Communicating Risk & Benefit to Health Care Providers & Patients

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Radiation Risk

Need to know information about Radiation and information about Risk

Radiation

Facts - Scientific Methods and Technology

Legitimacy
- Norms

Authenticity
-Personal and organisationa integrity/identity/truthfulness
-**What builds Trust**

Statens strålskyddsinstitut
Swedish Radiation Protection Authority

But what builds Trust ?

- Components of trust
- *(Institutional trustworthiness)*
- *Ortwin Renn (98)*

- Competence
- Openness
- Fairness
- Empathy

Factors in assessing trust and credibility
Vincent Covello (93)

- Competence & expertise
- Honesty & openness
- Dedication & commitment
- Empathy & caring

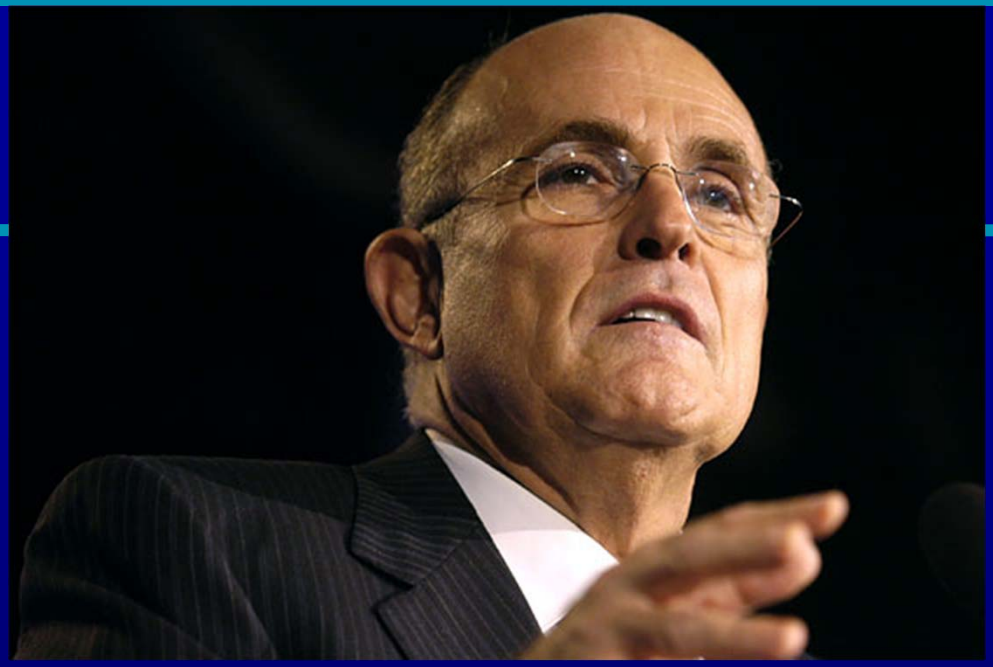
Collective Statistical Illiteracy in Health Care

1. Few physicians, patients, and politicians understand health statistics. Until they do, informed decision-making will remain science fiction.
2. Collective Statistical Illiteracy is largely caused by
   - non-transparent framing of information, unwittingly or intentionally, and
   - lack of efficient training in risk communication in medical schools and the educational system in general.
3. There's a simple solution: teach and implement transparent risk communication.

