Numeracy, affect, and risk

Ellen Peters
Decision Research
Eugene, OR
empeters@uoregon.edu

Abstract: Information in decision making appears to be processed using two different modes of thinking: deliberative and affective/experiential (Epstein, 1994; Sloman, 1996). Both modes of thought are important to informing decisions. The deliberative mode is conscious, analytical, reason-based, verbal, and relatively slow. It is the deliberative mode of thinking that we tend to consider in our attempts to inform choices as we simply provide information, believing that people will use it to make better decisions. Good decisions, however, require not only information, but the ability to comprehend information and its meaning. By focusing on the deliberative mode of thinking, we also may ignore the important influences of the experiential mode. The experiential mode is intuitive, automatic, associative, and fast. It is based on affective (or emotional) feelings, and one of its primary functions is to highlight information important enough to warrant further consideration. As shown in a number of studies, these affective feelings provide both meaning and motivation to choice processes (Damasio, 1994; Osgood, Suci, & Tannenbaum, 1957). Both modes of thinking are important, and good choices are most likely to emerge when both affective and deliberative modes work in concert and decision makers think as well as feel their way through judgments and decisions (Damasio, 1994). Studies of numeracy (the ability to understand and use basic probability and mathematical concepts) illustrate the importance of these dual modes of processing in judgments and decisions and highlight the importance of number ability to risk perceptions and risk communication.
To make good decisions, we must have:

- Information: available, accurate, timely
- Must comprehend it
- And its meaning
- Determine meaningful differences
- Weight factors to match needs and values
- Make tradeoffs
- Choose

(Hibbard & Peters, 2003)

Potential barriers to using information effectively in choices

1. Insufficient, uncertain, and changing information
2. Lack of comprehension
3. Lack of motivation
4. Comprehend information but not what it means

Two Study Samples:
Older adults aged 65+ (n = 253) & Employed Age < 65 (n = 239) (Hibbard et al., 2001)

The Comprehension Index:
Reflects number of errors made out of 34 decision tasks involving interpretation of tables and graphs
EXAMPLE OF DECISION TASK:

<table>
<thead>
<tr>
<th></th>
<th>HMO A</th>
<th>HMO B</th>
<th>HMO C</th>
<th>HMO D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Premium</td>
<td>$50</td>
<td>$75</td>
<td>$48</td>
<td>$63</td>
</tr>
<tr>
<td>Copayment for office visit with primary care doctor</td>
<td>$10</td>
<td>$5</td>
<td>$15</td>
<td>$10</td>
</tr>
</tbody>
</table>

1. Which HMO requires the lowest copayment for a visit with a primary care doctor?

Problems with comprehension and large age differences

More is better?

Potential barriers to using information effectively in choices

1. Insufficient, uncertain, and changing information
2. Lack of comprehension
3. Lack of motivation
4. Comprehend information but not what it means

Variety in taste testing

(Iyengar & Lepper, 2000)
More is not necessarily better

When choice is demotivating

Potential barriers to using information effectively in choices
1. Insufficient, uncertain, and changing information
2. Lack of comprehension
3. Lack of motivation
4. Comprehend information but not what it means

Evaluating the attractiveness of a risky bet

- Subjects are asked to rate the attractiveness of a bet (scale=0-20).
  - Group 1: The bet gives you 7/36 chances to win $9
  - Group 2: The bet gives you 7/36 chance to win $9 and 29/36 chances to lose 5 cents

- Group 2 has an objectively worse bet

Evaluating the attractiveness of a risky bet

The objectively worse bet is rated as more attractive

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9 bet</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>$9-5¢ loss bet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attractiveness (0-20)</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>Affect to $9 (-4 to +4)</td>
<td>0</td>
<td>+2</td>
</tr>
</tbody>
</table>
An Affect Account of the 5¢ Loss Effect

Probability is evaluable.
7/36 is a poor chance.

Payoff is less evaluable.
How good or bad is $9?

Adding the 5¢ loss makes $9 “come alive with feeling” and it then becomes meaningful and is weighted in the judgment.

