Communicating Food Benefits and Risks

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Food: Balancing Risk and Benefit – Challenges and Limitations for Risk Management
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Disclosure

I have no known conflicts of interest.
Normative analysis
  (how people should make decisions)
Descriptive research
  (how people do make decisions)
Prescriptive interventions
  (how people could make decisions)

(Edwards, 1954)
Some Basic Sources

Normative

Descriptive

Prescriptive
Good Communication Is Vital

listening for:
  fears, desires, opportunities
for conveying
  benefits, risks, respect for audience
Poor Communications

Undermine lay decision making by missing opportunities

to help people make sound choices
to learn about their concerns
to design better options
to get full value from our science and technology
Poor Communications

Erode the commons of goodwill by
-- undermining lay confidence in experts
-- undermining expert confidence in the public
Challenges

Normative analysis
  how to measure risks and benefits
Descriptive research
  how to measure beliefs and values
Prescriptive interventions
  how to make risks and benefits clear
Challenges

Normative analysis
how to measure risks and benefits

Descriptive research
how to measure beliefs and values

Prescriptive interventions
how to make risks and benefits clear
Common Constraints (Evidence)

Multiple, heterogeneous endpoints
Complex, uncertain direct data
Rich, nuanced background science
Common Constraints (Stakeholders)

Limited cognitive capacity (need data reduction)
Different values (not captured by any single representation)
Labile values (may be unstable with unfamiliar representations)
Different backgrounds (may not read between the lines similarly)
Common Metrics: Potential Benefits

- Reduced cognitive load by summarizing data
- Transparency with explicit measures
- Comparability with common measure
Common Metrics: Potential Risks

Increased cognitive load from decoding obscure measures
Reduced transparency with embedded values
Non-comparability due to lost data properties
Two Analytical Challenges

Embedded values
Lost data properties
Embedded Values

The terms of all analyses embody values that favor some interests. When transparent, those assumptions are controversial.
Defining “Risk of Death”

probability of premature death vs.
expected life-year lost
Defining “Risk of Death”

probability of premature death vs. expected life-year lost

The choice of measure depends on whether a death is a death or one values deaths of young people more.
Other Possible Bases for Distinguishing among Deaths

Are the risks
distributed equitably?
assumed voluntarily?
catastrophic?
well understood?
controllable?
dread?
borne by future generations?

...
4. A risk space based on ratings of 30 hazards on 9 risk attributes

“Discounting” Future Outcomes

Reasons to value future outcomes less
-- valuing them less
  deliberately
  unthinkingly (hyperbolic discounting)
-- opportunity costs
-- not expecting to have them provided
-- not expecting to be there to get them
-- dreading the wait
-- wanting to live with the experience

(Frederick, Loewenstein, O’Donoghue, 2002)
Embedded Values

The terms of all analyses embody values that favor some interests. When transparent, those assumptions are controversial.

As a result, common metrics obscure value issues, unless adopted by a credible public process resolving those controversies.
Lost Data Properties

Treatment of uncertainties

Lost Data Properties

Common metrics can obscure the expert judgment involved in data interpretation. Decision makers have no way to discover that logic or know if it matters.
Lost Data Properties

Common metrics can obscure the expert judgment involved in data interpretation. Decision makers have no way to discover that logic or know if it matters. As a result, a candid, comprehensible disclosure process is needed.
Challenges

Normative analysis
  how to measure risks and benefits
Descriptive research
  how to measure beliefs and values
Prescriptive interventions
  how to make risks and benefits clear
Decision Science Finds That

Decision making follows simple principles.
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Decision making follows simple principles. However,
the set of principles is large,
the contextual triggers are subtle, and
the interactions are complex
Decision Science Finds That

Decision making follows simple principles. However,
the set of principles is large, the contextual triggers are subtle, and the interactions are complex.

As a result, decision-specific research is needed.
Some Sources
<table>
<thead>
<tr>
<th>Some Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>plague, perchloroethylene, LNG, climate change, detergent, breast cancer, nuclear explosions, herpes (stigma), xenotransplantation, smart meters, ...</td>
</tr>
</tbody>
</table>
Challenges

Normative analysis
how to measure risks and benefits

Descriptive research
how to measure beliefs and values

Prescriptive interventions
how to make risks and benefits clear
Three Examples

Risk ranking (US EPA; HM Treasury)
Benefit-risk framework (US FDA CDER)
Drug fact boxes (US NCI, US FDA?)
Risk Ranking

US EPA attempt to involve public in resetting its priorities.
Solution pursued by many national bodies.
### School bus accident risk for Centerville Middle School*