Collective Statistical Illiteracy

I

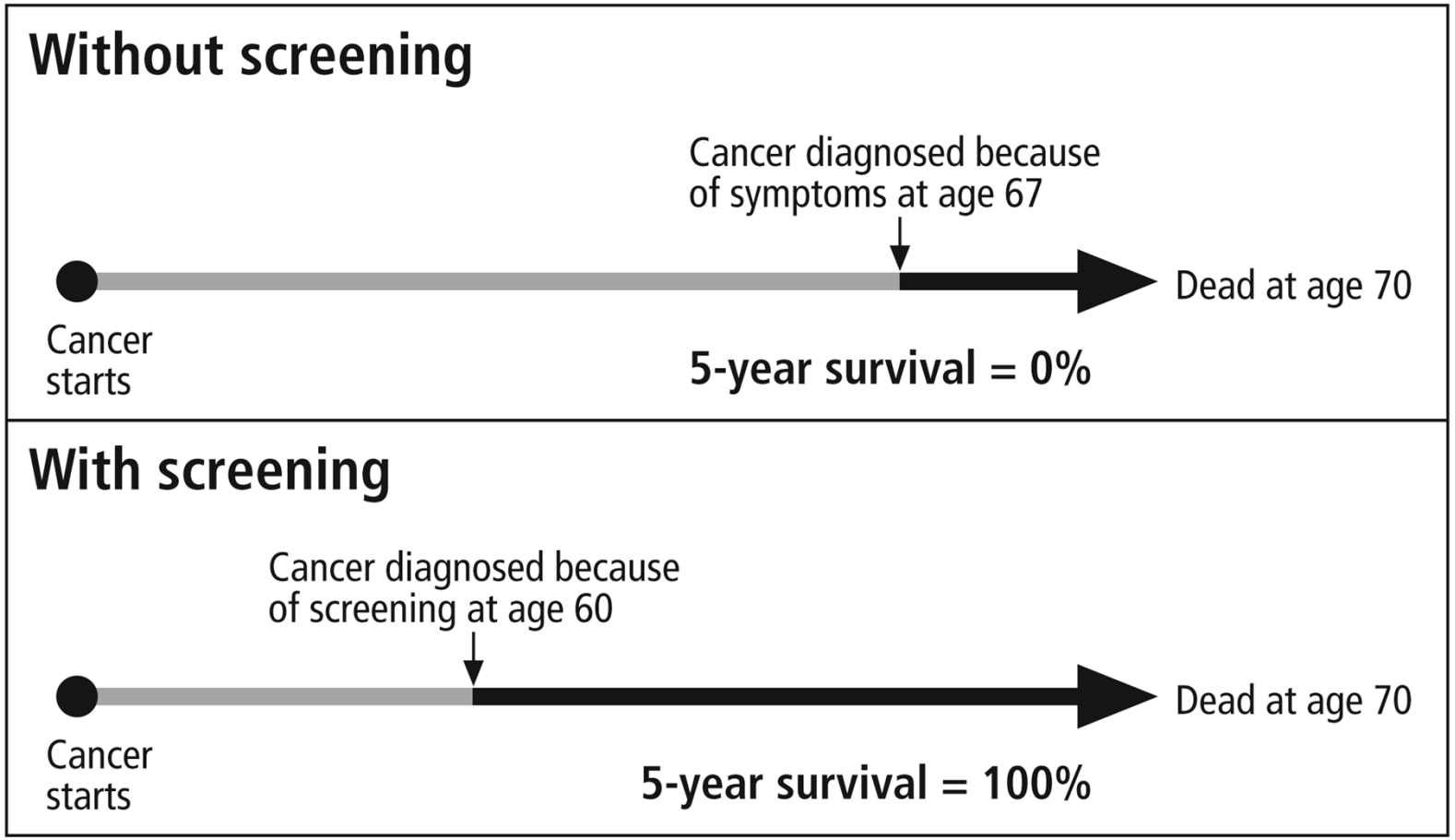
Politicians



"I had prostate cancer, five, six years ago. My chances of surviving prostate cancer and thank God I was cured of it, in the United States, 82 percent. My chances of surviving prostate cancer in England, only 44 percent under socialized medicine."

Rudy Giuliani, New Hampshire radio advertisement, October 2007

Lead Time Bias



Gigerenzer, Gaissmaier, Kurz-Milcke, Schwartz, & Woloshin 2007. *Psychological Science in the Public Interest*.

Collective Statistical Illiteracy

II

Physicians

Do Physicians Understand 5-Year Survival Rates?

Participants: 31 urologists
Setting: Continuing education

When the (same) information about PSA tests was framed as:

Survival rates: ***71%*** *recommend screening*

Mortality rates: ***10%*** *recommend screening*

When asked, what does lead-time-bias mean? ***84% did not know***
(Wegwarth, Gaissmaier & Gigerenzer, 2010)

➔*Uninformed decision making appears to be the rule. Costs of PSA mass screening: first year $12 – 28 billion (US)*

Gynecologists' understanding of a relative risk reduction

Participants: 150 German gynecologists

Setting: Continuing education session

"Mammography screening reduces mortality from breast cancer by about 25%. Assume that 1,000 women age 40 and over participate in mammography screening. How many fewer women are likely to die of breast cancer?"

