

The Science of Risk Communication

Baruch Fischhoff

Department of Engineering and Public Policy
Institute for Politics and Strategy
Carnegie Mellon University

<http://www.cmu.edu/epp/people/faculty/baruch-fischhoff.html>

**Developing a Long-Term Strategy for Low-Dose Radiation
Research in the United States**

October 27, 2021

Overview

Background

The science

Two good examples

Strategic challenges

Overview

Background

The science

Two good examples

Strategic challenges

ornl

**OAK
RIDGE
NATIONAL
LABORATORY**

**UNION
CARBIDE**

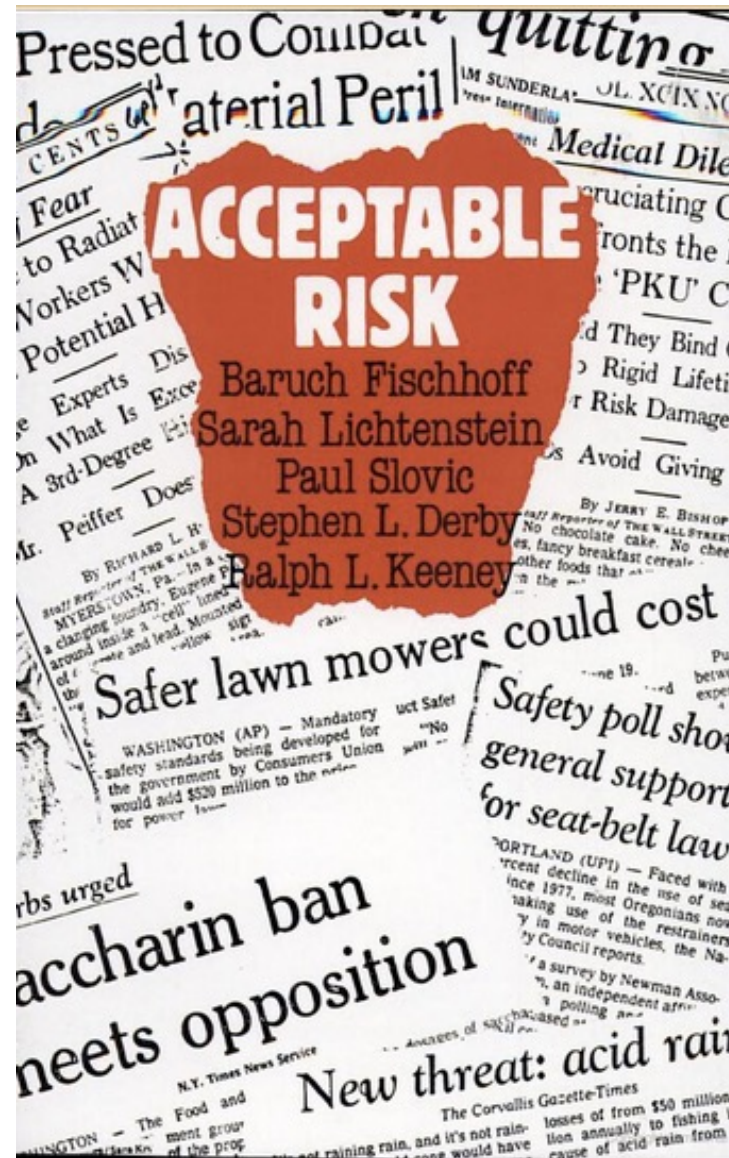
**OPERATED BY
UNION CARBIDE CORPORATION
FOR THE UNITED STATES
DEPARTMENT OF ENERGY**

**NUREG/CR-1614
ORNL/Sub-7656/1**

Approaches to Acceptable Risk: A Critical Guide

Baruch Fischhoff
Sarah Lichtenstein
Paul Slovic
Ralph Keeney
Stephen Derby

This Work Performed for
U.S. Nuclear Regulatory Commission
under
NRC Interagency Agreement 40-550-75



Fischhoff, B., Lichtenstein, S., Slovic, P., Derby, S. L. & Keeney, R. L. (1981). *Acceptable risk*. New York: Cambridge University Press. In Chinese, Peking University Press, 2009.

