO DE RADIOLOGIA

Veja mais três módulos da  
Programação Científica na página 12



**Dr. Ines Boechat, SPR President, at  
the Sociedade Brasileira de  
Radiologia, July 2009**

# The Internet



- Image Gently web site: International Resources
- Hot Linkages with other int'l web sites
  - IAEA's RPOP (radiation protection of patients)



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## The Alliance for Radiation Safety in Pediatric Imaging



International Resources

What Can I Do?

Resources

FAQ

Let's *image gently* when we care for kids! The *image gently* Campaign is an initiative of the Alliance for Radiation Safety in Pediatric Imaging. The campaign goal is to change practice by increasing awareness of opportunities to lower radiation dose in the imaging of children.

## RESOURCES



- Image Gently Practice Quality Improvement Module in Computed Tomography (CT) Scans in Children

# Free parent brochures



فحص الأشعة برفق  
Image Gently Pledge  
تعهد والتزام

أجل ، أريد أن اجري فحص الأشعة برفق  
Yes, I want to *image gently*.

انطلاقاً من معرفتي أن كل فرد في فريق الرعاية الطبية، يلعب دوراً حيوياً برعاية المريض،  
ويطمح دائماً لتقديم أفضل رعاية له، فإنني أتعهد:  
Recognizing that every member of the healthcare team plays a vital role in caring for the patient  
and wants to provide the best care, I pledge:

أن تكون رسالتنا لـ "فحص الأشعة برفق" على رأس أولوياتنا عند تحدث وتواصل أعضاء فريقنا  
الطبي في هذا العام.  
I will ensure that my staff communications this year  
will emphasize the importance of the Image Gently Pledge.  
أن تقوم باستعراض التوصيات أو البروفات التي اقترن بها هذا البرنامج مع جميع أعضاء فريقنا  
بتعديل إجراءاتنا للتوافق مع هذه التوصيات المقترحة من قبل الحملة.  
to review the protocol recommendations and, where necessary, implement adjustments to our  
processes

أن نحترم ونستمع إلى الاقتراحات التي يقدمها كل من أعضاء فريقنا الطبي والتمريض  
كجزء من إجراءاتنا التشغيلية.  
to respect and listen to suggestions from every member of the imaging team on ways to  
ensure changes are made  
أن نتواصل مع أولياء الأمور بشفافية.  
to communicate openly with parents

لكم جزيل الشكر على التزامكم بالهدف المنشود من حملة "فحص الأشعة برفق" عند إجراء فحص  
الأشعة للأطفال أو علاجهم.  
Thank you for your commitment to the goal to *image gently* when you image or treat children.  
فلنبادر بنشر هذا الهدف الطيب في القسم الذي تعملون به أو في مجال تخصصكم أو في المستشفى  
أو العيادة التي تعملون بها  
Spread the word in your department, practice, hospital or clinic.

First Name \* - الإسم الأول  
Last Name \* - اسم العائلة (الكنية)

● 2 versions

● 11 language versions

● Useful as a handout for  
Radiology departments  
Emergency departments  
Pediatric offices

CT, Radiology, Interventional



父母須知：  
關於兒童的醫用輻射安全

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www.imagegently.org

Head CT.....up to 6 months  
Abdominal CT.....up to 20 months

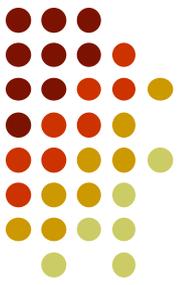
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# International Collaborations

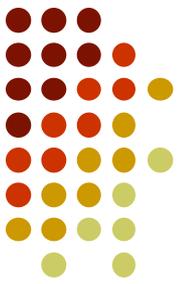


- WHO/IRQN guidelines, education, reports
- IAEA
  - Radiation Protection site visits to member countries
  - Surveys of protocols and dose estimates for pediatric CT and IR procedures (includes cardiac)
  - SMART card initiative
  - Ongoing audits
- IRPA, NCRP, HPS---RP culture,  
(Bernard Le Guen)

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# Tailoring the Message Locally



- Through cultural sensitivities
- Language translation
- Level of concern regarding radiation (eg, Chernobyl)
- Regional educational needs in developing nations, eg, fluoroscopy and interventional cardiovascular procedures vs CT

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Estimated to have come in contact with 5M people

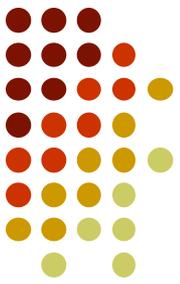
To put things in perspective:

U.S. collective annual radiation dose from medical imaging is greater than the worldwide collective radiation dose from Chernobyl



germy

# Volunteers continue to provide us with new tools and understanding



Thank you to all the dedicated and talented volunteers in radiology, medical physics & radiologic technology!



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# Communicating About Computed Tomography Challenges and Uncertainties

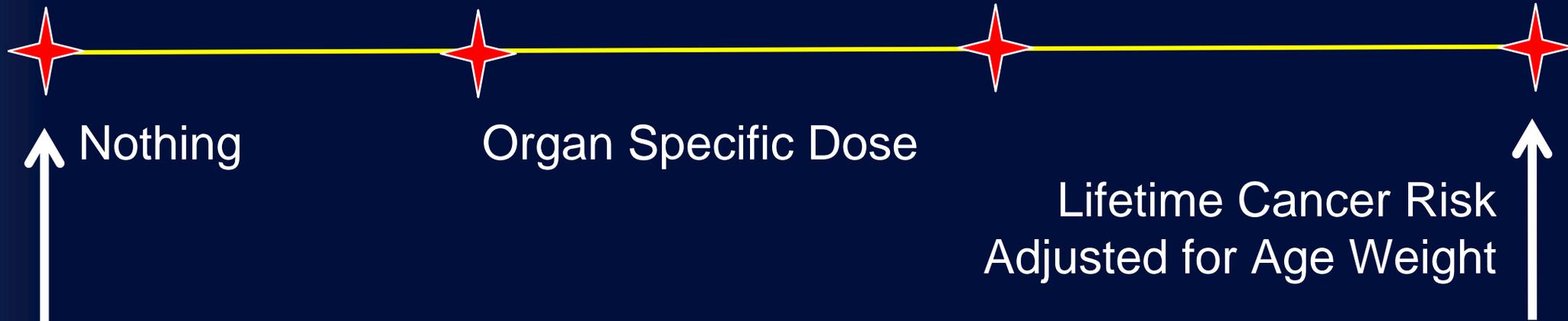
Rebecca Smith-Bindman, MD

Professor of Radiology and Biomedical Imaging  
Epidemiology and Biostatistics  
Obstetrics, Gynecology & Reproductive Sciences  
University of California, San Francisco

Visiting Research Scientist  
National Cancer Institute  
Radiation Epidemiology Branch

# What Should be Communicated : Extremes of Information

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## Recent US Congressional Hearing on Radiation from Imaging

“It is the radiologist job ensure safety– we don’t want to frighten pts”

“The risk of radiation injury from a CT scan is virtually non-existent”

“The risk of death by drowning > than the risk of death from a CT “

# Drowning and What It Adds to Our Understanding of Dose

---

In 2005, 3,582 fatal drownings in the United States

CDC web site

Laws on fencing, life preservers focused on minimizing drowning

In 2007, 15,000 cancer deaths would occur from exposure to CT that year

Using highly conservative estimates [Gonzales, Archives Internal Medicine 2009](#)

Risk of drowning death/yr

3582/ 300 million or 1/100,000

Risk of Abdominal CT cancer death/test

1/1400 or 70/100,000

Not clear the relevance of drowning to radiation risk but misinformation / fact spinning is not a good starting point for communication

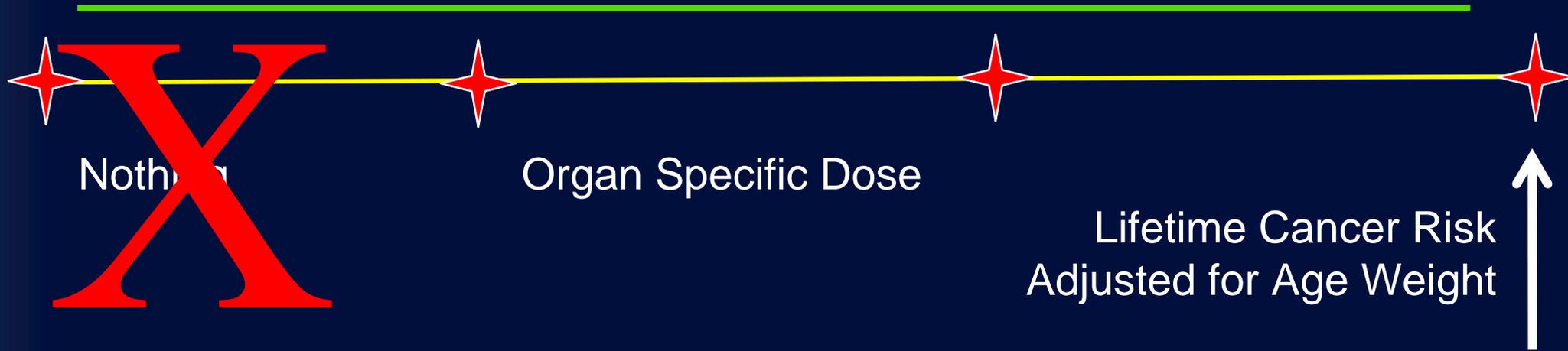
This does not reflect well on the radiologic & physics communities

There are lots of ways to spin risk data

The purpose of communication is to effectively inform patients/ providers

Providing accurate information demonstrates we understand that our clients have very different values/beliefs than we do

## What Should be Communicated



I am not sure WHAT should be communicated

Communicating NOTHING to patients, providers, health systems and regulators is no longer a viable option

Many different stakeholders need to contribute to this discussion

The consideration of this topic by the NCRP is extremely timely

# Why Communicate Risks of Radiation

---

We have abandoned the paternalistic view of medicine

Patients have the right to be involved in decision making

The Institute of Medicine “Crossing the Quality Chasm” has emphasized the need for patient centered care:

- Respect patients’ values, preferences and expressed needs

- Coordinate and integrate care across boundaries of the system

- Provide information, communication, education that people want

Other than radiation, there are lots of other relevant issues around imaging, and yet this is not an excuse to avoid providing information about radiation (because we don’t have all of the data)

We should provide the best data we have.