Dual process theory:
The Experiential and the Deliberative

Characteristics of the two information-processing systems (Epstein, 1994):

- Deliberative:
  - analytical
  - logical
  - conscious
  - slower
  - fairly recent evolutionary history

- Experiential:
  - affective
  - intuitive and holistic
  - based on our experiences
  - fast
  - less than conscious “We are seized by our emotions”

Choosing in Complex Decision Situations

I. Traditional “high reason” view of decision making

- Deliberation and utility maximization!!
- But limited capacity to represent, process, and manipulate information

We are boundedly rational

Rely on information as given

<table>
<thead>
<tr>
<th>Survival Frame</th>
<th>Mortality Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Of 100 people having surgery</td>
<td>Of 100 people having radiation</td>
</tr>
<tr>
<td>68 will be alive at 1 yr</td>
<td>77 will be alive at 1 yr</td>
</tr>
<tr>
<td>32 will have died by 1 yr</td>
<td>23 will have died by 1 yr</td>
</tr>
</tbody>
</table>

(McNeil, Pauker, Sox, & Tversky, 1982)
Rely on information as given

Of 100 people having surgery
- Survival Frame: 68 will be alive at 1 yr
- Mortality Frame: 32 will have died by 1 yr

Of 100 people having radiation
- Survival Frame: 77 will be alive at 1 yr
- Mortality Frame: 23 will have died by 1 yr

(McNeil, Pauker, Sox, & Tversky, 1982)

Surgery less attractive in mortality frame compared to survival frame

<table>
<thead>
<tr>
<th>Frame</th>
<th>% chose Surgery</th>
<th>% chose Mortality frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival</td>
<td>75%</td>
<td>58%</td>
</tr>
<tr>
<td>Mortality</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(McNeil, Pauker, Sox, & Tversky, 1982)

Rely on only some of the information

Colonoscopy Patient A
- Peak pain
- Subjectively less pain

Colonoscopy Patient B
- Peak pain
- Objectively less pain

(Adapted from Kahneman, 2003)

People use simplifying heuristics

- E.g., Anchoring and adjustment
- Median estimated fatalities from medical errors in the U.S. depend on the anchor given

Appendicitis = 400

(Peters, Slovic, Hibbard, & Tusler, 2006, Health Psychology)
People use simplifying heuristics

- E.g., Anchoring and adjustment

Median estimated fatalities from medical errors in the U.S. depend on the anchor given

0 3000 15000
Appendicitis = 400 Kidney disease = 40,000

(Peters, Slovic, Hibbard, & Tusler, 2006, Health Psychology)

An affective/experiential view of decision making

- Affect guides decisions and perceptions of information (e.g., Damasio, 1994; Loewenstein et al., 2001; Peters & Slovic, 1996, 2000)

- Affect acts as a source of information in the construction of preferences
  - Without affect, information lacks meaning

Affect Is:

- Positive and negative feelings about an object, option, attribute, or event
- Experienced as you consider the object
- E.g., Your feelings about:

  sunshine
  funeral

An affective/experiential view

- Affect performs multiple functions
  - As information
  - As a spotlight
  - As a common currency
  - As a motivator of information processing and behaviors

(Peters, in press; Peters, Lipkus, & Diefenbach, in press)
Risk as Analysis vs. Risk as Feelings

Analytic/ Deliberative

Experiential/ Affective

How do I feel about a nuclear waste repository?

Perceived benefit

Perceived risk

A model of the affect heuristic explaining the risk/benefit confounding observed by Alhakami and Slovic (1994). Judgments of risk and benefit are assumed to be derived by reference to an overall affective evaluation of the stimulus item.

In the world, risk and benefit are positively correlated.

In people’s minds, they are negatively correlated.
The strength of the inverse (negative) relationship between risk and benefit judgments for a particular hazard (e.g. nuclear power) depends on its affect: how good or bad it feels.

Mean perceived risk and perceived benefit for medical and nonmedical sources of exposure to chemicals.

Affect Influences Perceptions of Likelihood
- We are sensitive to possibility rather than probability with strong positive and negative events (Loewenstein et al., 2001; Rottenstreich & Hsee, 2001)

How much would you value being able to avoid a loss?