Premise

Low-dose radiation will not be judged in the abstract, but in the contexts where people encounter it.

Those Encounters Might Include

medical treatment and diagnostics

scientific discovery and innovation

power generation

terrorism and proliferation

lifecycle activities

mining, transport, construction, disposal,
shielding, decontamination, ...

...

Those Encounters Will Involve

Communications that are

- more and less well-informed,
- more and less well-intended,
- in news and social media, and everyday life

Premise (cont.)

Each such encounter shapes public beliefs and attitudes towards low-dose radiation and the people and institutions responsible for it.

Poor communication, like poor performance threatens the enterprise; good communication, like good performance protects it.

Effective Communication Must Be

Coordinated, creating a common picture

Accurate, sharing knowledge and uncertainty

Proactive, preempting mis- and dis-information

Cogent, avoiding confusion and overload

Respectful, accepting right to know and disagree

Effective Communication Must Be

Coordinated, creating a common picture
Accurate, sharing knowledge and uncertainty
Proactive, preempting mis- and dis-information
Cogent, avoiding confusion and overload
Respectful, accepting right to know and disagree

The science of risk communication can help achieve those goals, if employed strategically.

Challenges for the Public

Limited knowledge of subject matter, including its institutions.

Incomplete mental models, for imputing how things work.

Imperfect heuristics for estimating benefits and risks.

Limited slack for processing unfamiliar material.

Challenges for the Experts

Limited knowledge about diverse publics.

Limited capacity for learning about those publics.

Limited expertise in explaining their work.

Limited opportunities to interact with public and solve problems jointly.

Overview

Background

The science

Two good examples

Strategic challenges

Two Essential Components

Process: how stakeholders are engaged

Content: what stakeholders are told

Process and Content Are Intertwined

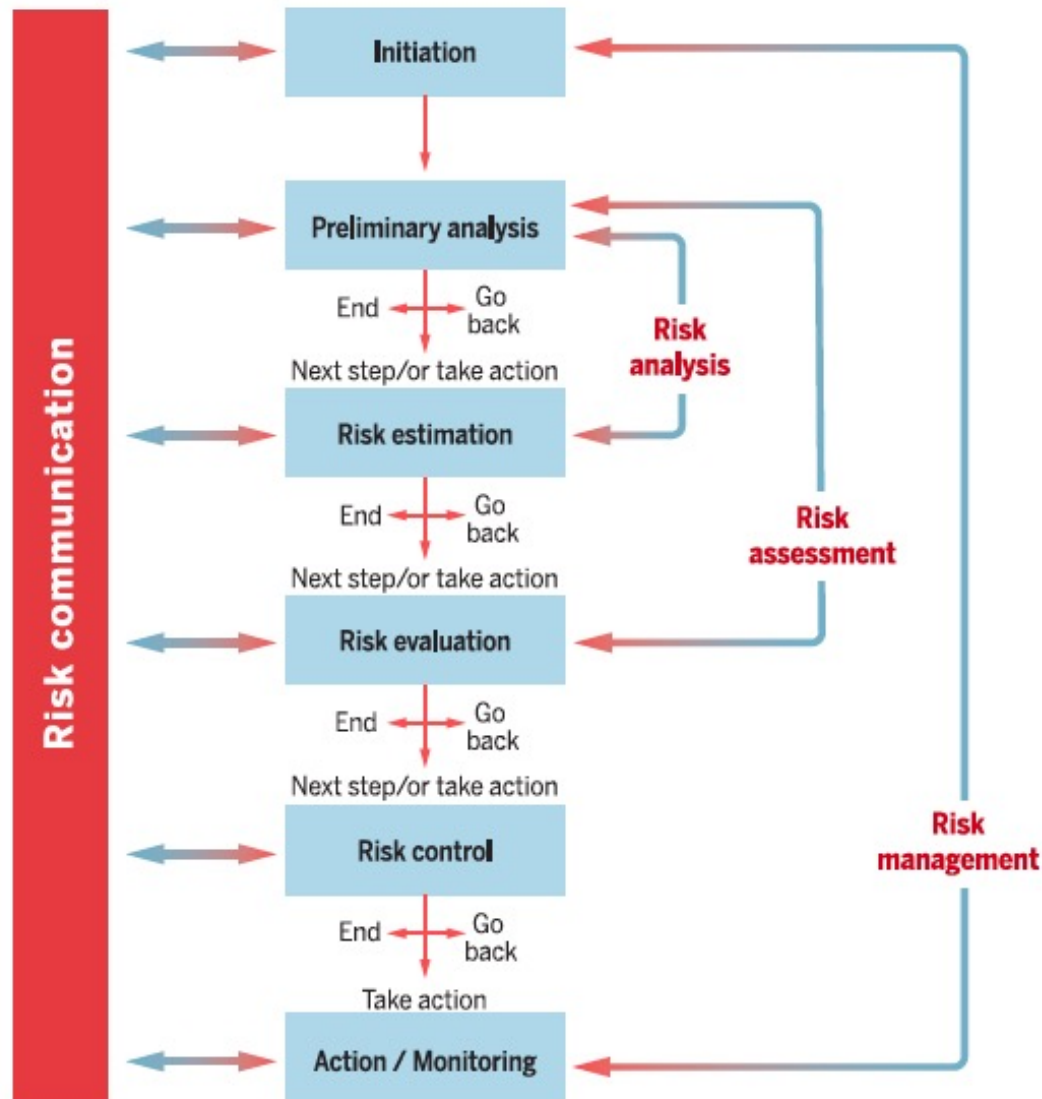
When and how an organization communicates shapes how its messages are interpreted and how well it is trusted.