# Some Potential Information That Might be Communicated

---

## Benefits of Imaging

Timely and accurate diagnosis of disease

Accurate exclusion of disease (i.e. importance negative studies)

Information that leads to an improvement in treatment & outcomes

This is hardly assured for the majority of imaging tests

Most of this other than accuracy has not been quantified

## Harms of Imaging

False positive test results that lead to unnecessary / harmful treatment

Over diagnosis of disease, that leads to unnecessary/harmful Tx

Surveillance of indeterminate findings

Anxiety related to testing and uncertain results

Time

Contrast reactions (many places document informed consent)

Radiation Exposure

# Communication of Some Component of Benefit and Harm

---

It is impossible to communicate every thing

Some measure of benefit -- and some measure of harm --should be thought through and communicated

The benefits have not been well characterized, yet these benefits are probably known best by the ordering clinician (they know the question)

The potential risk is probably known best by the radiologist/physicist

Both the benefit and risks will likely vary by history of prior imaging  
Need these data in medical record

Communication needs to involve both, both from the standpoint of assessing whether imaging benefit reaches a threshold where imaging makes sense, this is mostly at the point of referring doctor

# Who Should Learn About CT Radiation

---

Who should be the the recipient of dose information

## Ordering physicians

In general: they need education

Specifically : the clinician who orders a study

## The patient

In general: when they ask about imaging

Specifically in relation to their study

## A person who takes responsibility for QC in the Institution

Physicist, Hospital Safety Folks

## Those who have oversight: FDA

# How Should The Data be Communicated

---

- 1) What does it involve? Where does the data come from?
- 2) Where does this communication happen – given most radiologists never see the patient
- 3) Does the communication happen after the fact by communication with the medical record after the fact
- 4) Does the communication happen ahead of time, for example using decision support software, where these data are accessible in the medical record ahead of time- in contemplation of the test, so it can be used in the medical decision making.

## Doses and Risks

---

Should typical dose information be provided or should it be actual (or close to actual) dose data for each patient

Does it matter?

We found the doses associated with typical CT studies are higher and more variable than typically quoted

The variation in dose will translate into very profound differences in risk

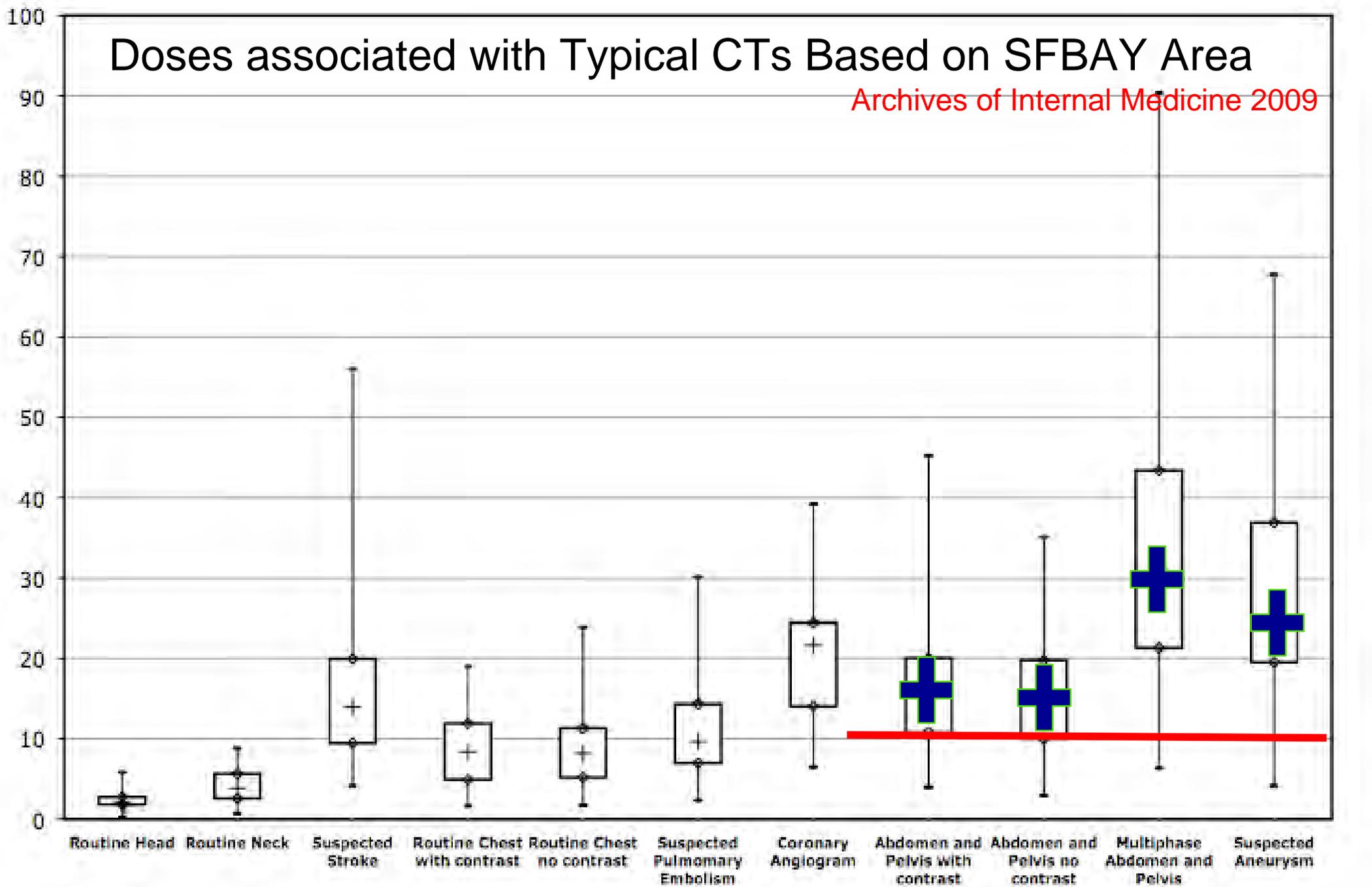
Using a single “average” dose to quantify studies does not really make sense to me, particularly if these average doses are not accurate for a particular institution

## Mean Effective Dose Across 4 Sites

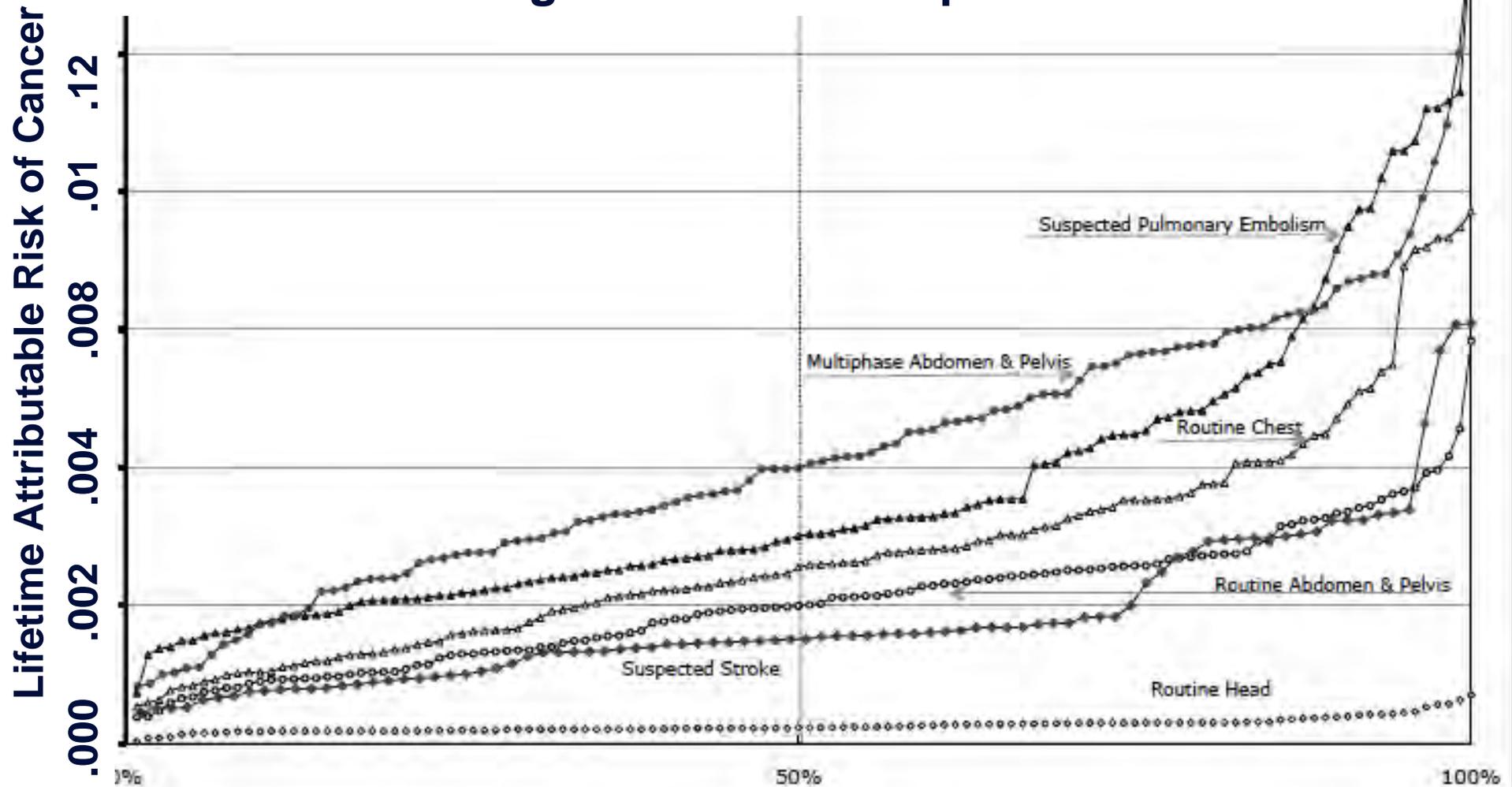
	Site 1	Site 2	Site 3	Site 4	P value
Routine Head	2.8	1.8	2.8	1.9	p<.00001
Routine Neck	2.8	5.9	5.1	2.3	p<.00001
Suspected Stroke	18	15	7.6	29	p<.00001
Routine Chest	5.2	12	11	7.4	p<.00001
Suspected PE	8.1	21	9.0	9.0	p<.00001
Coronary Angiogram	21.	19.7			p=.75
Routine					
Abdomen/Pelvis	12	19	20	12	p<.00001
Multiphase					p=
Abdomen/Pelvis	24	35	45	34	.00001
Suspected Aneurysm	49	25	22	25	p<.00001

# Doses associated with Typical CTs Based on SFBAY Area

Archives of Internal Medicine 2009



# Risk of Cancer Associated with CT Examinations Using BEIR VII Assumptions



# What Needs to Happen Setting Standards

---

Efforts need to promote efforts to reduce the variability in dose per patient and study

Standards need to be set regarding what should happen in actual clinical studies (not only phantom studies) , **and this would make it easier to know what to communicate**

ACR has upper limits for several study types

European has upper limits, and guidelines for averages

There are a limited number indications for CT and protocols should be adopted for each

radiologists can deviate from standards when needed

# Communicating Results

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Dose information needs to be communicated via **medical record**

The metric (s) needs to be understood by patients, technologists, radiologists, clinicians who order studies and hospital quality staff  
Each will use this information differently

Inaccuracy or imprecision in the metric should not be used as an excuse for not reporting information – this is what we have done!

