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Developing effective risk communication

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Overview

1. Need for effective risk communications
2. Features of effective risk communications
3. Examples of existing risk communications
4. The mental models approach to developing effective risk communications

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Need for risk communication

- Risk communication can help lay people to
  - Respond to acute situations and their aftermath
  - Participate in policy making

- Risk communication can help experts to
  - Provide practical information
  - Obtain informed consent
  - Maintain public trust and morale

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Effective risk communications

- Help people to understand the risk and to reduce it
- Are based on a systematic expert model
  - Reflect interdisciplinary scientific literature
- Are based on formative research with members of the intended audience
  - Use wording that lay people understand
  - Address decision-relevant gaps and misconceptions
  - Give behaviorally realistic advice

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Existing risk communications

- Are often not evaluated
- Are often ineffective, if they are evaluated
- Often lack the features of effective communications
  - Use wording lay people don't understand
  - Present basic facts, but don't fix gaps and misconceptions
  - Fail to give behaviorally realistic advice

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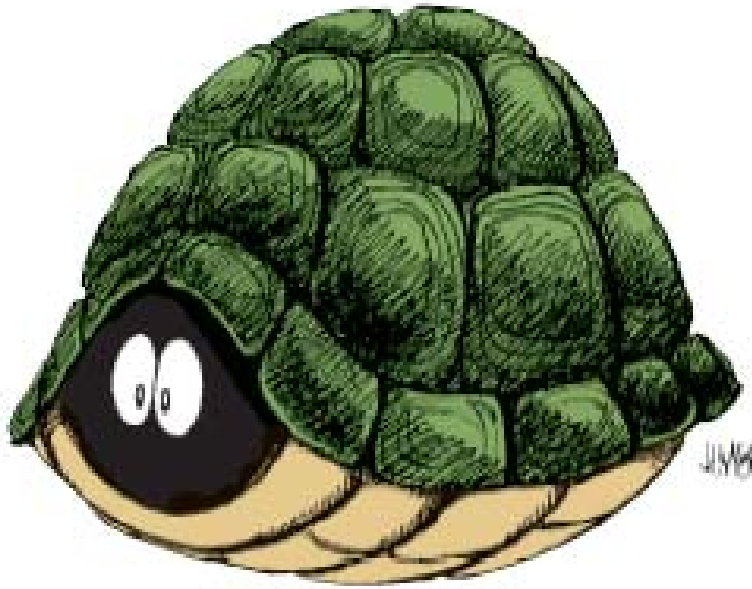
Example: Wording



SHELTER IN PLACE

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Example: Not fixing knowledge gaps

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Example: Not fixing knowledge gaps

This special UV light shows where the bacteria that can cause food poisoning could lurk on hands

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Example: No behavioral strategy

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Mental Models Approach

1. Normative: What should people know?
   - Interdisciplinary literature review and expert panel
   - Create expert model
2. Descriptive: What do people already know?
   - Conduct qualitative interviews and quantitative surveys
   - Identify relevant wording and decision contexts
   - Create lay model
3. Prescriptive: What do people still need to know?
   - Comparison of expert model and lay model
   - Identify knowledge gaps and misconceptions
   - Iterative message development
4. Evaluation: Does the risk communication work?
   - Randomized controlled trial, comparing risk communication to control group

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Example: Pandemic influenza

Problem:

- Not enough data to judge likelihood of occurrence, or effectiveness of interventions

1. Normative:
   - Model of risk with behavioral interventions (e.g., hand washing, social distancing, barrier methods)
   - Estimates of model parameters
2. Descriptive: In progress
3. Prescriptive: In progress