What an organization communicates reveals how well it understands public concerns and is willing and able to address them.

Sound Process

Engages stakeholders in continuing, respectful two-way communication, to get the right facts, as well as getting the facts right.

A Sound Process Model



Sound Content

Relevant
Comprehensible
Authoritative
Accessible

Creating Sound Content

Step 1. Identify the facts most relevant to the choices that people face.

Step 2. Find out what they know already.

Step 3. Design communications to fill critical gaps.

Evaluate.

Repeat, as necessary.

Some Applications

plague

perchloroethylene

LNG

climate change

detergent

breast cancer

nuclear explosions

herpes (stigma)

xenotransplantation

smart meters

phishing

...

domestic radon

methylene chloride

EMF

sexual assault

low birth weight

breast implants

nuclear energy in space

Plan B (morning after pill)

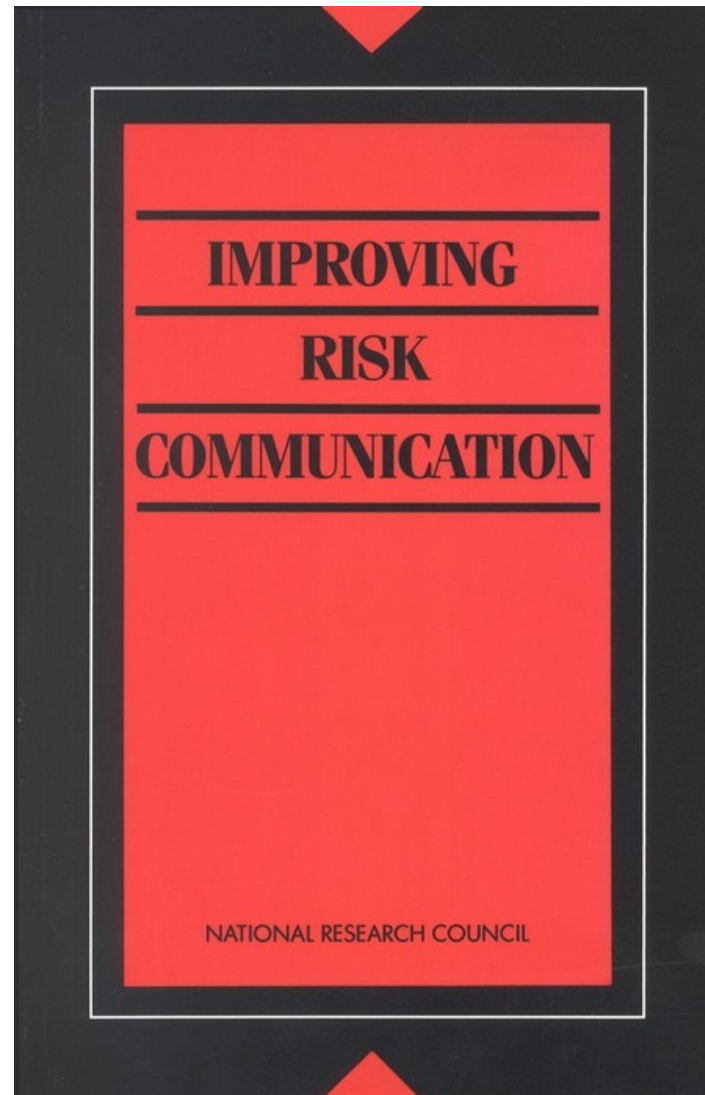
neonates

vaccines (anthrax, MMR)

tornadoes

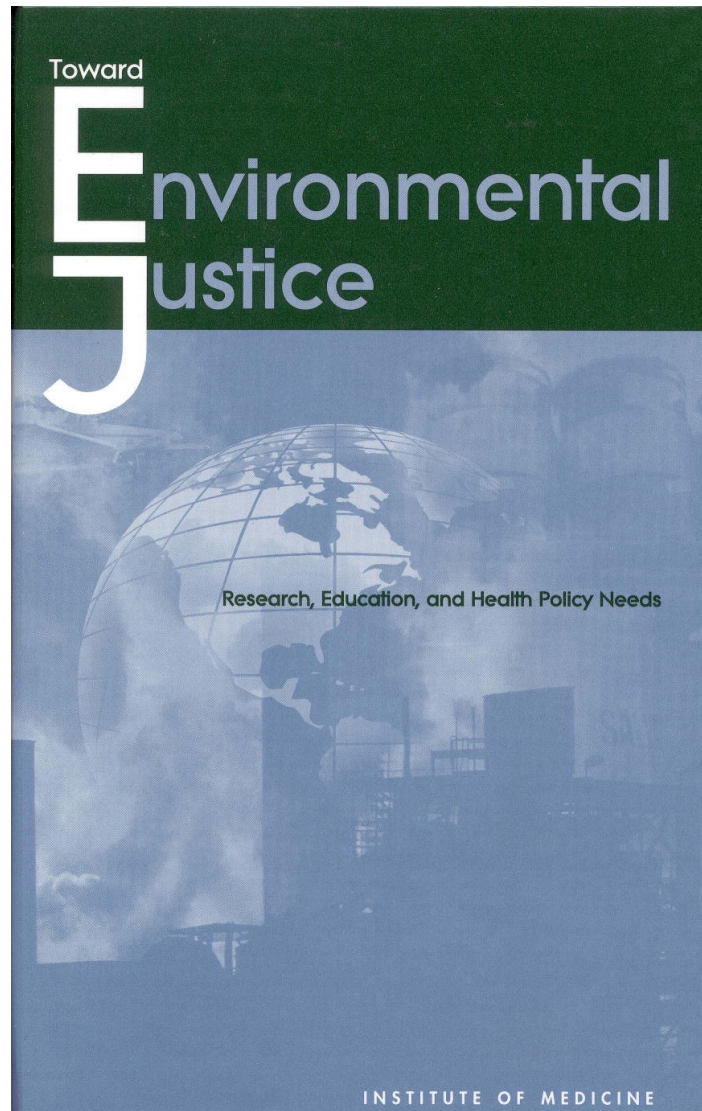
...