- 1 [66%]
- 25 [16%]
- 100 [3%]
- 250 [15%]

Gigerenzer, Gaissmaier, Kurz-Milcke, Schwartz, & Woloshin 2007. *Psychological Science in the Public Interest*.

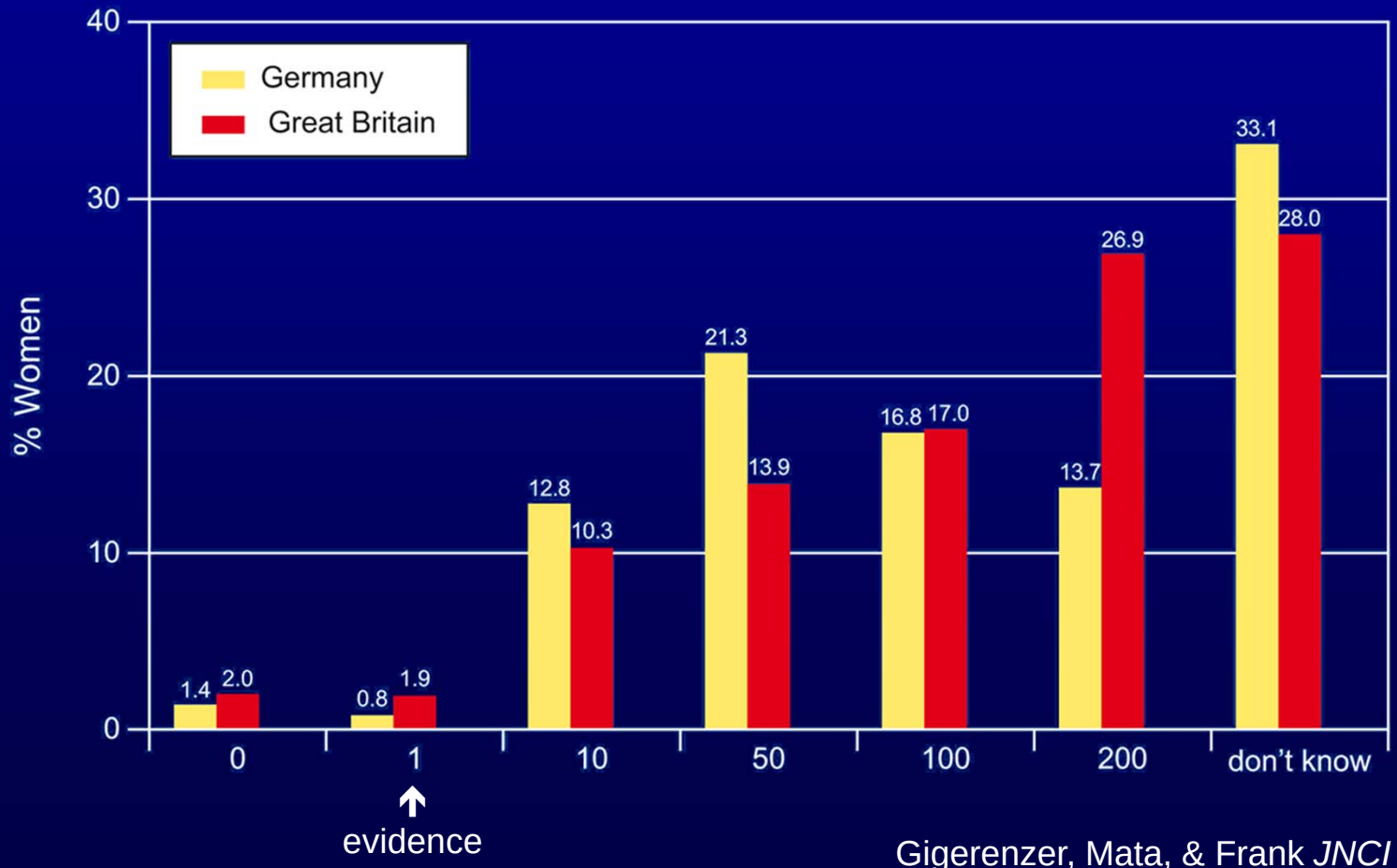
Collective Statistical Illiteracy

III

Patients

PERCEIVED BENEFITS OF MAMMOGRAPHY SCREENING

Out of 1000 women 50+ who regularly participate in screening, how many fewer will die of breast cancer in comparison to those who do not participate?