Probability of Efficient Human-to-Human Transmission

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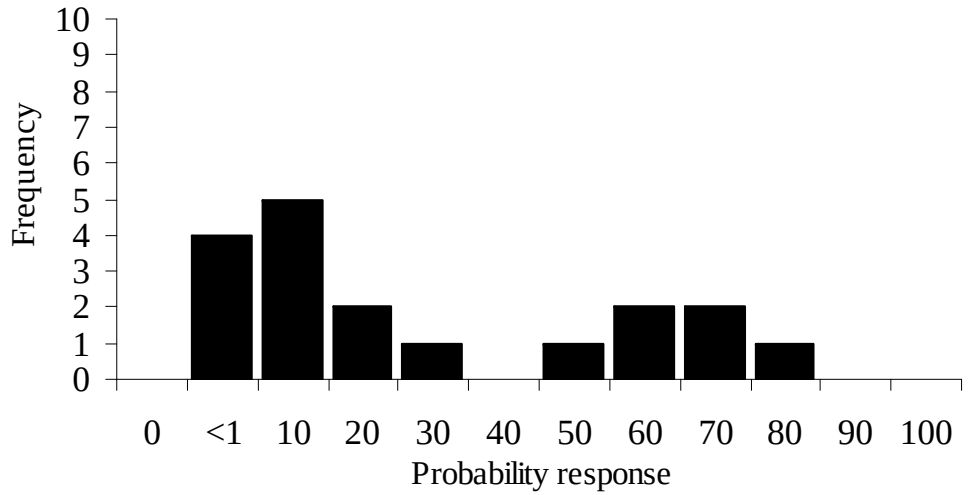
What is the probability that H5N1 will **become an efficient human-to-human transmitter (capable of being propagated through at least two epidemiological generations of affected humans)** sometime during the next 3 years?