Risk Communication at NASEM



<http://www.nap.edu/catalog/1189.html> (1989)

Risk Communication at NASEM



<http://www.nap.edu/catalog/6034/toward-environmental-justice-research-education-and-health-policy-needs>

Principles for Environmental Justice Research

BOX 1-1 THREE PRINCIPLES FOR PUBLIC HEALTH RESEARCH TO ADDRESS ENVIRONMENTAL JUSTICE ISSUES

1. **Improve the science base.** More research is needed to identify and verify environmental etiologies of disease and to develop and validate improved research methods.
2. **Involve the affected populations.** Citizens from the affected population in communities of concern should be actively recruited to participate in the design and execution of research.
3. **Communicate the findings to all stakeholders.** Researchers should have open, two-way communication with communities of concern regarding the conduct and results of their research activities.

Science of Science Communication



http://www.pnas.org/content/110/Supplement_3



http://www.pnas.org/content/111/Supplement_4

Arthur M. Sackler
COLLOQUIA
OF THE NATIONAL ACADEMY OF SCIENCES

Information
Summary
Directions
Partnership Awards

The Science of Science Communication III: Inspiring Novel Collaborations and Building Capacity

f t in +1

PNAS, 116(16), 7670-7675. www.pnas.org/cgi/doi/10.1073/pnas.1805863115

Barriers to Experts Using the Science

Reluctance to express uncertainty
Faulty intuitions about the public
Lack of absorptive capacity

Reluctance to Express Uncertainty

Experts

want to get the facts right before sharing
do not expect to understand uncertainty

Reluctance to Express Uncertainty

Experts

want to get the facts right before sharing
do not expect to understand uncertainty

As a result, they

leave a void for others to fill
seem untrustworthy when science changes

Faulty Intuitions about the Public

People, including experts
overestimate how well they understand other
people and are understood by them.

Faulty Intuitions about the Public

People, including experts
overestimate how well they understand other
people and are understood by them.

As a result, they
communicate poorly, without testing messages;
and blame the public for their failures.

Faulty Intuitions about the Public

People, including experts
overestimate how well they understand other
people and are understood by them.
As a result, they
communicate poorly, without testing messages;
and blame the public for their failures.
The problems grow,
The more different and distant they are from
the public.

Some Faulty Intuitions

common knowledge effect
false consensus effect
fundamental attribution error
self-serving biases
myths (panic, adolescent invulnerability ...)
...

Lack of Absorptive Capacity

Social, behavioral and decision science research can improve flawed intuitions. They require disciplinary training, practical experience, and some resources. Organizations without expertise cannot tell when they need help or find it if they look.

Behavior Follows Simple Principles

Some Principles of Judgment

People are good at tracking what they see,
but not at detecting sample bias.

People have difficulty projecting non-
linear trends.

People have limited ability to evaluate the
extent of their own knowledge.

People have difficulty imagining themselves
in other visceral states.

Transient emotions can affect perceptions,
perhaps enough to tip close decisions.

Some Principles of Choice

People are insensitive to opportunity costs.

People consider the return on their investment in making decisions.

People dislike uncertainty.

People confuse ignorance and stupidity.

People are prisoners to sunk costs, hating to recognize losses.

People may not know what they want, especially with novel questions.

Behavior Follows Simple Principles

However,

- the set of principles is large,
- the contextual triggers are subtle, and
- the interactions are complex

As a result, communication requires a scientifically informed design process.

Overview

Background

The science

Two good examples

Strategic challenges

FDA'S STRATEGIC PLAN FOR RISK COMMUNICATION

Fall, 2009

<https://www.fda.gov/AboutFDA/ReportsManualsForms/Reports/ucm183673.htm>
[https://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/
RiskCommunicationAdvisoryCommittee/UCM526451.pdf](https://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/RiskCommunicationAdvisoryCommittee/UCM526451.pdf)

FDA Risk Communication Advisory Committee (RCAC)

Charter of the Risk Communication Advisory Committee to the Food and Drug Administration

Authority:

The Advisory Committee on Risk Communication, referred to herein as the Risk Communication Advisory Committee, was established by 21 U.S.C. 360bbb-6, as added by section 917 of the Food and Drug Administration Amendments Act of 2007. The Committee is also governed by 21 CFR Part 14 and Pub. L. 92-463 (5 U.S.C. App.), the Federal Advisory Committee Act, which sets forth standards for the formation and use of advisory committees.