Almost Certain
- 99% chance to lose $20
- 99% chance of a "short, painful, but not dangerous electric shock" (affect-rich)

Possibility
- 1% chance to lose $20
- 1% chance of a "short, painful, but not dangerous electric shock" (affect-rich)
Strong Affect Insensitive to Probability

- The value of the electric shock lottery was not much affected by its probability

(Rottenstreich & Hsee, 2001)

Terrorism and Probability Neglect
Cass R. Sunstein
The Journal of Risk and Uncertainty, 26(2/3); 121-136, 2003

- People are prone to . . . probability neglect, especially when their emotions are intensely engaged.
- Probability neglect is highly likely in the aftermath of terrorism. People fall victim to probability neglect if and to the extent that the intensity of their reaction does not greatly vary even with large differences in the likelihood of harm. When probability neglect is at work, people’s attention is focused on the bad outcome itself, and they are inattentive to the fact that it is unlikely to occur.

Intuitive Toxicology: Main Results

- Many laypeople are insensitive to different exposures of chemicals that can produce dreaded effects, such as cancer (high affect)
Intuitive Toxicology: Main Results

- If large exposures are bad, small exposures are also bad (except medicines)

Affect conveys meaning upon information

Without affect, information lacks meaning and will not be used in judgment and decision making

- Affect is a key ingredient of rational behavior
- Affect sometimes leads to poor decision making

THAT’S GOOD! THAT’S BAD!
Margery Cuyler

Affect conveys meaning upon information

Information

Affect Meaning

- Without affect, information lacks meaning and will not be used in judgment and decision making
- Affect is a key ingredient of rational behavior
- Affect sometimes leads to poor decision making

Affect conveys meaning upon information

Information

Affect Meaning

- Without affect, information lacks meaning and will not be used in judgment and decision making
- Affect is a key ingredient of rational behavior
- Affect sometimes leads to poor decision making

THAT’S GOOD! THAT’S BAD!
Margery Cuyler
Numeracy

- The ability to understand and use basic probability and mathematical concepts
- About 1 out of 2 Americans do not have the minimal math skills needed to use numbers embedded in newspapers (Kirsch et al., 2002)
- Even those with adequate literacy skills may be challenged by the complex literacy demands required to make informed choices in health and financial domains

**Numeracy Scale** Which of the following numbers represents the biggest risk of getting a disease? 1 in 100, 1 in 1000, 1 in 10

<table>
<thead>
<tr>
<th></th>
<th>Students More than HS</th>
<th>HS or less</th>
<th>Other adults (65-94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergrads</td>
<td>96%</td>
<td>94%</td>
<td>83%</td>
</tr>
<tr>
<td>More than HS</td>
<td>71%</td>
<td>73%</td>
<td>94%</td>
</tr>
<tr>
<td>HS or less</td>
<td>87%</td>
<td>75%</td>
<td>93%</td>
</tr>
<tr>
<td>Older adults (65-94)</td>
<td>91%</td>
<td>87%</td>
<td>94%</td>
</tr>
</tbody>
</table>

If Person A’s chance of getting a disease is 1 in 100 in ten years, and person B’s risk is double that of A, what is B’s risk?

<table>
<thead>
<tr>
<th></th>
<th>Undergrads</th>
<th>More than HS</th>
<th>HS or less</th>
<th>Older adults (65-94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct</td>
<td>74%</td>
<td>76%</td>
<td>49%</td>
<td>58%</td>
</tr>
</tbody>
</table>

The chance of getting a viral infection is 0.0005. Out of 10,000 people, about how many of them are expected to get infected?

<table>
<thead>
<tr>
<th></th>
<th>Undergrads</th>
<th>More than HS</th>
<th>HS or less</th>
<th>Older adults (65-94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct</td>
<td>46%</td>
<td>33%</td>
<td>13%</td>
<td>11%</td>
</tr>
</tbody>
</table>
Who has lower numeracy?

- Strong relations with measures of education
  - Less health reading literacy
  - Lower education

- Moderate relations with health and health behaviors
  - Less patient activation
  - Lower self-reported health

- Weak relations with demographic information
  - Nonwhites compared to whites
  - Marginally lower income
  - No relation to age in this sample of 18-64-year-olds

Does numeracy matter?

The ability to understand numbers will influence:

- How much a decision maker transforms numbers from one format to another
- How much irrelevant affect influences choices and judgments
- How much feeling is drawn from numbers
- Comprehension and “Less is More”
- How risk information is understood and used in a cancer setting
Transforming Numbers:
Probability and Relative Frequency
in Risk Communication

Are they the same or different in communicating risk?