Median=15%

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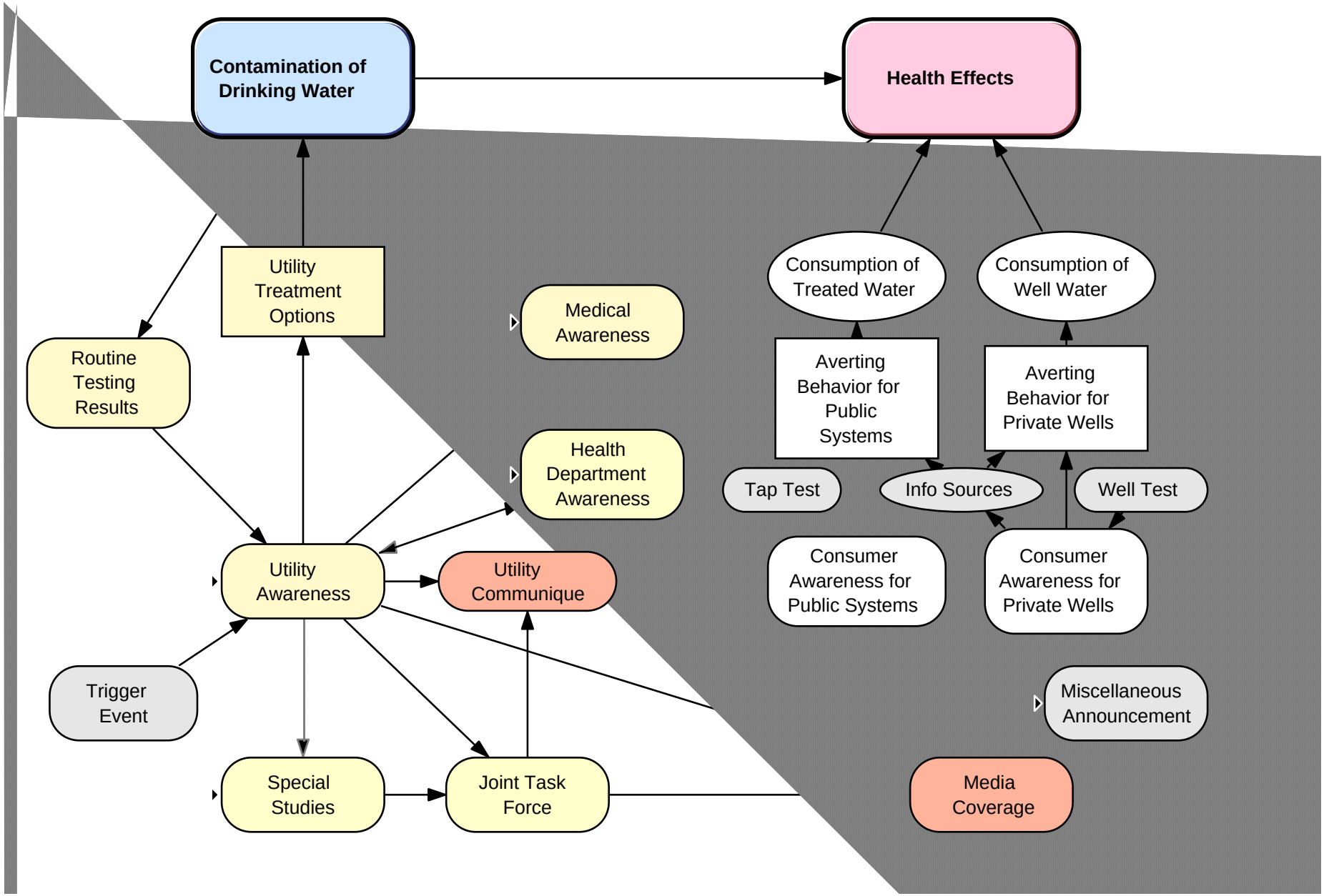
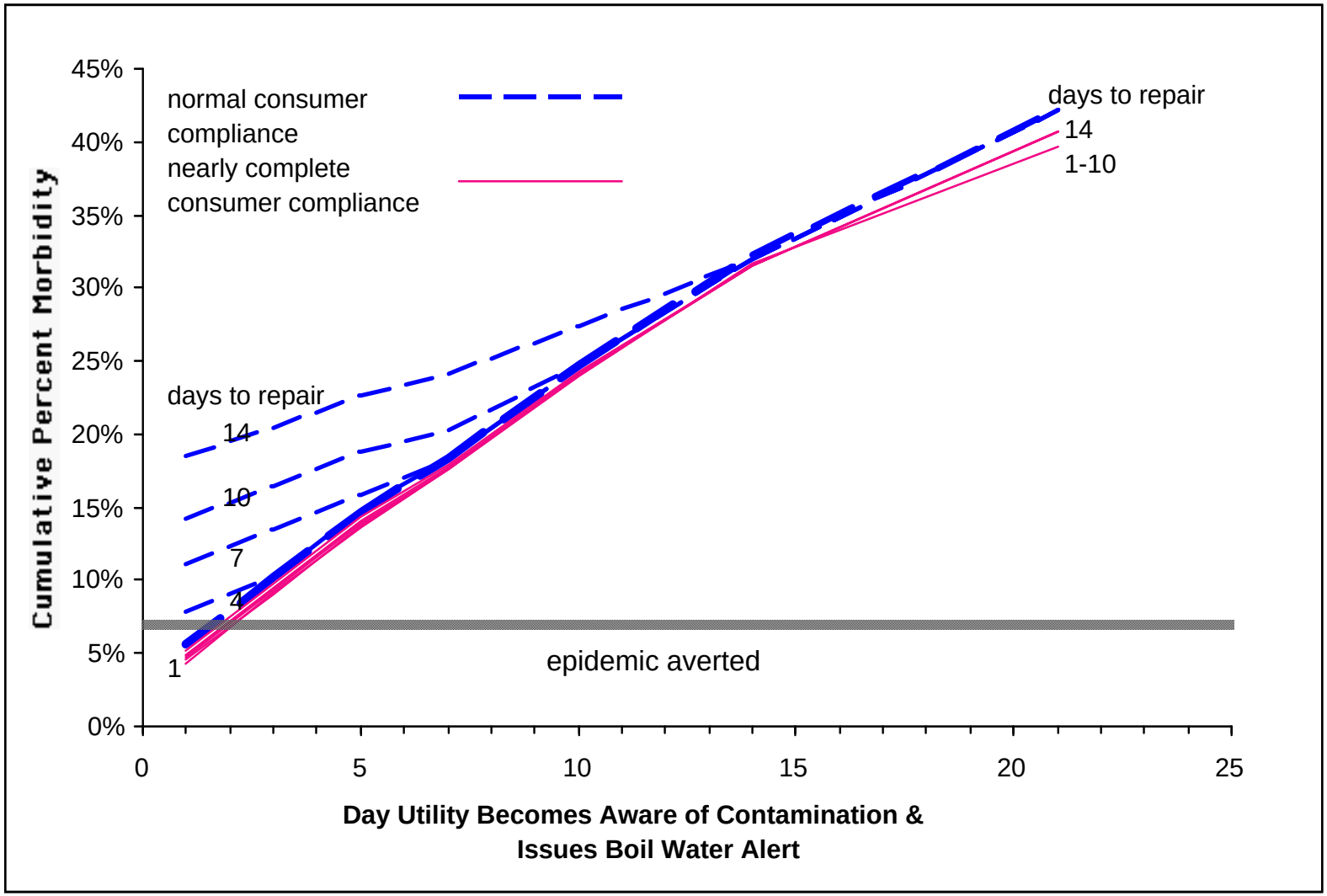
Example: Drinking-water-borne Cryptosporidium