<http://www.fda.gov/oc/advisory/OCRCACACpg.html>

RCAC Recommendations

Communication for Emerging Events

Have a consistent policy in all domains

Provide useful, timely information

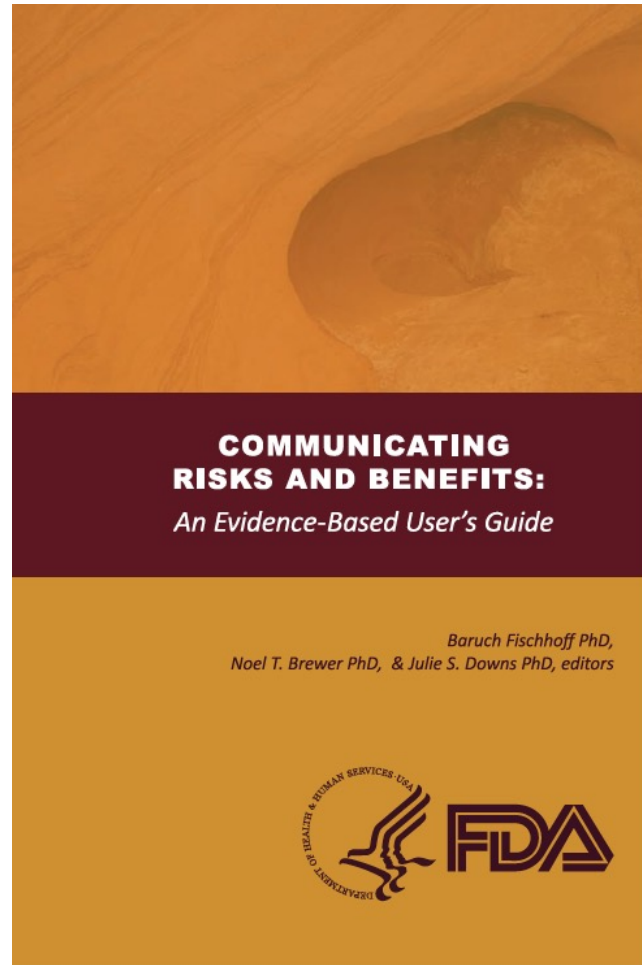
Address: risks and benefits, uncertainty,
personal actions, FDA actions

Audience needs should drive agency analyses

Use standard formats; evaluate routinely

Consider needs of diverse populations

A Guide to Inexpensive, Scientifically Grounded Communication



<http://www.fda.gov/AboutFDA/ReportsManualsForms/Reports/ucm268078.htm>

Each Chapter

Summarizes the science

Offers best guesses at practical implications

Each Chapter

Summarizes the science

Offers best guesses at practical implications

Shows how to evaluate communications

- for no money at all

- for a little money

- for money commensurate with the personal, organizational, and political stakes riding on effective communication

Evaluation for No Money

Ask a diverse members of the public,
to think aloud as they read a draft,
testing the message not them.

Evaluation for No Money

Ask a diverse members of the public,
to think aloud as they read a draft,
testing the message not them.

Listen for things that they:

- realize are confusing
- do not realize are confusing
- find offensive
- notice are missing



Structured Approach to Benefit-Risk Assessment in Drug Regulatory Decision-Making

Draft PDUFA V Implementation Plan - February 2013
Fiscal Years 2013-2017



Figure 1: FDA Benefit-Risk Framework

Decision Factor	Evidence and Uncertainties	Conclusions and Reasons
Analysis of Condition		
Current Treatment Options		
Benefit		
Risk		
Risk Management		
Benefit-Risk Summary Assessment		

FDA. (2013). Structured approach to benefit-risk assessment for drug regulatory decision making. Draft PDUFA V implementation plan (2/13). FY2013-2017.