Gigerenzer, Mata, & Frank *JNCI* 2009

What Does the Public Know about the Benefits of Breast and Prostate Cancer Screening?

Setting:

First Europe-wide representative study with 10,228 face-to-face interviews in Austria, France, Germany, Italy, the Netherlands, Poland, Russia, Spain, and the UK.

Key Results:

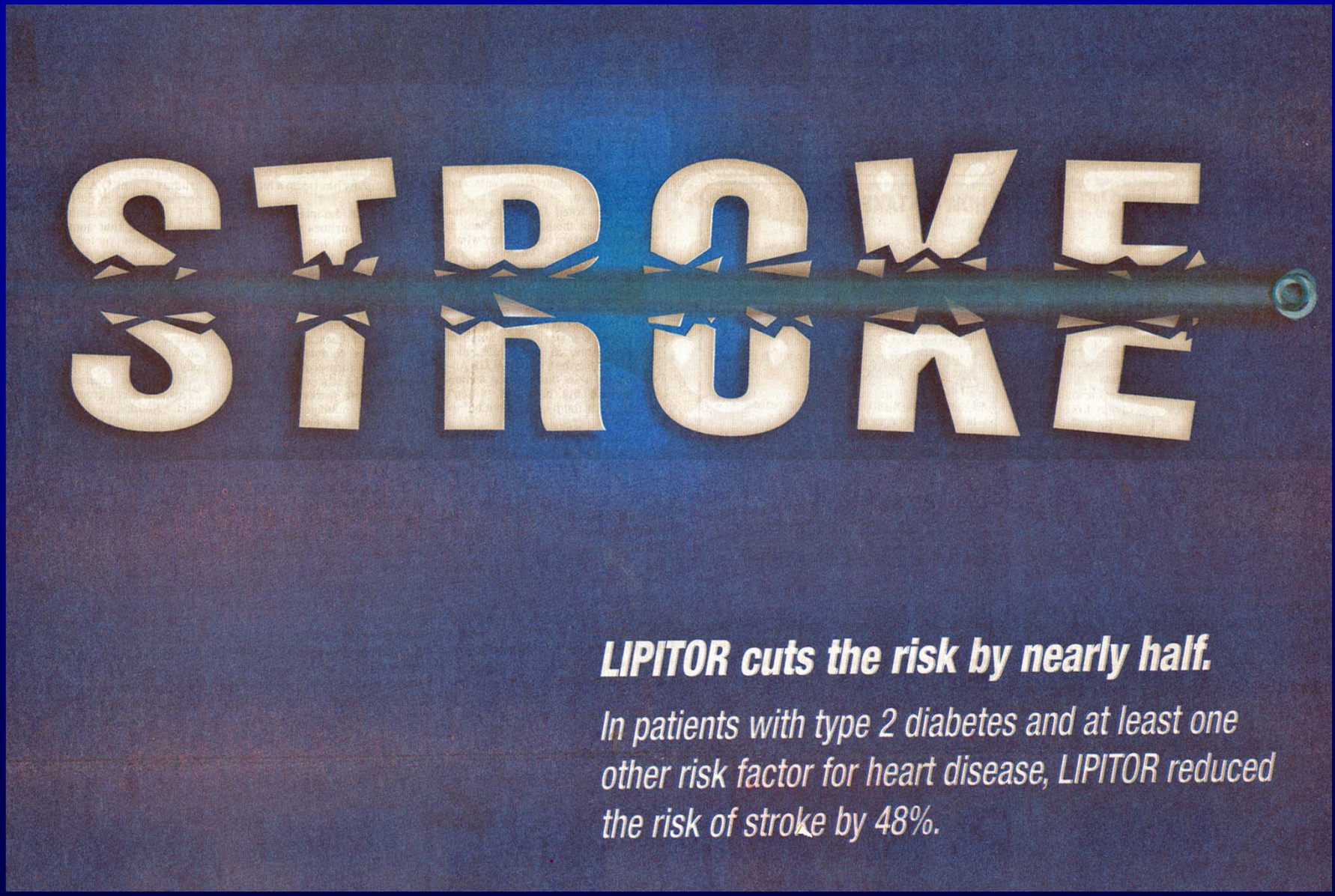
1. 92% (89%) of women (men) overestimated the cancer-specific mortality reduction by at least one order of magnitude or did not know.