Effective dose is useful for communicating with patients/Drs

CTDIvol and DLP and useful for safety and quality assessment

## Cumulative Exposure

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Repeated scanning is very significant issue

In a very large data analysis we are conducting, approximately 1% of patients who undergo CT have  $> 100$  mSv dose / year, and most, 2/3, do not have cancer

Patients, individual cumulative exposure to radiation needs to be calculated in the medical record to the degree possible, communicated to physicians at the point of order entry and communicated to patients so that they can be involved in decisions about the need for various tests

The decision to order a test will need to consider risk and benefits and this obviously influences risks

## Personalized Medicine – Is It Relevant

---

Personalized medicine reflects making decisions using information that is specific to an individual patients- that considers their individual risks, benefits and preferences and values.

It emphasizes that one size does not fit all

The degree to which decisions are informed by actual data – for example, actual dose from imaging studies – makes the decisions more informed

Currently these data are not shared with patients or providers, but manufacturers, through MITA have just agreed to use the Dose SR which will make this possible

## Information on Benefits of CT: What Do We Know

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There is extremely limited data that helps us understand or quantify the benefits of CT – how it improves patient outcomes as defined in the broadest sense

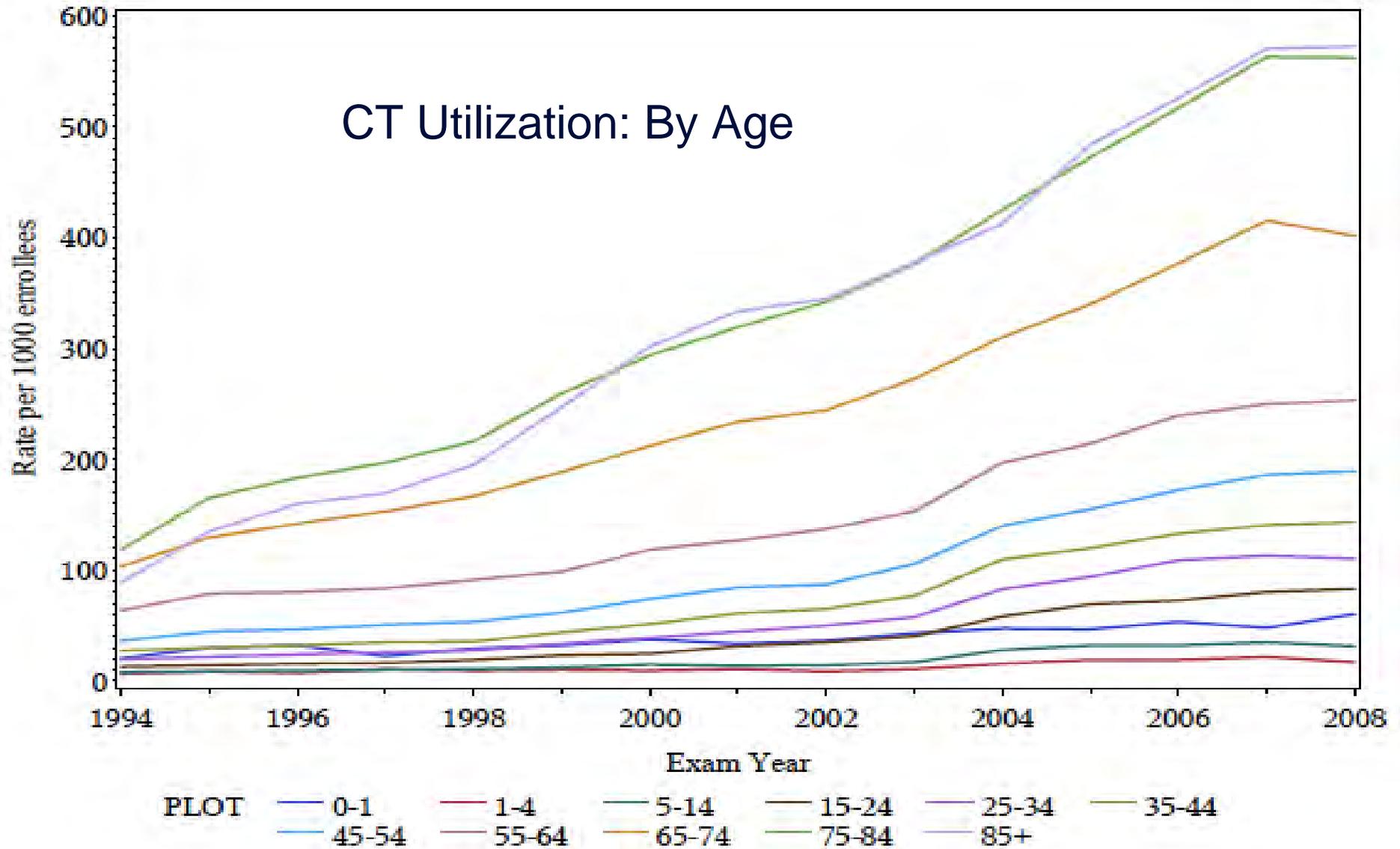
Accuracy is important, but only a tiny piece of the puzzle

Comparative effectiveness studies need to be done

We need much more standardization and quantification of benefits.

There are many CTs that are not indicated category and we need guidelines and evidence to help define the appropriate use of CT

# Patterns of Imaging By Age and Over Time: HMORN



# What is Effective Imaging

---

Effective Imaging would lead to: new diagnoses that would result in a change clinical management that would result in improvement in outcomes through improved treatment

For most diagnostic testing, there is little information on

- Accuracy for diagnosis
- Impact on clinical management or treatment
- Association with outcomes

Data on effectiveness and efficiency are desperately needed to understanding how to use imaging, but need data on the entire process from requesting imaging through outcomes

# Conclusion

---

CT is an amazing and powerful diagnostic test

Radiation dose associated with CT examinations are higher and more variable than known – demanding our concerted efforts to reduce and standardize dose

Doses in the range of even a single CT have been associated with cancer, and we can either question the exact risk, (and not move forward) or focus on ways to reduce dose to reduce those risks

Communication is an extremely important tool to help educate ourselves within the medical community, patients, and regulators

The communication needs to happen at each level, and be balanced, to have the greatest likelihood of creating informed consumers.

# Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting



**Steven Birnbaum, M.D.**  
**Department of Radiology**  
**Southern New Hampshire Medical Center**  
**Nashua, New Hampshire**

Nashua,



# Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting

- Arthur Schopenhauer
  - 19<sup>th</sup> Century German Philosopher
  - “All truth passes through three stages.
  - First, it is ridiculed.
  - Second, it is violently opposed.
  - Third, it is accepted as being self-evident.”
- Adapted from Budoff and Shinbane, Cardiac CT Imaging, Springer Verlag, 2006

# Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting

## ● Nature and Scope of the Problem

- 70,000,000 CT Studies in the U.S. in 2008
- NCRP- 60% of Medical Diagnostic Radiation Exposure from 15% of Exams
- Southern New Hampshire Medical Center
  - 188 Bed General Community Hospital with Busy Emergency Room
  - 1985- 2,500 CT Studies
  - 2009- 20,000+ Studies

# Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting

- **Elements of the SNHMC Radiation Safety Program**
  - **Educational Efforts**
    - Referring Providers, Radiologists and Technologists
    - Encourage Use of Non-ionizing Modalities
  - **Efforts to Decrease Dose on a Per Study Basis**
    - Automatic Dose Modulation/Noise Index
    - Coning
    - Shielding
    - Diminish Repeats/Redoes
    - Decrease Use of Multi-phasic Studies
    - Monitor DLP's over Time

# Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting

## I Elements of SNHMC Radiation Safety Program

- Patients Under the Age of 40 or as Designated by RSO
- Benign Diagnoses
- 5 Studies of the Neck, Chest, Abdomen or Abdomen/Pelvis
  - I Gross Dose Estimate of 50 mSv
- Required Radiologic Consultation Prior to Performance of Further Studies
- Flagging Patients in Radiology Information System (RIS) in Contrast Allergy Field
- Certified Letters to Providers in Patients with 5 Studies
- Certified Letters to Providers and Patients with 10 or more studies

# Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting

## ● **Methods of Patient Identification**

- “Prospective” by CT Technologists and Radiologists as Studies are Performed
- “Retrospective” via Data Mining in RIS
  - Use of Crystal Reports to Identify Patients
  - Quarterly Data Runs
  - Elimination of Patients with Oncology Providers

# Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting

## | “Flagged” Patients at SNHMC with Subsequent Studies Ordered

- Average Age- 35 years
- Sex- 60% Female/ 40% Male
- Clinical History
  - | Abdominal Pain- 20 Patients= 39%
  - | Chest Pain/ R/O PE- 10 Patients= 20%
  - | Renal/Ureteral Stones-7 Patients= 14%
  - | Crohn’s Disease-7 Patients= 14%
  - | Pancreatitis- 3 Patients= 6%
  - | Diverticulitis-3 Patients= 6%
  - | Trauma- 1 Patient= 1%

# Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting

## I What Happens to the “Flagged Patient”?

- 51 “Flagged” Patients had CT studies Ordered over an 18 Month Interval after Program Institution
- 8/51 Studies Cancelled- 15.7%
- 8/51 Studies to Changed to other Non-ionizing Modalities- 15.7%
- 1/51 Study Performed at Patient Insistence- 2%
- 13/51 Studies Performed at Clinician Insistence- 25.5%
- 21/51 Studies Performed Following Radiologist and Clinician Consultation- 41.2%

# Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting

## I **Ordering Physicians of Studies in 51 “Flagged” Patients**

- Emergency Room Physicians- 27/51- 52.9%
- Hospitalists- 10/51- 19.6%
- Gastroenterologists- 7/51- 13.7%
- Various Specialties- 7/51- 13.7%

## I **Radiologist Performance with “Flagged” Patients**

- Highly Variable
- 2/6 Studies Performed with One Radiologist Consulted
- 6/6 Studies Performed with Another Radiologist

# Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting

## ● Conclusions

- Patient Monitoring in an Early Trial Program Can Reduce Helical CT Irradiation in Certain High Risk Groups by Approximately 30%
- Insistence on Study Performance Remained High Among Clinicians Following Consultation
- Study Performance also Varied a Great Deal Among Radiologists When Consulted
- C.T. Technologists are Valuable Allies in this Type of Program

# Radiation Safety in the Era of Helical Computed Tomography: Methods to Decrease Patient Exposure in the Community Hospital Setting

## ● More Conclusions

- More Education and Awareness of Both Clinicians and Radiologists are Needed
- Further Efforts to Decrease Dose on a Per Study Basis are Necessary
- Is Radiation Exposure from Helical CT the Medical Equivalent of Global Warming?
- Are Decisions We Don't Make Today for Political and Economic Reasons Going to Haunt Us 20 Years from Now?