Decision Science Principles in FDA's Benefit-Risk Framework

Recognizes scientific and policy judgment in all analyses

Quantifies the quantifiable, without ignoring other concerns

Highlights ethical and political tradeoffs, rather than burying them in a metric

Supports risk management

Fischhoff, B. (2017). Breaking ground for psychological science:

The U.S. Food and Drug Administration. *American Psychologist*, 72(2). 118-125. doi: 10.1037/a0040438

The Voice of the Patient

A series of reports from the U.S. Food and Drug Administration's (FDA's)
Patient-Focused Drug Development Initiative

Chronic Fatigue Syndrome and Myalgic Encephalomyelitis

Public Meeting: April 25, 2013

Report Date: September 2013

The Voice of the Patient

A series of reports from the U.S. Food and Drug Administration's (FDA's)
Patient-Focused Drug Development Initiative

Sickle Cell Disease

Public Meeting: February 7, 2014

Report Date: October 2014

<https://www.fda.gov/downloads/ForIndustry/UserFees/PrescriptionDrugUserFee/UCM418430.pdf>

Design Principles in FDA's Voice of the Patient Initiative

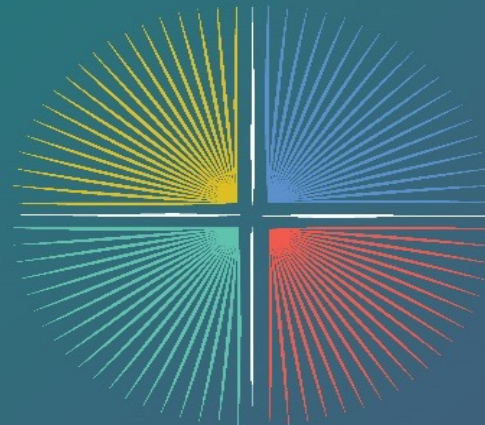
Enlist the public in informing the agency.
Allow the public to speak in its own terms.
Let experts speak first.
Let regulators assess relevance.
Develop agenda public representatives.

Fischhoff, B. (2017). Breaking ground for psychological science:
The U.S. Food and Drug Administration. *American Psychologist*, 72(2), 118-125.

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

CONSENSUS STUDY REPORT

FRAMEWORK FOR
EQUITABLE
ALLOCATION OF
COVID-19
VACCINE



NATIONAL ACADEMY OF MEDICINE

Free PDF of the report and related materials (summaries under Resources tab.

: <https://www.nationalacademies.org/our-work/a-framework-for-equitable-allocation-of-vaccine-for-the-novel-coronavirus>

Building Communication Capacity



<https://www.nap.edu/catalog/24738>

Commitment to Transparency

To ensure that the framework is equitable and **is seen as equitable**, the committee designed it

- to be easily understood by diverse audiences
- to be reliably translated into operational terms
- to distinguish scientific and ethical judgments

p. S-6

Two Essential, Mutually Dependent Elements of Vaccine Distribution

Risk Communication and Community Engagement (Chapter 6)

Mission: Provide the facts that people need in order to feel respected, make personal choices, evaluate programs, and understand their rationale.

Health Promotion (Chapter 7)

Mission: Provide official recommendations, through trustworthy channels, along with the resources needed to act on them.

Overview

Background

The science

Two good examples

Strategic challenges

Staffing (for Absorptive Capacity)

Subject matter specialists for accuracy

Decision scientists for relevance

Behavioral scientists for mutual understanding

Practitioners for execution

All opinions welcome, but authority is vested in those who know most about each topic.

Performance Metrics

A communication is adequate, if...
it contains the facts material to effective
decision making
users can access those facts
users understand and trust them

Leadership

Senior management must:

- see communication as strategic, not an afterthought.
- assume stewardship over the lifecycle.
- seek industry-wide discipline.
- separate risk communication from health promotion.
- value trust as an intangible asset with tangible benefits.