<table>
<thead>
<tr>
<th>Student deaths</th>
<th>Low est.</th>
<th>Best estimate</th>
<th>High est.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of deaths per year</td>
<td>.0001</td>
<td>.0002</td>
<td>.0004</td>
</tr>
<tr>
<td>Chance in a million of death per year for the average student</td>
<td>.25</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Chance in a million of death per year for the student at highest risk</td>
<td>0.5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Greatest number of deaths in a single episode</td>
<td>20 - 50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student illness or injury</th>
<th>Low est.</th>
<th>Best estimate</th>
<th>High est.</th>
</tr>
</thead>
<tbody>
<tr>
<td>More serious long-term cases per year</td>
<td>.0002</td>
<td>.0006</td>
<td>.002</td>
</tr>
<tr>
<td>Less serious long-term cases per year</td>
<td>.0004</td>
<td>.0015</td>
<td>.004</td>
</tr>
<tr>
<td>More serious short-term cases per year</td>
<td>.001</td>
<td>.002</td>
<td>.006</td>
</tr>
<tr>
<td>Less serious short-term cases per year</td>
<td>.002</td>
<td>.005</td>
<td>.015</td>
</tr>
</tbody>
</table>

### Other Factors

- Time between exposure and health effects: **Immediate**
- Quality of scientific understanding: **High**
- Combined uncertainty in death, illness, injury: **1.6 (low)**
- Ability of student/parent to control exposure: **Moderate**

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Risk: Improving government’s capability to handle risk and uncertainty

Summary report

STRATEGY UNIT REPORT – NOVEMBER 2002
Decisions on managing risks to the public

CBA, including...

Deaths

Harm

‘Baseline’ WTP

Societal Concerns

<table>
<thead>
<tr>
<th>Concern factors</th>
<th>Expert views</th>
<th>Public views</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Familiarity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Understanding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Equity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Dread</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Trust</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Decision making

FDA CDER Benefit-Risk Framework

Capture rationale of FDA evaluation of evidence and decision making. Clear to producers and consumers. In PDUFA V.

<table>
<thead>
<tr>
<th>Decision Factor</th>
<th>Evidence and Uncertainties</th>
<th>Conclusions and Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of Condition</td>
<td>Summary of evidence:</td>
<td>Conclusions (implications for decision):</td>
</tr>
<tr>
<td>Unmet Medical Need</td>
<td>Summary of evidence:</td>
<td>Conclusions (implications for decision):</td>
</tr>
<tr>
<td>Clinical Benefit</td>
<td>Summary of evidence:</td>
<td>Conclusions (implications for decision):</td>
</tr>
<tr>
<td>Risk</td>
<td>Summary of evidence:</td>
<td>Conclusions (implications for decision):</td>
</tr>
<tr>
<td>Risk Management</td>
<td>Summary of evidence:</td>
<td>Conclusions (implications for decision):</td>
</tr>
</tbody>
</table>
Drug Fact Boxes

Patterned on nutrition fact boxes. Decision-specific risks and benefits. Empirically evaluated to publication standard.

Prescription Drug Facts: Lunesta (Eszopiclone)

What is this drug for?
To make it easier to fall or to stay asleep

Who might consider taking it?
Adults age 18 and older with insomnia for at least 1 month

Who should NOT take it?
People under age 18

Recommended testing
No blood tests, watch out for abnormal behavior

Other things to consider doing
Reducing caffeine (especially at night), exercise, regular bedtime, avoid daytime naps

LUNESTA Study Findings

788 healthy adults with insomnia for at least 1 month -- sleeping less than 6.5 hours per night and/or taking more than 30 minutes to fall asleep -- were given LUNESTA or a sugar pill nightly for 6 months. Here’s what happened:

<table>
<thead>
<tr>
<th>What difference did LUNESTA make?</th>
<th>People given a sugar pill</th>
<th>People given LUNESTA (3 mg each night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did LUNESTA help? LUNESTA users fell asleep faster (15 minutes faster)</td>
<td>45 minutes to fall asleep</td>
<td>30 minutes to fall asleep</td>
</tr>
<tr>
<td>LUNESTA users slept longer (37 minutes longer)</td>
<td>5 hours</td>
<td>6 hours</td>
</tr>
<tr>
<td>45 minutes</td>
<td>22 minutes</td>
<td></td>
</tr>
</tbody>
</table>

Did LUNESTA have side effects?