# **Beyond Dose Assessment**

Using Risk with Full Disclosure of  
Uncertainty in Public and  
Scientific Communication

**F. Owen Hoffman and David C. Kocher**

SENES Oak Ridge, Inc.  
Center for Risk Analysis  
102 Donner Drive  
Oak Ridge, TN 37830

# Disadvantages of Dose as an Assessment Endpoint

- Two individuals with the same dose may have markedly different risks
  - The risk per unit dose depends on organ exposed, age at time of exposure, gender, attained age, and variations in baseline risk
- Effective dose is a poor surrogate for risk
  - Especially for cancers of high incidence but low mortality such as the skin and thyroid
  - Maximum annual effective dose addresses compliance with regulatory dose limits
  - Risk is a function of accumulated exposure

# Advantages of dose over risk as an assessment endpoint

- Risk communication paradigms:  
Peter Sandman

$$\text{Risk} = \text{Hazard} + \text{Outrage}$$

Hoffman and Kocher

$$\text{Risk} = \text{Hazard} \times \text{Outrage}^2$$

- Limiting the focus to dose reduces outrage by avoiding a direct assessment of hazard

# When radiation assessments are based on dose

- Communication limited to comparisons with
  - Regulatory standards
  - Natural background radiation
  - Doses from medical radiation
  - Epidemiological limits of risk detection
    - Doses associated with Lowest Observed Adverse Effects Levels (LOAELs)

**The public has legitimate  
questions about risk;  
they deserve direct answers**

# Example questions

- If I am (was) exposed, what is my risk of disease?
  - How long am I likely to be at risk?
  - What would my risk be had I not been exposed?
- If a larger number of people are (were) exposed, how many would be likely affected?
  - If exposure occurred long ago, what illnesses may have already occurred, what illnesses are still to come?

# Example questions

- I was exposed some years ago, but so far I am quite healthy,

Am I still at risk?

- I was exposed some years ago, and I was recently diagnosed with cancer,

What is the chance that radiation exposure contributed to my disease?

# When answering questions about risk

- Uncertainty must be communicated
  - Considerable judgment required to extrapolate risk beyond the domain of direct observation
  - 90% to 95% uncertainty ranges often more informative than a central “best estimate” value
- Distinctions should be made between
  - Excess risk, baseline risk, and total risk
  - Past risk versus future risk
  - Disease incidence versus mortality

# **Examples of Radiation Risk Evaluations**

# There are many different ways to express risk

- Excess lifetime risk of death from lung cancer (for someone who has never smoked and exposed to radon at the national indoor average of  $46 \text{ Bq m}^{-3}$ )
  - 20 chances per 10,000  
(8 to 50 chances per 10,000)\*
    - \* 90% uncertainty range
  - $2 \times 10^{-3}$  ( $0.8 \times 10^{-3}$  to  $5 \times 10^{-3}$ )
  - 0.2% (0.08% to 0.5%)
  - 2000 deaths per million never-smokers exposed  
(800 to 5000 cases per million)
  - One excess death per 500 never-smokers exposed  
(1 per 1300 to 1 per 200 )

# There are many different ways to express risk

Annual risk of death in 1995 from lung cancer for the US population

- 157,400 deaths in the total population
  - 146,400 for ever smokers
  - 11,000 for never smokers

Fraction of lung cancer deaths attributed to radon

- 14% (6% to 30%)\* for the general population
- 26% (13% to 45%)\* for never smokers

Annual risk of death in 1995 from radon

- 21,000 (9,000 to 50,000)\*

\* 90% uncertainty range

# Examples of risk estimation

## CT scans in medicine

- Lifetime risk of cancer incidence for an abdominal scan to a 50 year-old female
  - 15 (6 to 35)\* chances per 10,000
    - Not including differences in risk between x-rays and high energy gamma rays
  - 36 (7 to 110)\* chances per 10,000
    - Including differences in risk between x-rays and high energy gamma rays

\* 95% uncertainty range

# Examples of risk estimation

## CT scans in medicine

Population risk in the USA  
from 57 million CT scans in 2007

- 29,000 (15,000 to 45,000)\* excess cancers
  - Without accounting for enhanced risk from exposure to x-rays vs. high energy gamma rays
- 60,000 (17,000 to 150,000)\*
  - Considering uncertainty in the enhanced risk from exposure to x-rays
  - The risk of cancer incidence would increase further if non-melanoma skin cancer were included

\* 95% uncertainty range

# Examples of Risk Estimation

## Nation-wide Exposures to Iodine-131 in NTS Nuclear Fallout

- Excess incidence of thyroid cancer in the USA
  - 77,000 (13,000 to 254,000)\*
  - \* 95% uncertainty range
- Female born in 1952 who consumed 1 to 3 glasses of fresh milk per day

Total future risk of thyroid cancer (baseline + excess)

Chances per 10,000

City	Total Future Risk	90% uncertainty range
San Francisco, CA	30	10 to 50
Kansas City, MO	40	10 to 110
Washington, DC	30	10 to 60

# Examples of Risk Estimation

## Nation-wide Exposures to Iodine-131 in NTS Nuclear Fallout

Female born in 1952 who consumed 1 to 3 glasses per day of fresh milk

Probability of causation for a thyroid cancer diagnosed in later life

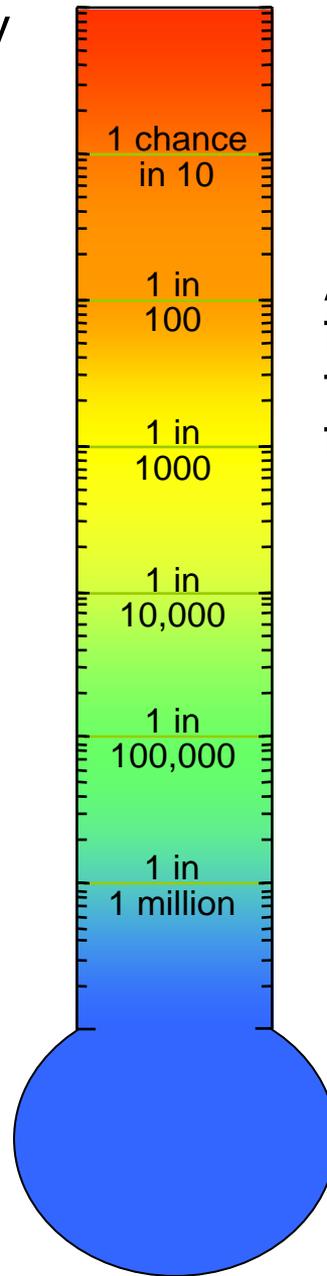
<b>City</b>	<b>PC (%)</b>	<b>90% uncertainty range</b>
San Francisco, CA	28%	4% to 68%
Kansas City, MO	50%	17% to 84%
Washington, DC	36%	8% to 72%

# Placing Risk into Perspective

The Challenge is to Communicate  
Risk to a Public Unfamiliar with the  
Language of Risk Assessment