- e.g., 1% chance
  vs.
  1 out of 100


Risk Communication

A patient — Mr. James Jones — has been evaluated for discharge from an acute civil mental health facility where he has been treated for the past several weeks. A psychologist whose professional opinion you respect has done a state-of-the-art assessment of Mr. Jones. Among the conclusions reached in the psychologist’s assessment is the following:

High numerate hypothesized to have both formats accessible

- **Probability condition**
  Of every 100 patients similar to Mr. Jones, 10% are estimated to commit an act of violence to others during the first several months after discharge

- **Frequency condition**
  Of every 100 patients similar to Mr. Jones, 10 are estimated to commit an act of violence to others during the first several months after discharge

Perceived risk to others

F(3,42)=4.4, p<.01 (Frame, p<.05; Numeracy, n.s.; Interaction, p<.05)
The ability to understand numbers will influence:

- How much a decision maker transforms numbers from one format to another
- How much irrelevant affect influences choices and judgments
- How much feeling is drawn from numbers
- Comprehension and "Less is More"
- How risk information is understood and used in a cancer setting

Irrelevant Affect I: Jellybean task

A \hspace{1cm} B

9% colored jellybeans \hspace{1cm} 10% colored jellybeans

If you pick a colored jellybean, you will **WIN**.

From which bowl would you prefer to pick a jellybean?

Lower numeracy linked to more choices of the suboptimal bowl A

The more numerate had more precise feelings about the 9% chance in bowl A
Irrelevant Affect II: 
Making numbers easier to evaluate

- Community sample (N=303)
- Subjects rate the attractiveness of a hospital based on three quality indicators
- Subjects received either:
  - Numbers only or Numbers made easier to evaluate
  - Each quality indicator had a low, medium, or high value attached to it

Peters, Dieckmann, Västfjäll, Mertz, Slovic, & Hibbard, in review

<table>
<thead>
<tr>
<th>Condition = Numbers only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital</td>
</tr>
<tr>
<td>A</td>
</tr>
</tbody>
</table>

What we want to explain

- Attractiveness
  - Imagine you need to choose a hospital. How attractive is this hospital to you?

- Evaluations like these are important:
  - when deciding whether or not to go to the usual hospital
  - when deciding whether or not to go to the hospital recommended by a doctor
  - whenever the consumer evaluates a single hospital at a time
Hypotheses

1. Hospital quality will not influence evaluations if we give them only numbers.
2. Making multiple (and very different) quality indicators easier to evaluate will help decision makers use them.
3. This will be particularly true for the low numerate.

Presenting quality indicators in an easier to evaluate format helps consumers low in numeracy to use more of the information.

What did the low numerate use when given numbers only?

- Their mood
- Numbers only
- Easier to evaluate

What did the low numerate use when given numbers only?

- Their mood!
- Just prior, “How do you feel right now?” Good, Bad, Upset, Happy
- Low numerate decision makers misattributed their current feelings to the hospital.
- Instead of using the numbers
- Those in more positive moods rated the hospital as more attractive
The ability to understand numbers will influence:

- How much a decision maker transforms numbers from one format to another
- How much irrelevant affect influences choices and judgments
- How much feeling is drawn from numbers
- Comprehension and “Less is More”
- How risk information is understood and used in a cancer setting

Drawing feelings from numbers: Rating the attractiveness of a bet

- Subjects are asked to rate the attractiveness of a bet (scale=0-20).
  - Group 1: The bet gives you 7/36 chances to win $9
  - Group 2: The bet gives you 7/36 chance to win $9 and 29/36 chances to lose 5 cents
- Surprising effect - Group 2 rates their bet as more attractive (Slovic et al., 2002)

High (and not low) numerate drive the surprising effect and find the objectively worse bet more attractive

High numerate feel more positive affect about $9 when 5 cent loss is present

Interaction F(1,40)=4.4, p<.05; main effect of numeracy is also significant
The ability to understand numbers will influence:

- How much a decision maker transforms numbers from one format to another
- How much irrelevant affect influences choices and judgments
- How much feeling is drawn from numbers
- Comprehension and "Less is More"
- How risk information is understood and used in a cancer setting

Less is More I

- Subjects choose among three hospitals based on cost, quality information, and other information
- Hospitals that cost more have higher quality in this design
- Three conditions (all include cost information)
  - unordered
  - ordered (quality information first) and highlighted
  - quality information only and highlighted