Problem

- Reduce risk of outbreak

1. Normative:
   - Risk model to track occurrence and evolution of outbreak, including contaminant delivery and detection, water treatment efficiency, timing of interventions, compliance with boil water notices


Contamination of Drinking Water
Health Effects
Utility Treatment Options
Routine Testing Results
Medical Awareness
Health Department Awareness
Utility Awareness
Utility Communique
Trigger Event
Special Studies
Joint Task Force
Consumption of Treated Water
Consumption of Well Water
Averting Behavior for Public Systems
Averting Behavior for Private Wells
Tap Test
Info Sources
Well Test
Consumer Awareness for Public Systems
Consumer Awareness for Private Wells
Miscellaneous Announcement
Media Coverage


45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Cumulative Percent Morbidity
normal consumer compliance
nearly complete consumer compliance
days to repair
14
1-10
days to repair
14
10
7
4
1
epidemic averted
0
5
10
15
20
25
Day Utility Becomes Aware of Contamination & Issues Boil Water Alert

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Example: Drinking-water-borne Cryptosporidium

Problem:

- Reduce risk of outbreak

1. Normative:
   - Risk model to track occurrence and evolution of outbreak, including contaminant delivery and detection, water treatment efficiency, timing of interventions, compliance with boil water notices
2. Descriptive:
   - Little to no knowledge in general population
   - Useless knowledge in vulnerable populations
3. Prescriptive:
   - Abandon reliance on current warning system
   - Provide protective resources for immunocompromised