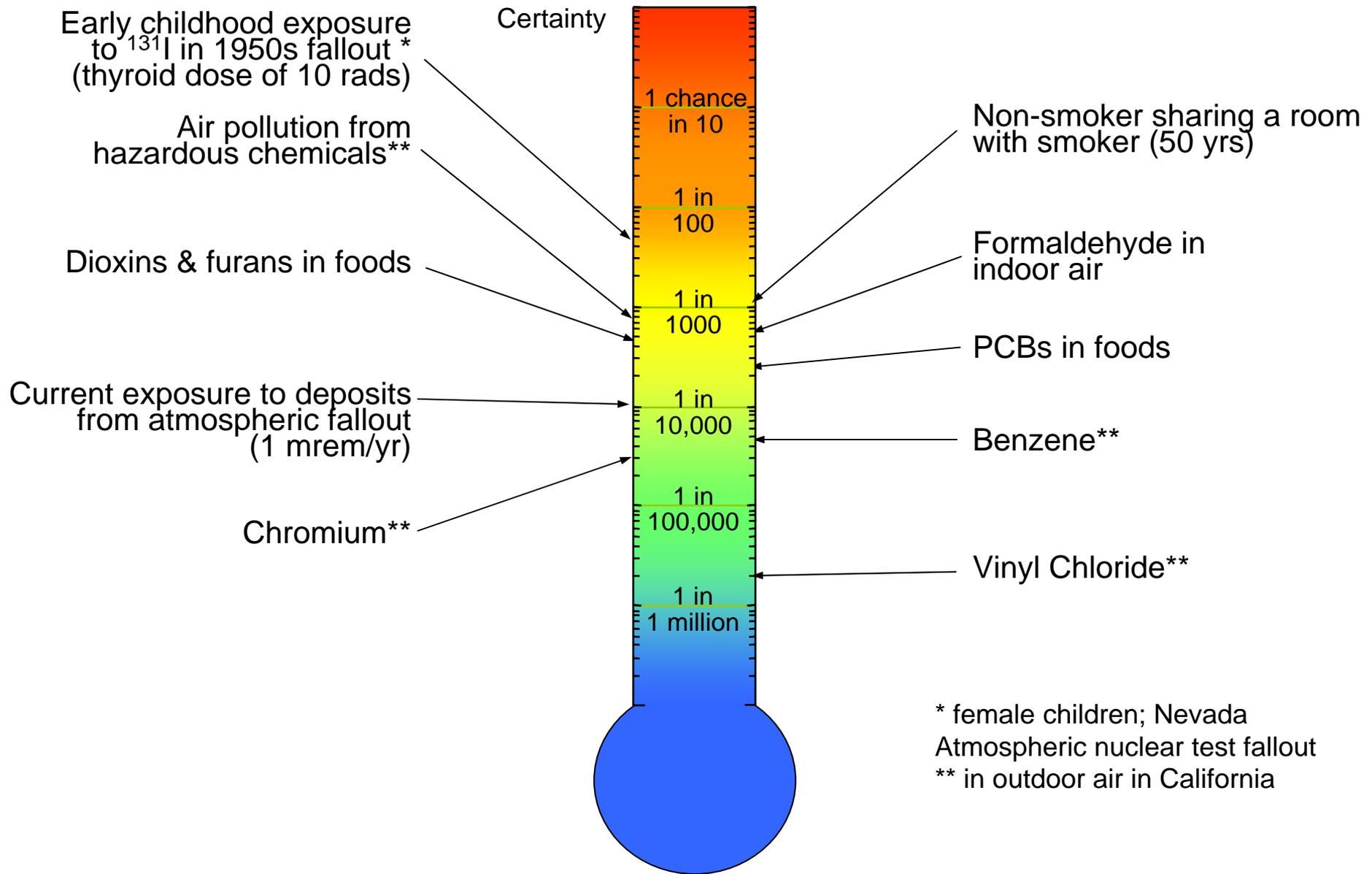
# Use of Risk Thermometers

Certainty

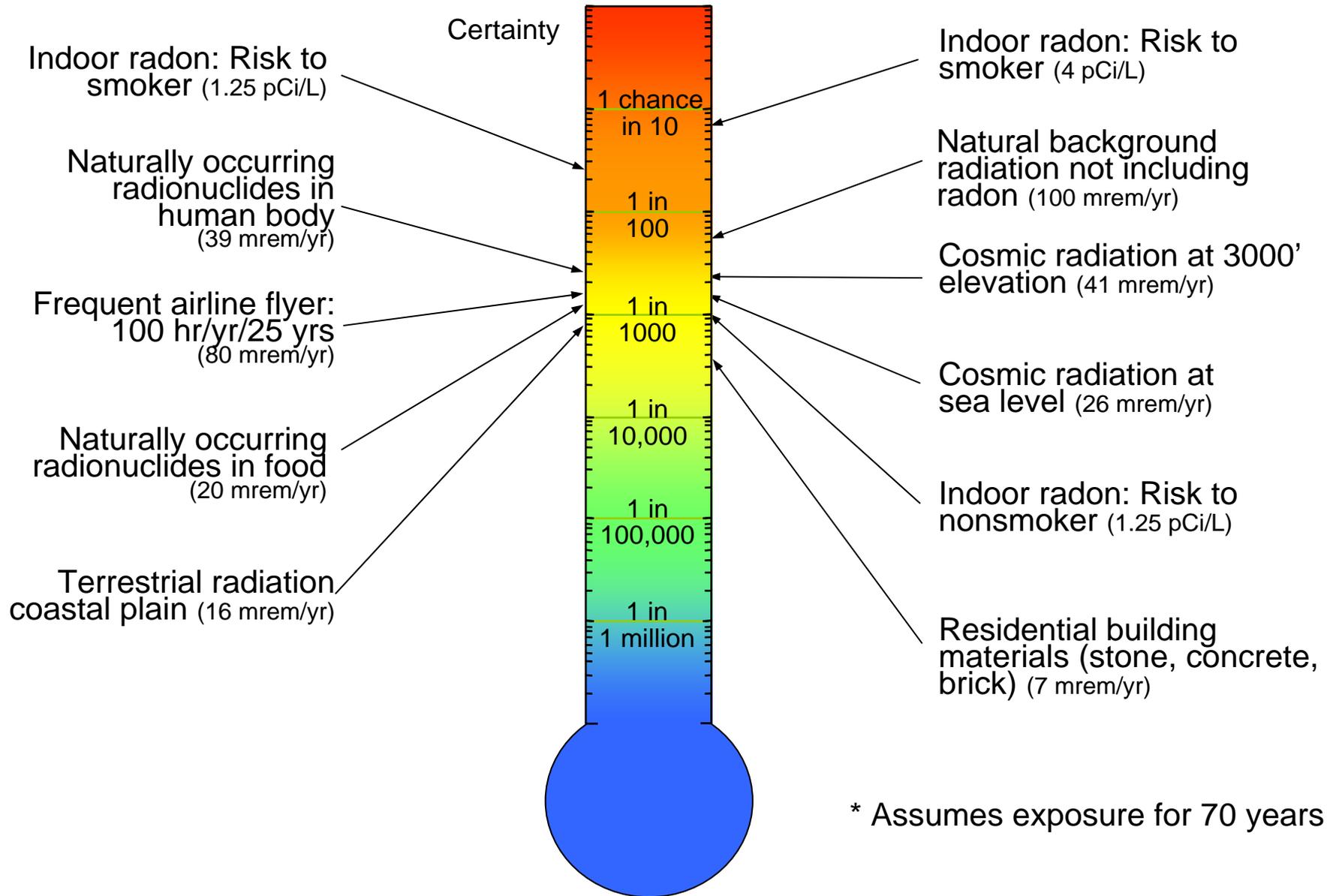


A logarithmic scale allows for a comparison of risks that differ by more than a factor of ten.

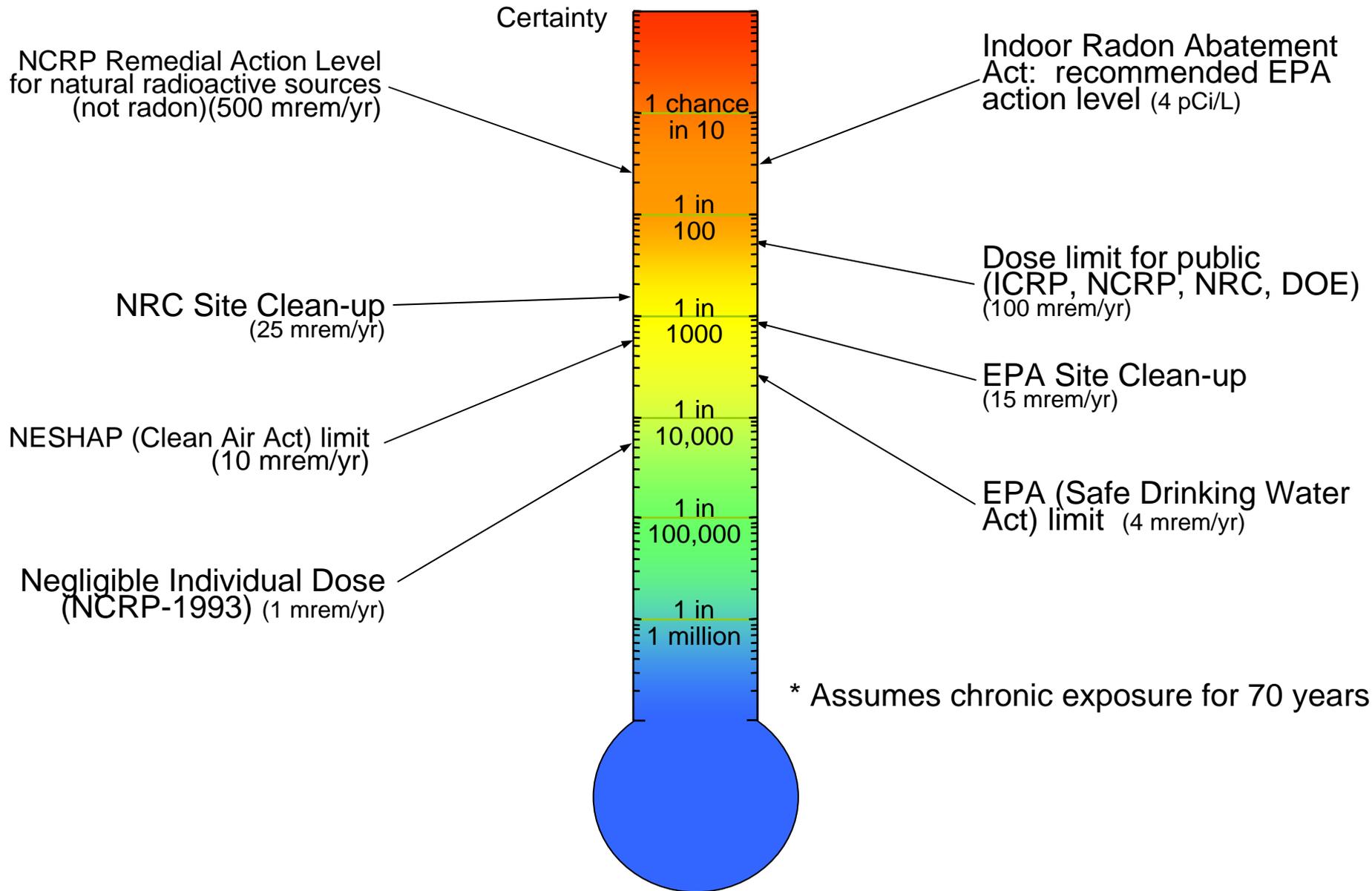
# Imposed, Involuntary Lifetime Risks of Cancer Incidence



# Lifetime Risk of Cancer Incidence from Exposure to Background Radiation\*



# Lifetime Risk of Cancer Incidence Associated With Federal Regulatory Dose Limits\*



# What are a few things we have learned from risk assessment?

- Medical exposures have become a leading source of future radiation risk to the general population
  - Risk assessments for medical exposures need to include
    - enhanced risks due to exposure to x-rays vs. high energy gamma rays
    - skin cancer incidence
- Indoor radon may cause from 13% to more than 40% of lung cancers in those who have never smoked

# What are a few things we have learned from risk assessment?

- Thyroid cancers in later life resulting from childhood exposures to I-131 in weapons fallout would be compensable nation-wide
  - If the criteria for probability of causation established for compensation of energy employees were extended to the public
    - (The upper 99<sup>th</sup> percentile of the uncertain estimate of probability of causation exceeds a value of 50%)
- A one in a million excess life-time risk is associated with a life-time accumulated whole body dose that is vanishingly small
  - 10  $\mu$ Sv or less, or fractions of a  $\mu$ Sv per year for a lifetime exposure

# When will Risk as an Assessment Endpoint be Embraced by the Radiation Protection Community?

It all depends on whether.....

- Risk is acknowledged when doses are
  - below radiation protection standards
  - below limits of epidemiological verification of risk
- Upper and lower bounds of the uncertainty range in risk are used in decision-making
- Risk communication can overcome the concern that risk numbers may alarm, if not harm, an otherwise uninformed public

# Using the IRPA Guiding Principles on Stakeholder Engagement:

*Putting Theory into Practice*

NCRP 2010 Meeting

C. Rick Jones

# Evolution of Radiation Protection Decision Process with Stakeholders

- DAD - Decide, Announce, Defend
  - MUM - Meet, Understand, Modify
    - SON - Share, Open, Negotiate

# Who is a Stakeholder?

*All interested and impacted individuals and/or organizations that can influence, positively or negatively, a proposed activity or existing situation.*

## Characteristics

- Self-identified
- Outreach needed to be inclusive
- Changes over time
- Independent experts as appropriate

# When do you engage with Stakeholders?

- Like voting - early and often
- Be proactive!
- Establish partnerships as soon as possible
- Must be based upon mutual goals and trust
- Maintain open and inclusive dialogue by keeping them engaged and active

# The IRPA Guiding Principles on Stakeholder Engagement

- Consider each principle and let them guide your everyday activities
- They are a proven tool in establishing relationships with stakeholders
- Enhances your effectiveness
- Establish continuous improvement through feedback at all stages

# Putting Theory into Practice!

- The Health Physics Society (HPS) Board of Directors has recently endorsed the IRPA Guiding Principles
- A stakeholder engagement PEP Course was presented at the 2010 HPS Mid-Year meeting
  - IRPA Associate Societies, organizations and professionals should implement the Guiding Principles to the extent practical

# How do you use the IRPA Guiding Principles?

- Let them guide the establishment or enhancement of your outreach activities:
  - Community Groups
  - Emergency Planning - particularly for Recovery and Rehabilitation activities
  - Scope and conduct of mission and research agenda
  - Content and conduct of surveillance activities (*e.g.*, environmental and medical)

# What is needed?

- Management support, funding, and time
- Shared goals or purpose with stakeholders
- Multidisciplinary team of professionals for some situations (*e.g.*, physicians, teachers, business/trade, tourism, politicians, psychologists, hydrologists)
- Clear roles, responsibilities and procedures
- Conflict resolution provisions (*e.g.*, parking lot, speaker time limits, defined topic/issue)

# Why Engage with Stakeholders?

- Informs decision makers on positions held by stakeholders
- Results in informed, sustainable decisions that can be implemented
- Makes progress on stalled and difficult issues

# Where do I find the IRPA Guiding Principles?

*The IRPA Guiding Principles for Radiation  
Protection Professionals on Stakeholder  
Engagement* are available at:

[www.irpa.net](http://www.irpa.net)

Need more information ?