2. In the group of 50-69 year-olds targeted by screening programs, fewer understood the benefit than those not targeted, both men and women.

3. Frequent consulting of physicians or health pamphlets tended to *increase* rather than reduce overestimation of benefit. Only information provided by health insurance agencies (both public and private) improved understanding.

Gigerenzer, Mata & Frank *JNCI* 2009

Exploiting Collective Statistical Illiteracy



Unwarranted enthusiasm for treatment: Reduction from 2.8 to 1.5 per 100

One of the most prestigious cancer centers in the US: M. D. Anderson

Prostate Cancer

Over four decades, the overall survival rate has more than doubled for men with prostate cancer treated at M. D. Anderson.

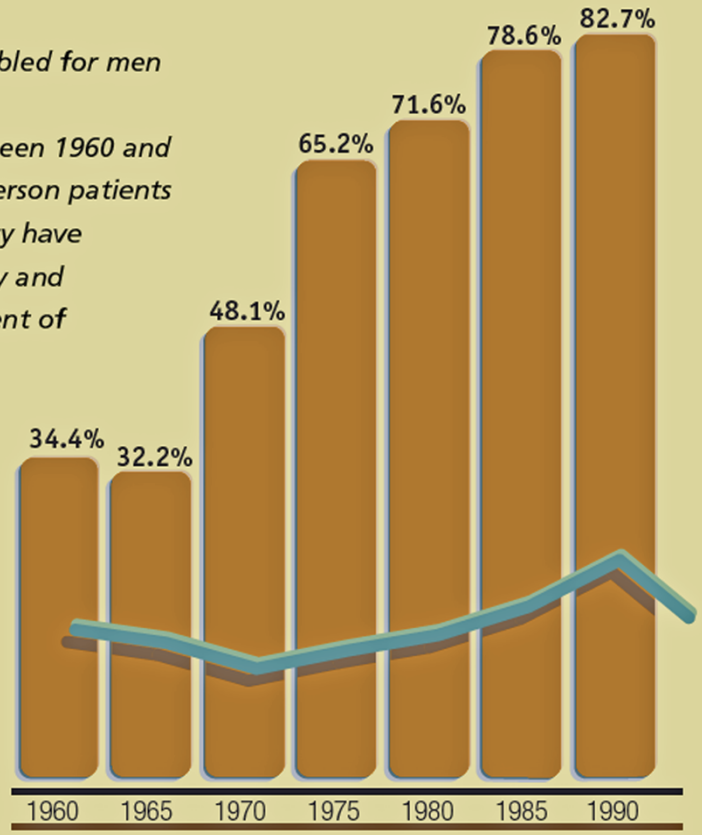
As national mortality rates for prostate cancer fluctuated between 1960 and 1990, five-year survival rates for prostate cancer among M. D. Anderson patients continued to improve. More effective radiation therapy and surgery have contributed to the overall increase in longevity, with chemotherapy and hormone treatments now playing an increasing role in the treatment of prostate cancer.

What makes these survival statistics even more remarkable is that the M. D. Anderson patient population includes more advanced patients. If the cancer center's case mix was more like that seen nationally, its survival rates would likely be even higher.

M. D. Anderson Overall Survival*

Average Annual U.S. Mortality Rate**

1960 - 64	21.5
1965 - 69	21.0
1970 - 74	20.0
1975 - 79	20.7
1980 - 84	21.3
1985 - 89	22.4
1990 - 94	24.2
1995 - 98	21.2



* Medical Informatics, The University of Texas M. D. Anderson Cancer Center

** National Center for Health Statistics public use tapes provided to the National Cancer Institute. The rates are per 100,000 and are age-adjusted to the 1970 U.S. standard population.