(Peters, Dieckmann, et al., in review)
Less is More I: Hypotheses

1. Including less information will help choice and comprehension.
2. This will be particularly true for those low in numerical literacy

Comprehension improves when only the most relevant quality information is shown

The 3 conditions are significantly different, $F(2,298)=6.4, p<.01$

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Hospital X</th>
<th>Hospital Y</th>
<th>Hospital Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your out-of-pocket costs</td>
<td>$5</td>
<td>$55</td>
<td>$55</td>
</tr>
<tr>
<td>Number of Registered Nurses per 100 patients</td>
<td>18</td>
<td>38</td>
<td>29</td>
</tr>
<tr>
<td>Has computer system to prevent medication errors</td>
<td>No</td>
<td>Yes</td>
<td>Limited</td>
</tr>
<tr>
<td>% of time guidelines for heart attack care are followed</td>
<td>82%</td>
<td>92%</td>
<td>87%</td>
</tr>
<tr>
<td>% of time guidelines for pneumonia care are followed</td>
<td>60%</td>
<td>89%</td>
<td>78%</td>
</tr>
</tbody>
</table>
Including only the most relevant information helps comprehension the most in the low numerate

Low and high numerate choose highest quality hospital when only the most relevant quality information is shown

The 3 conditions are significantly different, Chi-square(df=2) =10.2; p<.01

Less is More II:
Make only important indicators easier to evaluate

- Subjects told that they need treatment for heart failure

- Subjects choose among 15 hospitals based on cost, overall patient satisfaction (less important), and death rate for heart failure patients (more important)

Condition = Make only death rate easier to evaluate

"Imagine you need treatment for heart failure"

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Cost</th>
<th>Overall patient satisfaction</th>
<th>Death rate for heart failure patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital E</td>
<td>$$$</td>
<td>68</td>
<td>1.4%</td>
</tr>
<tr>
<td>Hospital H</td>
<td>$$$</td>
<td>76</td>
<td>€ 4.1%</td>
</tr>
<tr>
<td>Hospital B</td>
<td>$$$</td>
<td>81</td>
<td>€ 4.9%</td>
</tr>
<tr>
<td>Hospital J</td>
<td>$$$</td>
<td>87</td>
<td>€ 5.3%</td>
</tr>
<tr>
<td>Hospital K</td>
<td>$$$</td>
<td>90</td>
<td>€ 6.1%</td>
</tr>
<tr>
<td>Hospital D</td>
<td>$$</td>
<td>71</td>
<td>3.9%</td>
</tr>
<tr>
<td>Hospital F</td>
<td>$$</td>
<td>78</td>
<td>€ 4.4%</td>
</tr>
<tr>
<td>Hospital I</td>
<td>$$</td>
<td>85</td>
<td>€ 4.9%</td>
</tr>
<tr>
<td>Hospital N</td>
<td>$$</td>
<td>90</td>
<td>€ 6.1%</td>
</tr>
<tr>
<td>Hospital G</td>
<td>$$</td>
<td>94</td>
<td>6.4%</td>
</tr>
<tr>
<td>Hospital M</td>
<td>$</td>
<td>88</td>
<td>€ 5.2%</td>
</tr>
<tr>
<td>Hospital A</td>
<td>$</td>
<td>91</td>
<td>€ 6.4%</td>
</tr>
<tr>
<td>Hospital C</td>
<td>$</td>
<td>95</td>
<td>7.3%</td>
</tr>
<tr>
<td>Hospital O</td>
<td>$</td>
<td>96</td>
<td>8.9%</td>
</tr>
<tr>
<td>Hospital L</td>
<td>$</td>
<td>98</td>
<td>9.9%</td>
</tr>
</tbody>
</table>
Condition =
Make both easier to evaluate
"Imagine you need treatment for heart failure"