C. Rick Jones  
[J3e08@msn.com](mailto:J3e08@msn.com)

# The Community Environmental Monitoring Program: A Case Study of Public Education and Involvement in Radiological Monitoring

Forty-Sixth Annual Meeting of the National Council  
on Radiation Protection & Measurements:  
Communication of Radiation Benefits and Risks in Decision Making

March 9, 2010



William "Ted" Hartwell  
David S. Shafer



Desert Research Institute  
Nevada System of Higher Education  
Las Vegas, Nevada



# Outline

- Program Background
  - Nevada Test Site (NTS)
  - Evolution of Public Opinion
- CEMP Network and Operations
  - Coverage and Infrastructure
  - Data Collection and Accessibility
  - Pitfalls of Transparency
- Citizen Involvement
  - Community Environmental Monitors (CEMs)
  - Training Workshops
  - Public Outreach
  - CEMP and IRPA Guiding Principles

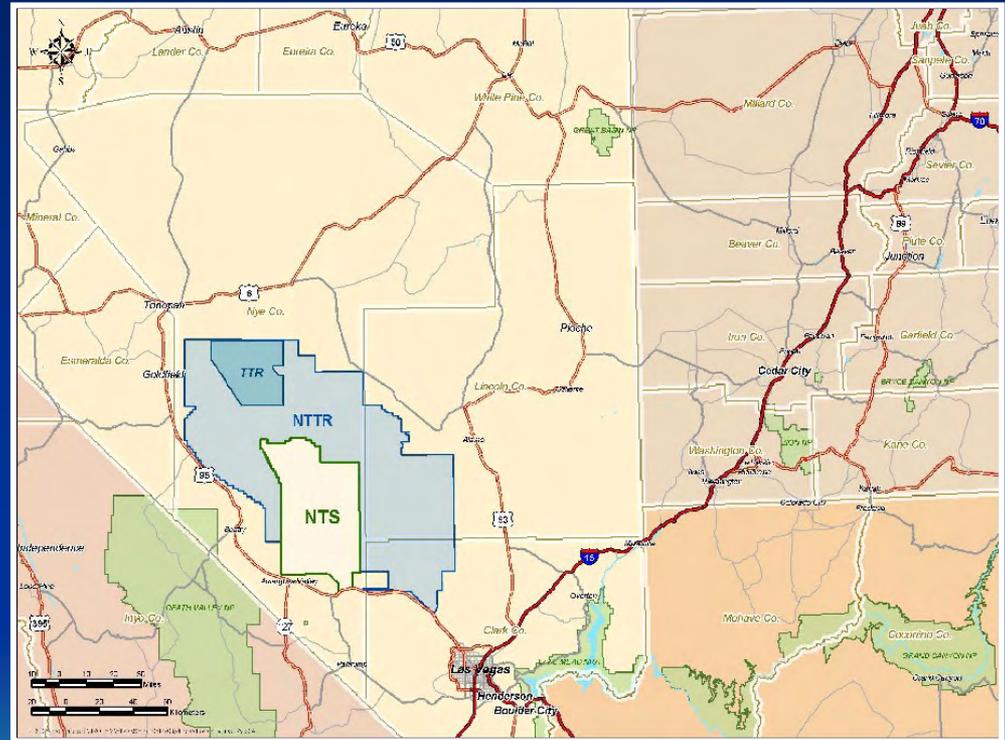


# The Nevada Test Site

-Located approximately 75 miles northwest of Las Vegas

-Encompasses about 1375 square miles

-Served as primary United States continental site for testing nuclear weapons between 1951 and 1992.



# Atmospheric Nuclear Testing At The NTS

-100 atmospheric nuclear tests conducted at the NTS between 1951 and 1962.

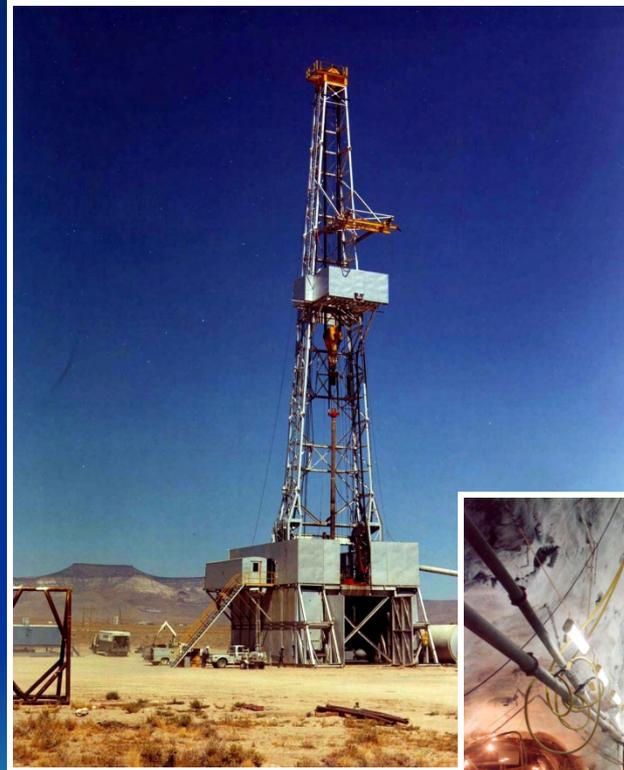
-Largest was the *Hood* test, with a yield of 74 kilotons.



# Underground Testing at The Nevada Test Site

-828 underground  
nuclear tests  
conducted between  
1951 and 1992

-Largest was the 1.3  
megaton *Boxcar* test  
of April 26, 1968.



# Unplanned Venting of NTS Underground Nuclear Test



Baneberry, December 18, 1970

# Artifacts of Underground Nuclear Testing At The Nevada Test Site

Subsidence Craters in Yucca Flat



# Initial Public Perception & Nuclear Testing

-Early public opinion viewed testing as a necessity and a display of national prowess

-Word "atomic" heavily utilized in popular culture

-Public was often rapt witness to weapons tests



1950's Postcards---mushroom clouds possibly added to photos.

# Changing Perception of Nuclear Testing

- Public awareness of the potential for adverse health impacts from radiation raised level of public concern by late 1950s
- By 1970s, concern had become fear
- Protests outside the NTS became larger and more frequent



# Three Mile Island

- 1979 accident at Three Mile Island in Pennsylvania and associated media coverage enhanced public fear of “all things nuclear”
- Citizens Monitoring Network implemented involving public stakeholders
- CEMP modeled in part after this program



# Community Environmental Monitoring Program

- Established in 1981
- Facilitates communication between the Department of Energy, National Nuclear Security Administration (DOE/NNSA) and the communities surrounding the Nevada Test Site (NTS)
- Increases accessibility to and transparency of monitoring data
- Provides hands-on role for the public in the monitoring process.
- Funded by the Department of Energy National Nuclear Security Administration's Nevada Site Office
- Administered by the Desert Research Institute (DRI) of the Nevada System of higher Education



# Community Environmental Monitoring Program

- Currently includes a total of 29 monitoring stations
- Twenty-four stations are located in Nevada, with 18 in communities and six at ranches
- Four stations are located in towns in Utah
- One station in California
- All stations collect information on both background radiation and weather information
- Employs members of the local communities as independent Community Environmental Monitors (CEMs) to serve as station managers
- Meteorological instruments on stations helps explain much of the variation in background radiation.



**Ely, Nevada CEMP Station at US Bureau of Land Management & Forest Service Site.**



**C**ommunity  
**E**nvironmental  
**M**onitoring  
**P**rogram

<http://cemp.dri.edu/>

-web site enhances the mission of the CEMP by increasing the transparency of the data as well as public accessibility to the data





“Latest Readings” is a popular feature of the web site. For most stations, values are updated every ten minutes on a schematic of the station.

# CEMP

## Community Environmental Monitoring Program

[CEMP Home](#) [More Info](#) [Educational Info](#) [Contact Us](#)

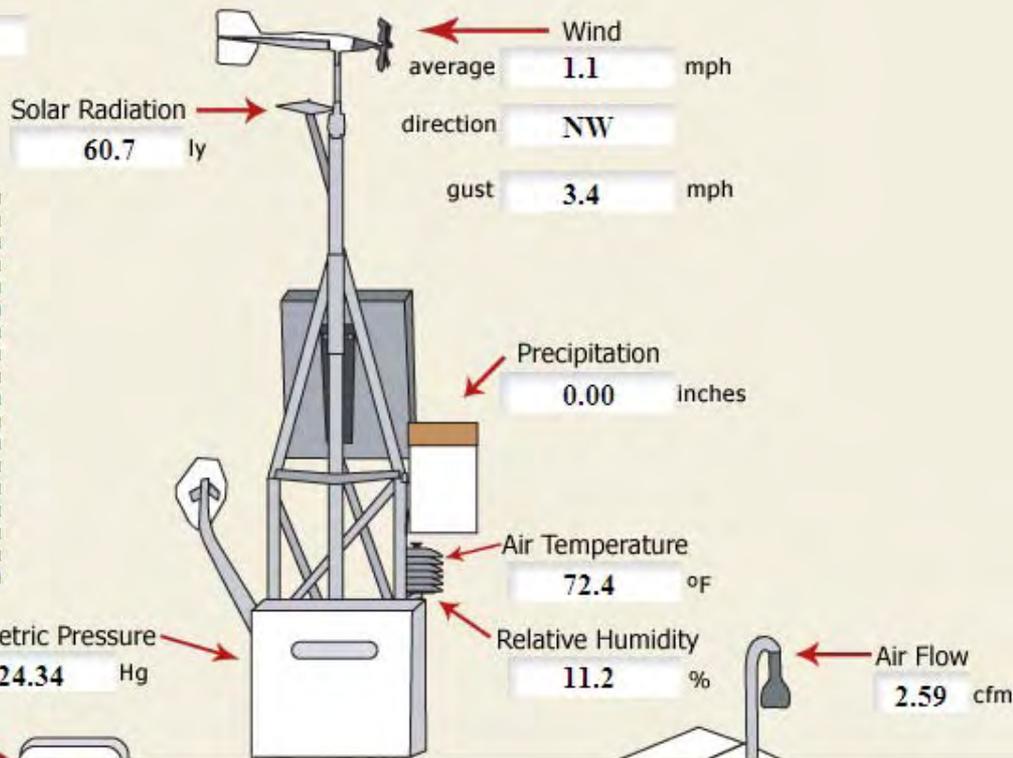
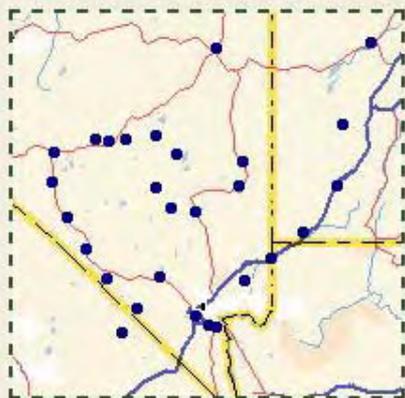
### Pioche Nevada