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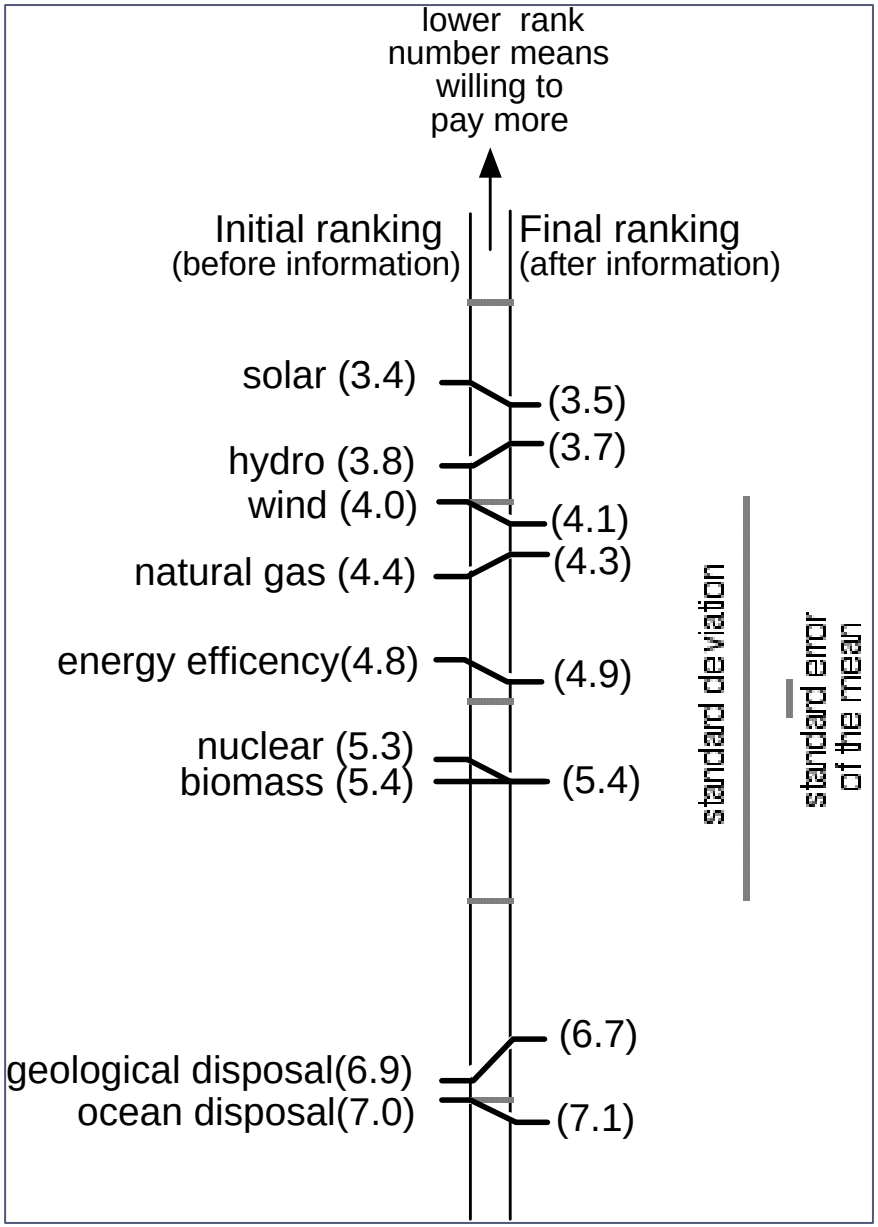
Example: Carbon Capture and Storage

Problem:

- Inform public acceptance judgments

1. Normative:
   - CCS may help to reduce carbon dioxide emissions
2. Descriptive:
   - Interviewees had little to no knowledge about CCS
   - They preferred to discuss CCS relative to other low-carbon technologies as part of a low-carbon energy portfolio

Public perceptions of CCS



- Survey respondents ranked CCS below other low-carbon options
- However, they had limited information about these options

See Palmgren et al., ES&T, 2004

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Example: Carbon Capture and Storage

Problem:

- Inform public acceptance judgments

1. Normative:
   - CCS may help to reduce carbon dioxide emissions
2. Descriptive:
   - Interviewees had little to no knowledge about CCS
   - They preferred to discuss CCS relative to other low-carbon technologies as part of a low-carbon energy portfolio
3. Prescriptive: In progress
   - Provide more realistic information about costs and benefits of portfolios including CCS vs. alternative portfolios (which may make CCS look better)

Communication materials

Wind Power

How it Works: Unlike the old windmills that ground grain and pumped water in Holland, or the metal wind mills that pumped water for cattle in the American West, modern wind machines are large (often more than 100 feet high). The machines have blades designed like wings of airplanes. Wind turns the blades of the turbine, which are connected to a generator to make electricity.