<http://www.thebulletin.org/nuclear-energy-industrys-communication-problem>

Some Sources

Fischhoff, B. (2013). The sciences of science communication. *PNAS*, 110, 14033-14039.
doi:10.1073/pnas.1213273110

Fischhoff, B., & Davis, A.L. (2014). Communicating scientific uncertainty. *PNAS*, 111, 13664-13671.
www.pnas.org/cgi/doi/10.1073/pnas.1317504111

Fischhoff, B. (2019). Evaluating science communication. *PNAS*, 116(16), 7670-7675.
www.pnas.org/cgi/doi/10.1073/pnas.1805863115

RESEARCH

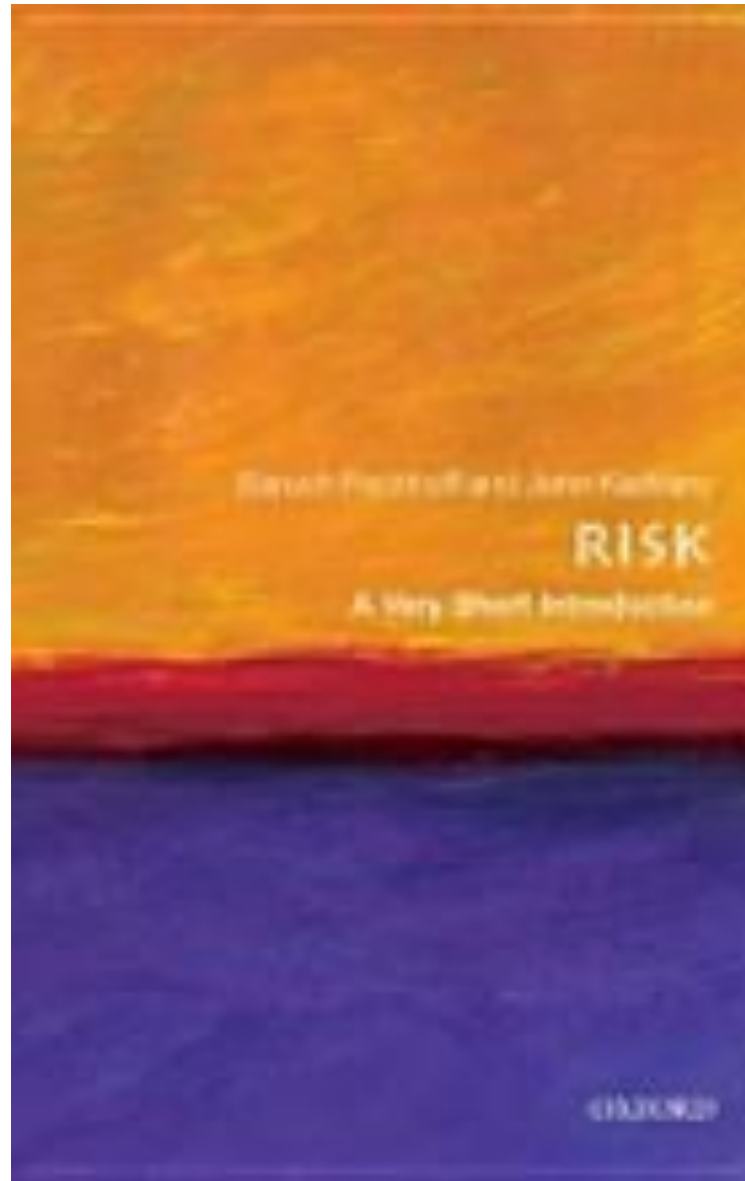
REVIEW

RISK ASSESSMENT

The realities of risk-cost-benefit analysis

Baruch Fischhoff

<http://dx.doi.org/10.1126/science.aaa6516>



Fischhoff, B., & Kadvany, J. (2011). Risk: A very short introduction. Oxford: Oxford University Press