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Cost</th>
<th>Overall patient satisfaction</th>
<th>Death rate for heart failure patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>$$6$$</td>
<td>68</td>
<td>1.4%</td>
</tr>
<tr>
<td>F</td>
<td>$$6$$</td>
<td>76</td>
<td>4.1%</td>
</tr>
<tr>
<td>G</td>
<td>$$6$$</td>
<td>87</td>
<td>5.3%</td>
</tr>
<tr>
<td>H</td>
<td>$$6$$</td>
<td>90</td>
<td>6.1%</td>
</tr>
<tr>
<td>I</td>
<td>$$6$$</td>
<td>71</td>
<td>3.9%</td>
</tr>
<tr>
<td>J</td>
<td>$$6$$</td>
<td>91</td>
<td>4.0%</td>
</tr>
<tr>
<td>K</td>
<td>$$6$$</td>
<td>88</td>
<td>5.2%</td>
</tr>
<tr>
<td>L</td>
<td>$$6$$</td>
<td>95</td>
<td>6.4%</td>
</tr>
<tr>
<td>M</td>
<td>$$6$$</td>
<td>90</td>
<td>6.1%</td>
</tr>
<tr>
<td>N</td>
<td>$$6$$</td>
<td>91</td>
<td>6.4%</td>
</tr>
<tr>
<td>O</td>
<td>$$6$$</td>
<td>90</td>
<td>6.1%</td>
</tr>
<tr>
<td>P</td>
<td>$$6$$</td>
<td>94</td>
<td>6.2%</td>
</tr>
<tr>
<td>Q</td>
<td>$$6$$</td>
<td>88</td>
<td>5.2%</td>
</tr>
<tr>
<td>R</td>
<td>$$6$$</td>
<td>95</td>
<td>7.3%</td>
</tr>
<tr>
<td>S</td>
<td>$$6$$</td>
<td>96</td>
<td>8.0%</td>
</tr>
<tr>
<td>T</td>
<td>$$6$$</td>
<td>90</td>
<td>6.4%</td>
</tr>
</tbody>
</table>

Death rate for heart failure patients:
- Hospital E: 1.4%
- Hospital F: 4.0%
- Hospital G: 5.3%
- Hospital H: 6.1%
- Hospital I: 3.9%
- Hospital J: 4.0%
- Hospital K: 5.2%
- Hospital L: 6.4%
- Hospital M: 6.1%
- Hospital N: 6.4%
- Hospital O: 6.1%
- Hospital P: 5.2%
- Hospital Q: 6.2%
- Hospital R: 7.3%
- Hospital S: 8.0%
- Hospital T: 6.4%

More people choose the lowest death rate hospital when only it is made easier to evaluate.

The 3 conditions are significantly different, Chi-square(df=2) = 6.0; p<.05

Making only the most important information easier to evaluate helps the most in choices, especially for the low numerate.

Less is More III:
Use numbers in a direction consistent with the number line ("Higher numbers mean better")

- Subjects choose among three hospitals based on cost and ratio of patients to nurses
- The ratio of patients to nurses is either:
  - Number of patients per nurse (lower is better)
  - Number of nurses per 100 patients (higher is better)
- Hospitals A and M are the two best choices
  - All other hospitals are worse on either cost or quality
**Condition = Lower numbers mean better**

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Number of patients per RN</th>
<th>Your out-of-pocket cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.6</td>
<td>$$$</td>
</tr>
<tr>
<td>B</td>
<td>2.8</td>
<td>$$$$</td>
</tr>
<tr>
<td>C</td>
<td>3.1</td>
<td>$$$$</td>
</tr>
<tr>
<td>D</td>
<td>2.6</td>
<td>$$$$</td>
</tr>
<tr>
<td>E</td>
<td>4.1</td>
<td>$$</td>
</tr>
<tr>
<td>F</td>
<td>2.7</td>
<td>$$$$</td>
</tr>
<tr>
<td>G</td>
<td>5.3</td>
<td>$$$$</td>
</tr>
<tr>
<td>H</td>
<td>4.9</td>
<td>$</td>
</tr>
<tr>
<td>I</td>
<td>5.6</td>
<td>$</td>
</tr>
<tr>
<td>J</td>
<td>4.8</td>
<td>$$</td>
</tr>
<tr>
<td>K</td>
<td>4.2</td>
<td>$</td>
</tr>
<tr>
<td>L</td>
<td>4.3</td>
<td>$$$$</td>
</tr>
<tr>
<td>M</td>
<td>3.9</td>
<td>$</td>
</tr>
<tr>
<td>N</td>
<td>4.1</td>
<td>$$$$</td>
</tr>
<tr>
<td>O</td>
<td>5.8</td>
<td>$$</td>
</tr>
</tbody>
</table>