	MOR
Cost	The cost of wind power has made. *To learn more, see t*
Air and water pollution	Wind farms cause very little *sheet on "Pollution Compari*
Availability	Wind plants are built in wind the center of the state. How the power that is possible if
Reliability	Wind varies in strength and electricity made in PA come for times when it is not wind wind (in batteries) may also
Average Lifespan	Wind turbines can operate f
Noise	Wind farms make some low facilities. But, since the wind noticeable.
Land use and ecology	Wind farms need between 4 many turbines require hund of it can still be used for far turbines. This can disturb th can be very visible.
Accidental death/injury	Wind farms are very safe fo strike and kill birds and bats
Waste	There is very little solid was

Carbon Dioxide (CO_2) Capture

How it Works: Ordinarily, when coal is burned, CO_2 is released to the atmosphere. However, equipment can be added to plants that captures CO_2 instead of letting it escape. Once captured, the CO_2 gas is made into a liquid form and carried by pipeline to a place where it can be permanently disposed in suitable rock formations more than half a mile underground. If the location is chosen correctly, the CO_2 will stay trapped in the underground rocks. The CO_2 can be monitored to make sure it stays in place. After a few decades, the CO_2 will dissolve in the water in the rocks. Over thousands of years, it may change into minerals.

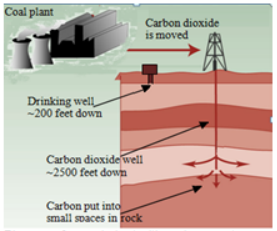

Diagram of a coal plant with carbon capture and disposal. Modified from http://www.co2crc.com.au

MORE INFORMATION	
Cost	The cost of capturing CO_2 is factored into the cost of electricity for coal power plants. *To learn more, see the separate sheet on "Cost Comparison".*
Air/water pollution	The pollution made from capturing carbon dioxide is factored into pollution from coal power plants. *To learn more, see the separate sheet on "Pollution Comparison".*
Availability	• There are suitable rock formations in much of the U.S. The formations are tested to make sure that they can safely hold the CO_2. PA has lots of space that can be used. There is enough underground space to capture CO_2 for the entire lifetime of any new coal plant that is built. • There are thousands of miles of oil and gas pipelines in the U.S. today. CO_2 can be moved through similar pipelines. Some CO_2 pipelines are already in use in the U.S.
Reliability	Capturing CO_2 will not affect the dependability of electricity from coal plants.
Average Lifespan	• It should be possible to capture CO_2 however long the power plant is operating. • Experts disagree on how long the underground space will need to be monitored. Once an underground space is full and closed, the government will continue to monitor it for safety.
Accidental death/ injury	• Unlike oil and gas, CO_2 cannot burn or explode. As with oil and gas pipelines, the chance of pipeline leaks is low. CO_2 could cause people to suffocate if gas did leak. • There is a small chance that CO_2 could leak out of the underground space. This can be monitored with underground equipment. If the CO_2 starts to move to places where it should not be, this can be fixed. The CO_2 will eventually dissolve in underground water, making leaks less likely. The government will limit any risks to underground drinking water. CO_2 wells will be built more than 10 times deeper than a drinking well. • Pumping CO_2 into the ground builds up underground pressure. This could increase the risk of small earthquakes in the area. However, PA is not prone to earthquakes.

- 10 technologies presented on 9 mini-sheets
- Multi-attribute qualitative information presented
- Readability at low grade level:
  - Flesch-Kincaid score is 7.7

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Energy portfolio ranking study

- Participants sampled from the community
  - hs education
  - no science or technical background
- Procedure
  - Study materials at home
  - Conduct initial individual ranking
  - Group discussion jury-like groups of 6-8 people
  - Conduct group ranking
  - Conduct individual ranking
  - Exit survey

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Public acceptance of CCS *may* be increased with

- Broader public understanding of
  - Costs and risks of CCS and alternatives to reduce CO_2
- Better risk communication
  - Open and respectful of the public's concerns

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Conclusion

- Effective risk communications
  - help people to make informed decisions
  - Are not developed by one expert but require extensive input from experts and lay people
- Their effectiveness is shown in randomized controlled trials, comparing the risk communication to controls

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Relevant references

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