Life threatening side effects
No difference between LUNESTA and a sugar pill

Symptom side effects

| More had unpleasant taste in their mouth (additional 20% due to drug) | 6% | 26% |
| 6 in 100 | 26 in 100 |
| More had dizziness (additional 7% due to drug) | 3% | 10% |
| 3 in 100 | 10 in 100 |
| More had drowsiness (additional 6% due to drug) | 3% | 9% |
| 3 in 100 | 9 in 100 |
| More had dry mouth (additional 5% due to drug) | 2% | 7% |
| 2 in 100 | 7 in 100 |
| More had nausea (additional 5% due to drug) | 6% | 11% |
| 6 in 100 | 11 in 100 |

How long has the drug been in use?

Lunesta was approved by FDA in 2005. As with all new drugs we simply don’t know how its safety record will hold up over time. In general, if there are unforeseen, serious drug side effects, they emerge after the drug is on the market (when a large enough number of people have used the drug).
Patient and Physician Guide: National Lung Screening Trial (NLST)

What is the purpose of this guide?
To explain the benefits and harms of low-dose computed tomography (CT) screening for lung cancer in people at high risk for the disease. The NLST showed a reduction in deaths from CT screening compared to chest X-ray screening. The Prostate, Lung, Colorectal, and Ovarian (PLCO) Cancer screening trial recently showed that chest X-ray screening (compared to no screening) did NOT reduce the chance of dying from lung cancer.

Who participated in the NLST?
Current, or former cigarette smokers within the past 15 years, 55 to 74 years of age, with at least 30 pack-years of smoking [Pack-years = packs per day x number of years smoking]. Participants had no symptoms or signs of lung cancer or other serious medical conditions, and were medically fit for surgery.

Study Findings: Low-dose CT versus Chest X-ray screening

53,454 current and former smokers were randomly assigned to be screened once a year for 3 years with low-dose CT or chest X-ray. Here’s what happened after an average of 6.5 years:

| Benefit: How did CT scans help compared to Chest X-ray, an ineffective screening test? |
|--------------------------------------------------|--------------------------------------------------|
| 0.4% fewer people died from lung cancer          | 1.3% versus 1.7%                                 |
| 0.5% fewer people died from all causes           | 7.0% versus 7.5%                                 |

<table>
<thead>
<tr>
<th>Harm: What problems did CT scans cause compared to Chest X-ray?</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.3% more people had at least one false alarm</td>
</tr>
<tr>
<td>1.8% more people had a false alarm leading to an invasive procedure, such as bronchoscopy, biopsy, or surgery</td>
</tr>
<tr>
<td>0.2% more people more had a major complication from invasive procedures</td>
</tr>
</tbody>
</table>

"Take home" messages

Lung cancer screening with CT scans is the only screening test shown to lower the chance of dying from lung cancer. The effect of screening may vary depending on how similar you are to the people who participated in the study. The benefit of screening may be bigger if your lung cancer risk is higher. The harm may be bigger if you have more medical problems (like heart or severe lung disease) which could increase problems from biopsies and surgery.

For perspective, the reduction in deaths from lung cancer with CT screening is larger than the reduction in deaths from the target cancers of other common screening tests, such as mammograms for breast cancer.

There is a tradeoff: CT screening decreases your chance of death but increases your chance of having a false alarm. If you choose to have CT screening, it is important to have it done at a medical center with special expertise in lung cancer screening and treatment.

Most important thing you can do

DON'T SMOKE. Regardless of your screening decision, avoiding cigarettes is the most powerful way to lower your chance of dying overall or suffering or dying from a variety of diseases, such as lung cancer, emphysema, heart or vascular disease. For example, at age sixty-five, 8.9% of male current smokers will die of lung cancer in the next 10 years versus 0.4% of never smokers. For women, the corresponding figures are 5.5% versus 0.5%.

For help quitting, call 1-800-QUIT-NOW
Effective Communication Requires

Normative analysis
which risks and benefits matter

Descriptive research
into what people believe and want

Prescriptive interventions
tested for creating the beliefs needed
to make decisions addressing wants
The National Academy of Sciences invites you to attend the
Arthur M. Sackler Colloquium on

THE SCIENCE OF SCIENCE COMMUNICATION

May 21–22, 2012
at the newly restored
National Academy of Sciences building
2101 Constitution Avenue, NW
Washington, DC

Books

Research Articles

http://www.hss.cmu.edu/departments/sds/src/src/faculty/fischhoff.php
Carnegie Mellon Electricity Center: http://wpweb2.tepper.cmu.edu/ceic/
Center for Climate and Environmental Decision Making: http://cedm.epp.cmu.edu/index.php
Center for Risk Perception and Communication: http://sds.hss.cmu.edu/risk/
Center for Human Rights Science: http://www.cmu.edu/chrs/