Station

Pioche Nevada

Time

09-29-2006 09:20AM

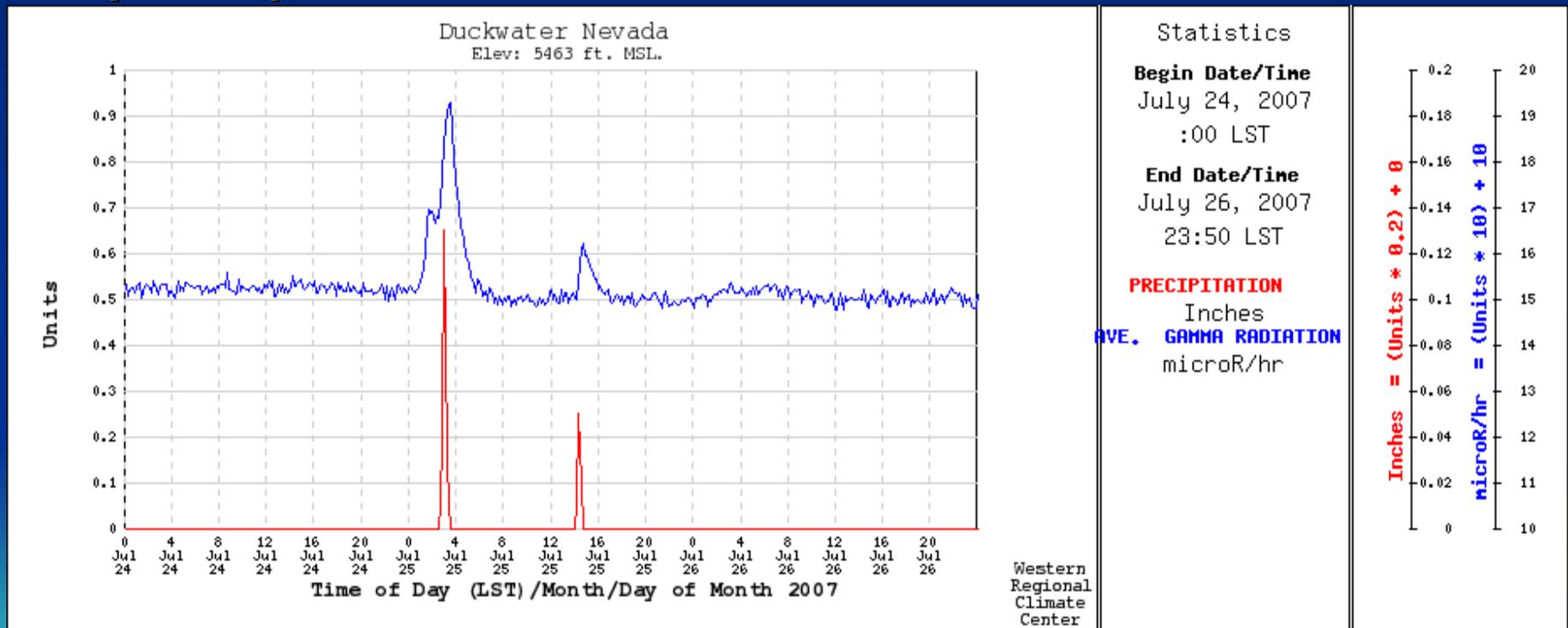


# CEMP Web Site

-Statistical trends & linkages between data can be done by anyone on the public web site.

*Web site helps to standardize the analysis, but...  
also allows the analysis to be decentralized.*

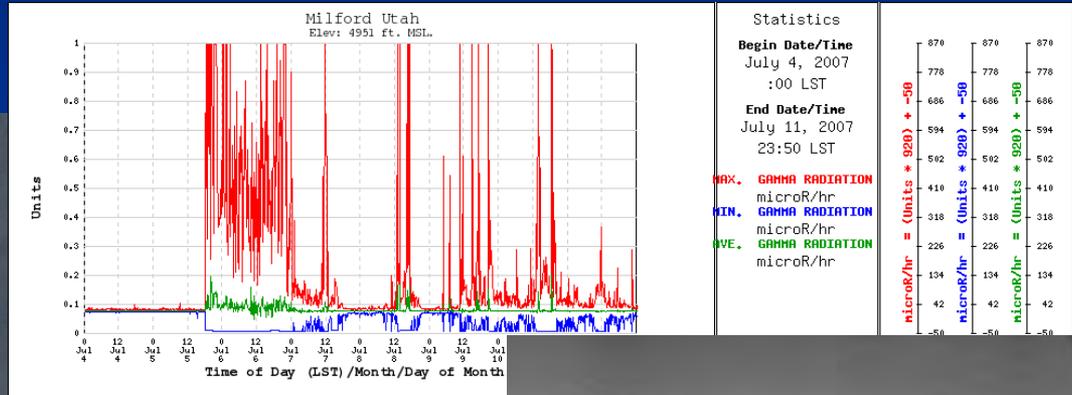
--Sample output:



Gamma radiation "spikes" associated with precipitation events at the Duckwater, Nevada, station. Real-time plot on web site.

# Pitfalls of Transparency

- Milford Flat Fire---2007
- Largest wildfire in Utah history
- Malfunctioning PIC (nearly) concurrent with initiation of fire



## Who are the Community Environmental Monitors (CEMs)?

- Two in each community
- Over half are high school or college science teachers
- Others representative of very diverse backgrounds
- Respected members of community and willing to take on responsibilities for minimal compensation
- Become “lay-experts” in their communities on issues related to ionizing radiation
- Involvement improves public credibility of monitoring data and alleviates “fear factor”
- Participation results in significant cost savings to overall monitoring program



# CEMs---Data Collection and Dissemination

- collect bi-weekly filter samples and are part of the official chain of custody
- Post monthly summary data for all stations
- serve as points-of-contact for their communities.
- In addition, the CEMs are responsible for ensuring that the stations are operating properly.



# CEM Training

- participate in on-site training that familiarize them with the operation of the equipment at the proper procedures for filter collection.

- monthly mailings of articles/information

- attend workshops that teach them about ionizing radiation, including a history of its discovery, natural and manmade sources, potential biological effects, etc.

- Workshops includes briefing on current activities at the Nevada Test Site

- experience variety of invited lectures on diverse subjects dealing with ionizing radiation.



# Past CEMP Workshop Topics

- Socio-historical perspective on atomic testing
- Community monitoring at Three Mile Island
- Updates on Chernobyl ecosystem and human effects studies
- Health effects in downwind populations
- Biological and cultural effects of atomic testing on populations of the Marshall Islands in the Pacific Ocean
- Worldwide high natural background areas and effects
- Investigations of fires on a mechanism of radionuclide transport
- Nuclear power and global climate change
- Recent detection of tritium in a groundwater well drilled off the NTS.



# Additional Public Interaction

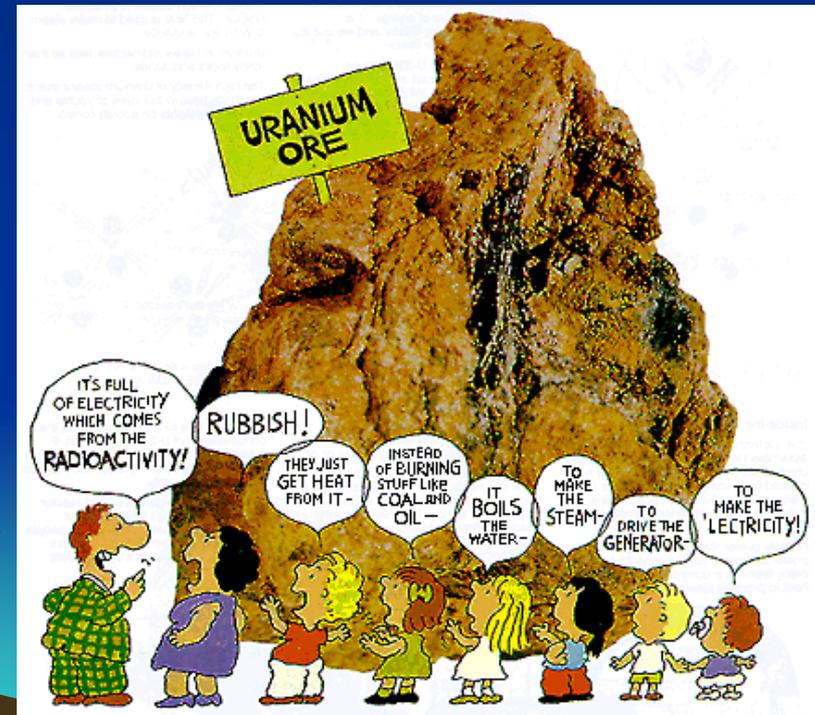
- Targeted outreach activities
  - Community events (county fairs, council meeting)
  - Presentations to civic and religious organizations
  - Classroom presentations and seminars



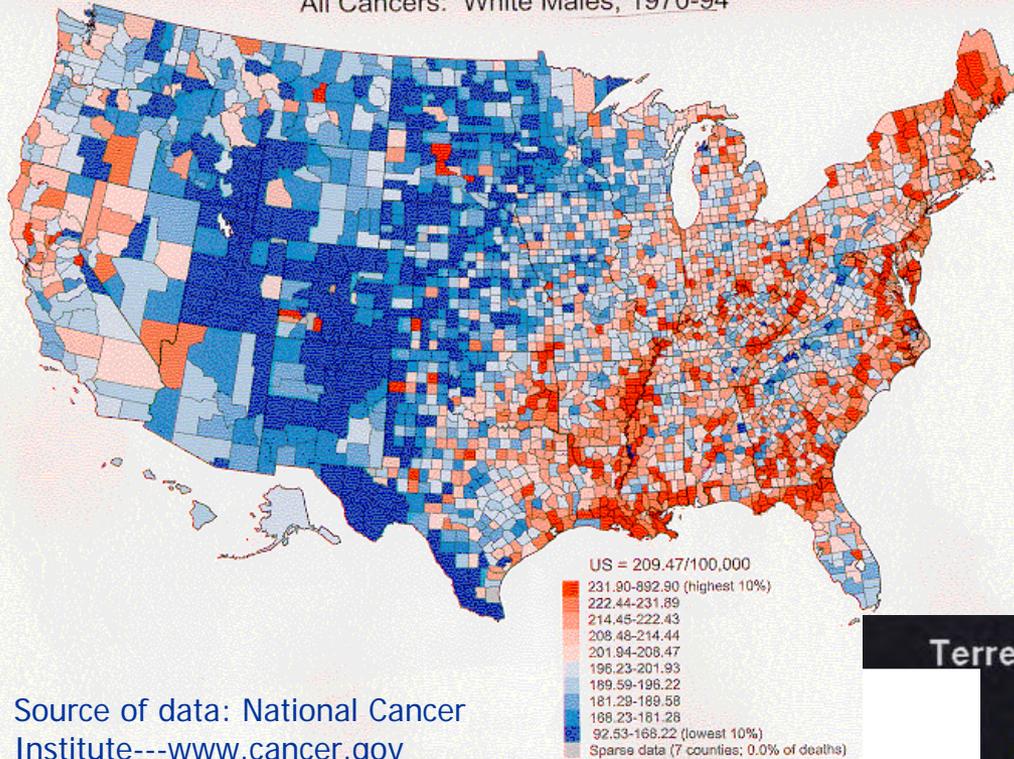
# The Amount of Radioactivity is NOT Necessarily Related to Size

- Specific activity is the amount of radioactivity found in a gram of material.
- Radioactive material with long half-lives have low specific activity.