**Condition = Higher numbers mean better**

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Number of RNs per 100 patients</th>
<th>Your out-of-pocket cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>38</td>
<td>$$$</td>
</tr>
<tr>
<td>B</td>
<td>36</td>
<td>$$$$</td>
</tr>
<tr>
<td>C</td>
<td>32</td>
<td>$$$$</td>
</tr>
<tr>
<td>D</td>
<td>38</td>
<td>$$$$</td>
</tr>
<tr>
<td>E</td>
<td>24</td>
<td>$$</td>
</tr>
<tr>
<td>F</td>
<td>37</td>
<td>$$$$</td>
</tr>
<tr>
<td>G</td>
<td>19</td>
<td>$$$$</td>
</tr>
<tr>
<td>H</td>
<td>20</td>
<td>$</td>
</tr>
<tr>
<td>I</td>
<td>18</td>
<td>$</td>
</tr>
<tr>
<td>J</td>
<td>21</td>
<td>$$</td>
</tr>
<tr>
<td>K</td>
<td>24</td>
<td>$</td>
</tr>
<tr>
<td>L</td>
<td>23</td>
<td>$$$$</td>
</tr>
<tr>
<td>M</td>
<td>26</td>
<td>$</td>
</tr>
<tr>
<td>N</td>
<td>24</td>
<td>$$$$</td>
</tr>
<tr>
<td>O</td>
<td>17</td>
<td>$$</td>
</tr>
</tbody>
</table>

"Higher numbers mean better" improved comprehension

\[
F(1,292) = 13.4, p < .001
\]

The low numerate were helped by "Higher means better"

\[
\%
\]

Hospitals A or M
Less is More: Conclusions

- How information is presented influences choice and comprehension
  - This was particularly true of the less numerate consumers
- Less can be more
  1. Delete less relevant information whenever possible
  2. Highlight the meaning of only important information
  3. Use numbers in a direction consistent with how people usually process numbers
- Making careful choices about how information is framed may help reduce health disparities

The ability to understand numbers will influence:

- How much a decision maker transforms numbers from one format to another
- How much irrelevant affect influences choices and judgments
- How much feeling is drawn from numbers
- Comprehension and “Less is More”
- How risk information is understood and used in a cancer setting

Shared Decision Making—Adjuvant Decision Aid

<table>
<thead>
<tr>
<th>Decision</th>
<th>Number of Women Alive in 10 Years (out of 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Additional Therapy</td>
<td>70</td>
</tr>
<tr>
<td>Hormonal Therapy</td>
<td>74</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>76</td>
</tr>
<tr>
<td>Combined Therapy</td>
<td>79</td>
</tr>
</tbody>
</table>

Shared Decision Making—Improved Format

<table>
<thead>
<tr>
<th>Number of Women Alive in 10 Years (out of 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No additional therapy</td>
</tr>
<tr>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Hormonal therapy</td>
</tr>
<tr>
<td>Combined therapy</td>
</tr>
</tbody>
</table>
Numeracy and Format Interact in Comprehension

Information Format made a difference to the Treatment recommended to a friend

Conclusions
1. Simply providing information is not enough
2. How information is presented may matter as much as what information is presented
3. Numeracy matters

Implications
1. You can’t present “just the facts.”
   - Different people will understand and react to the same numbers differently
   - How numbers are presented will influence the choices people make
   - Less can be more
2. Numbers are just numbers
3. We think and feel our way through risky decisions
Ellen Peters is a research scientist at Decision Research and an adjunct assistant professor of psychology at the University of Oregon in Eugene. Peters received her B.S.E. and B.S. from the University of Pennsylvania in systems engineering and business. She completed her M.S. and Ph.D. in psychology from the University of Oregon. She was a visiting scientist at the National Cancer Institute. She is currently on an external advisory board for the Iowa Cancer and Aging Program and has been a guest editor for special issues of Health Psychology and the Journal of Behavioral Decision Making. She won a best paper award at the 2003 annual meeting for the Society of Risk Analysis. Her research focuses on how affective and deliberative processes help people to make decisions in an increasingly complex world. She studies decision making as an interaction of characteristics of the decision situation and characteristics of the individual and is currently funded by grants from the National Science Foundation and other federal and private agencies. She has published widely in journals such as Psychological Science, Risk Analysis, Health Affairs, and Health Psychology. Her research interests include decision making, dual processes, affect, emotion, risk perception, numeracy, aging, and health decision making, and she is particularly interested in the application of psychological theory to applied problems in health and financial domains.