Confusion about progress against cancer.
Unwarranted enthusiasm for medical center.

Mismatched Framing:

Report benefits in BIG numbers and harms in SMALL numbers

BMJ, JAMA, *and* The Lancet, *2004-2006:*

In 1 out of 3 cases was mismatched framing used (mostly relative risks for benefits of treatments, and absolute risks for harms)

Sedrakyan & Shih 2007 Medical Care

In late 2009, the GERMAN CANCER AID's pamphlets on breast cancer screening switched to more transparent and complete information presentation

	years up to 5/2009	12/2009
Benefits?		
Mortality	NO INFORMATION	NO INFORMATION
Breast cancer mortality	up to 30%; 98% survival rate	from 4 to 3 in 200 women
Harms?		
False alarms	NO INFORMATION	5 of 6 positive women don't have cancer; 1 gets a biopsy
Overtreatment	NO INFORMATION	1 in 8 women with cancer
Radiation-induced cancer	barely significant	harms smaller than benefits
A positive test means:	NO INFORMATION	1 in 6 women has cancer

Collective Statistical Illiteracy in Health

1. **Few physicians, patients, and politicians understand health statistics.**
2. **Lack of understanding is largely caused by non-transparent framing of information. The solution is to teach transparent risk communication in medical school and implement it in pamphlets, journals, and advertisements.**
3. **Since at present neither patients nor physicians have a legal right for transparent and complete information, we need to find other efficient tools, such as the reputation of institutions.**
4. **A health system that permits incomprehension of risk and evidence among doctors and patients will eventually pay a high price, just as a democracy that does not educate its citizens will.**

More:

Gigerenzer 2002. Calculated Risks. Simon & Schuster.

Gigerenzer, Gaissmaier, Kurz-Milcke, Schwartz, & Woloshin 2007. *Psychological Science in the Public Interest*

Radiation Dose

- Complex
- Calculated

What's the dose from an abdominal CT scan?

$$\text{Radiation Absorbed Dose (rad)} = \frac{\textbf{Energy (100 ergs)}}{\textbf{Mass (1 gram)}}$$

Dose (Gy) = Exposure (Coul/kg) x Factor (Gy/Coul/kg)

Radiation Dose

- Complex
- Calculated
- Assumptions
- Uncertainties
- Rising

Risk

Likelihood that someone will get a certain disease in a specific amount of time.

The number of chances in 100 that someone will get a disease.