1 gram of Cobalt-60  
*has the same activity as*  
1800 tons of natural  
Uranium



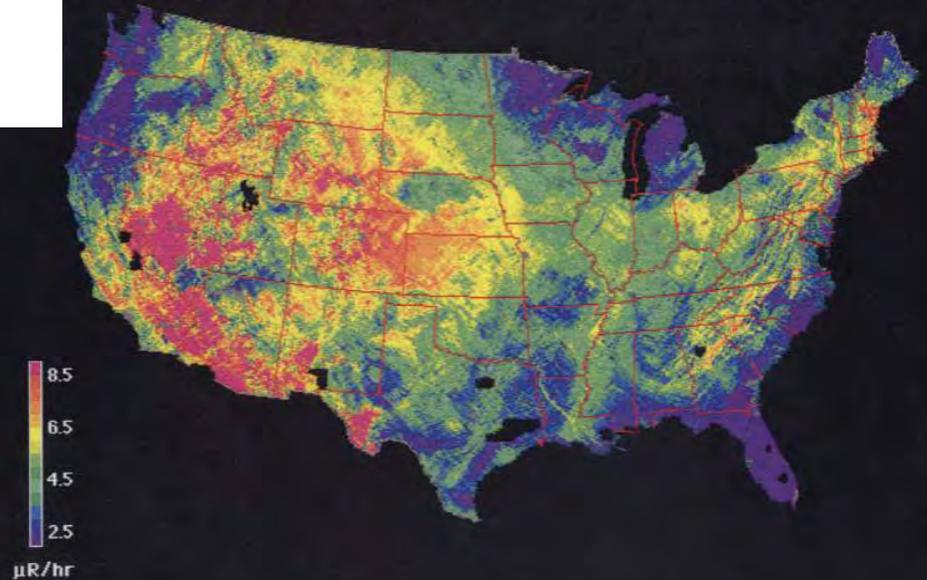
Cancer Mortality Rates by County (Age-adjusted 1970 US Population)  
All Cancers: White Males, 1970-94



Source of data: National Cancer Institute---[www.cancer.gov](http://www.cancer.gov)

A map of US cancer mortality rates by county compared with natural gamma exposure rates across the US.

Terrestrial Gamma-Ray Exposure at 1m above ground



Source of data: U.S. Geological Survey Digital Data Series DDS-9, 1993

# Ancillary Benefits of Direct Public Involvement

CEMs have assisted with resolution of several rad-related incidents and inquiries:

- Rocket crash near Goldfield, Nevada
  - Bluebunny™ Ice Cream plant at St. George, Utah
  - Milford Flat Fire response
  - Response to (inaccurate) report of semi with low-level nuclear waste overturning near Indian Springs, Nevada
- 

# The CEMP and IRPA

## Guiding Principles for Radiation Protection Professionals on Stakeholder Engagement

- Identify opportunities for engagement and ensure the level of engagement is proportionate to the nature of the radiation protection issues at stake and their context **YES**
- Initiate the process as early as possible and develop a sustainable implementation plan **NO**
  - **CEMP is not a decision making process. However, the CEMP can help DOE/NNSA know what information stakeholders need to understand an issue.**
- Enable an open, inclusive and transparent stakeholder engagement process **YES**
- Seek out and involve relevant stakeholders and experts **YES**
- Ensure that the roles and responsibilities of all participants, and the rules for cooperation are clearly defined **YES**



# The CEMP and IRPA

## Guiding Principles for Radiation Protection Professionals on Stakeholder Engagement

- Collectively develop objectives for the stakeholder engagement process, based on a shared understanding of issues and boundaries **YES**
- Develop a culture which values a shared language and understanding, and favours collective learning **YES**
- Respect and value the expression of different perspectives **YES**
- Ensure a regular feedback mechanism is in place to inform and improve current and future stakeholder engagement processes **YES**
- Apply the IRPA Code of Ethics in their actions within these processes to the best of their knowledge **YES**



# Conclusions

- A hands-on role for the public improves the transparency and credibility of monitoring data.
- Anecdotal evidence that “fear factor” is lessened with stakeholder involvement, particularly in rural communities.
- The internet can be an effective tool for disseminating results and helping build program credibility by providing near real-time access to monitoring data.
- Stakeholders are willing to take on significant responsibilities in assisting with the operation of monitoring networks, including educating themselves and members of their communities about the results of such monitoring.
- A hands-on role can actually result in reduction of programmatic costs
- The CEMP can serve as a model for public involvement in programs dealing with issues of environmental concern



# Contact Information for CEMP

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# Psychosocial and Health Impacts of Uranium Mining and Milling on Navajo Lands

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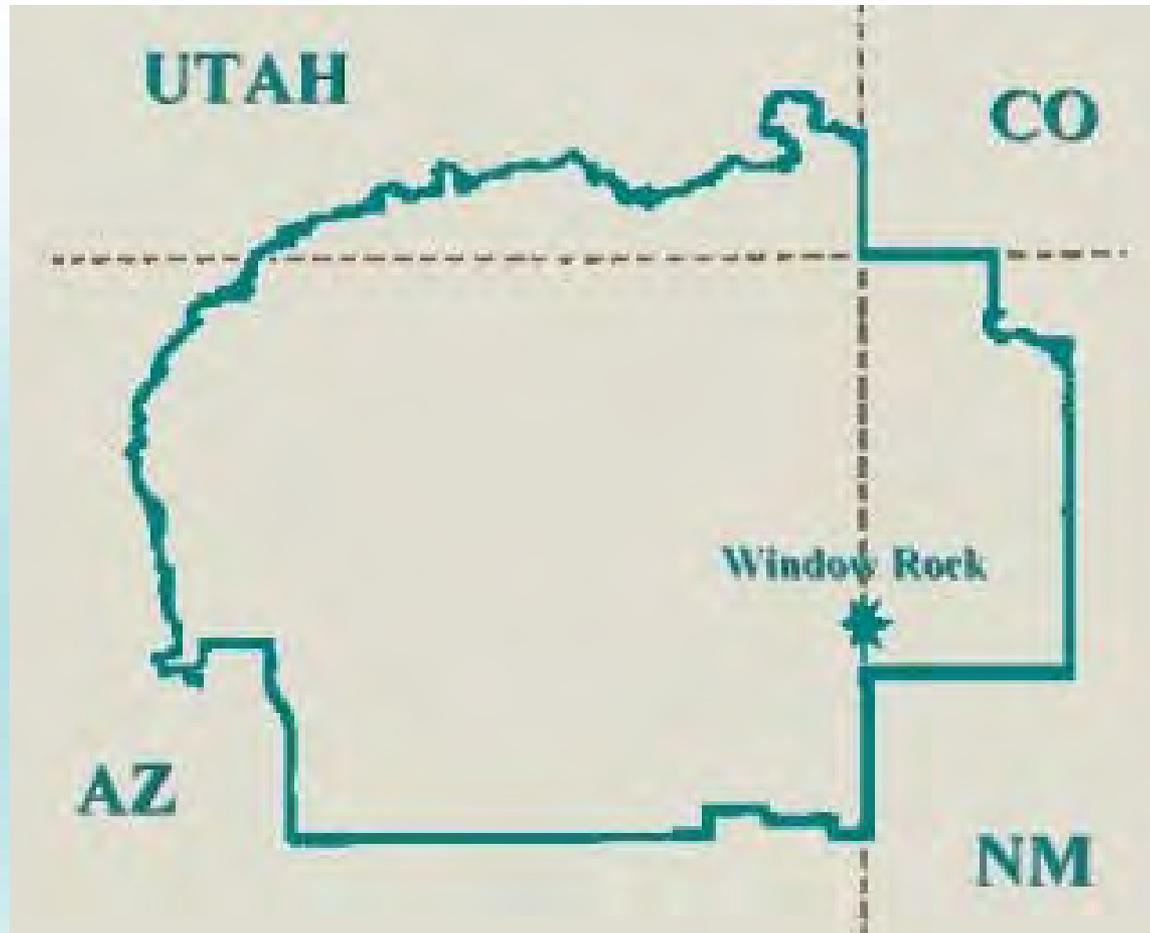
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# Introduction

- Our studies of uranium workers examined perceptions of:
  - Occupational and environmental exposures
  - Working conditions
  - Health impacts
- Radiation Exposure Compensation Act (RECA)
  - 1990 RECA
  - 2000 Amendments to the Act
  - RECA claims
- Resurgence of Uranium Mining and Milling
  - Global
  - United States
  - Navajo Nation

# Navajo (Diné) Nation



# Uranium Doghole/Mine



# Uranium Doghole/Mine



# Uranium Underground Deep Mine



# Jackpile Surface Uranium Mine



# Reclaimed Jackpile Mine



# Cameron, AZ, Uranium Surface Mining



# Underground Uranium Miner Circa 1950



# Moab Uranium Mill and Colorado River



# Moab, UT, Uranium Mill



# Uranium Transport Truck at Mill Site



# Crushed Uranium Conveyer Belt



# Millworker at Yellowcake Barreling Site



# Yellowcake Hearth/Barreling



# Sample Characteristics

- Total 275
- Age 36-79, Mean 53
- 30% Women (81)
- 35% Indians (95)
- 71% Millers (196)
- 22% Miners (59)
- 5% Clerical (14)
- 2% Truckers (2)



## Environmental Exposures

- 79% (75) Indians lived near mine/mill mean 10 y.
- 25% (45) Non-Indians lived near mine/mill 6 y.
- 32% (30) Indian children played near mine/mill
- 8% (15) Non-Indian children played near mine/mill



# Moab, UT, Tailings Pile



# Rare Metals Mill Site, Navajo Nation, Worker Housing Reclamation



# Monticello, UT, Mill Tailings Reclamation



# Moab, UT, Mill Reclamation



# Shiprock, Navajo Nation, Mill Reclamation



# Green River, UT, Reclaimed Tailings



# Radiation Exposure Compensation System

Claims to Date Summary of Claims Received by 06/28/2009

<b>Claim Type</b>	<b>Approved</b>	<b>\$ Approved</b>
Downwinder	13,249	\$662,420,000
Onsite Participant	1,322	\$94,563,639
Uranium Miner	5,081	\$507,374,560
Uranium Miller	1,238	\$123,800,000
Ore Transporter	256	\$25,600,000
<b>Total</b>	<b>21,146</b>	<b>\$1,413,758,199</b>

(Source: Department of Justice 2009)

# Shiprock, Navajo Nation