Relative Risk

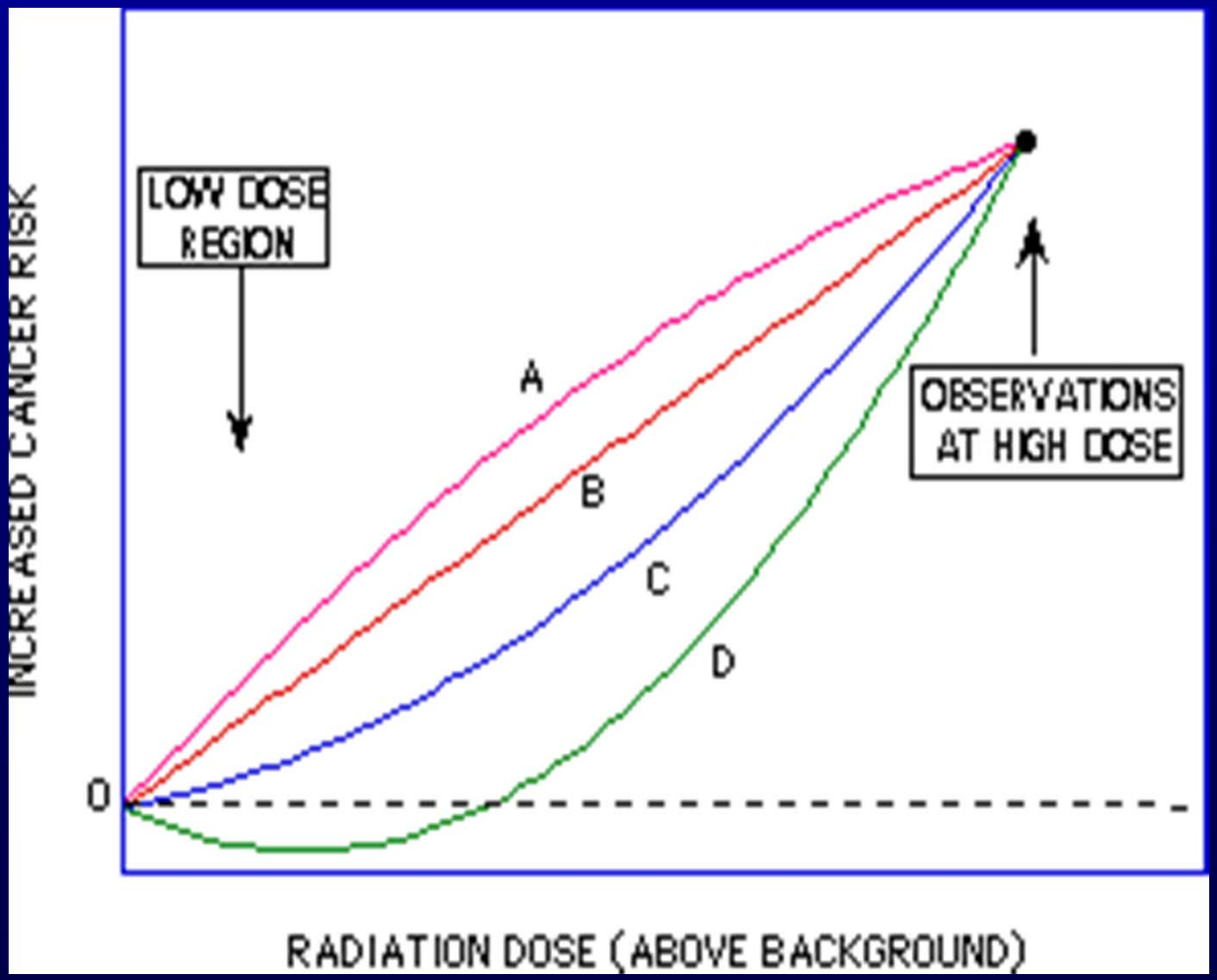
Ratio of two risk estimates

Relative Risk of 1 $\Rightarrow$ No Association

Relative Risk of 2 $\Rightarrow$ Twice as Likely

Radiation Risk

Topic	Google Hits (Millions)
Radiation	108
Risk	565
Radiation Risk	13
Sex	594
Cardiology	34
Medical Physics	63
Radiological Physics	2


INCREASED CANCER RISK
LOW DOSE REGION
A
B
C
D
OBSERVATIONS AT HIGH DOSE
0
RADIATION DOSE (ABOVE BACKGROUND)

Radiation Risk

Industry	Lost Days
20 Cigarettes / day	2370
20% Overweight	985
Mining & Quarrying	328
Construction	302
Agriculture	277
Government	55
340 mrem/yr for 30 yr	49
100 mrem/yr for 70 yr	34

BEIR, NAS

Radiation Risk ⇒ Biological Injury

- Biological injury includes
  - deterministic effects (skin burns, cataract formation)
  - stochastic effects (cancer induction, genetic effects)
- Risk estimates are derived from
  - atomic bomb survivor data, other exposed groups
- Risk estimates are dependent on
  - organ dose and type, age, gender, reproductive status
  - organ doses depend on patient size

Radiation Risk

- Stochastic v. Deterministic
- Probabilities
- Assumptions
- Uncertainties
- Changing

Radiation Risk

- Outcome with/without Procedure
- Medical Condition Confounds Situation
- Very Different for Healthy vs. Sick
- Must be Evaluated in Medical Context

Radiation Risk – Take Home

- Risk is Complex – Be Wary of Dogmatic Statements
- Given All Else, Radiation Risk is the Least Problem for Cardiology Patients
- Not Every Cardiovascular Patient needs a Cardiovascular CT