

Performance of a Comprehension Question in Discrete-Choice Experiment Surveys

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BACKGROUND

- Developing methods to assess the quality of data from patient preference surveys is an active research area and a need identified by regulatory bodies¹
- Comprehension questions
 - Teach respondents how to interpret text and graphics
 - Reinforce important survey elements
 - May also identify respondents who might not provide reliable data for stated-preference surveys like discrete-choice experiments or other similar methods
- In our studies, we use a standardized comprehension question for a pictogram depicting probability (risk grid comprehension question) (Figure 1)
 - The actual stated-preference choice questions present the pictogram with words (e.g., 15 out of 100 people) and percentages (e.g., 15%) (Figure 2)
- In our studies, comprehension questions are typically followed by a statement that the respondent answered the question correctly or incorrectly and an explanation of the correct response
- There are several reasons why a respondent might answer the risk grid comprehension question incorrectly (Table 1)

OBJECTIVES

- To examine the proportion of respondents providing an incorrect response to a risk grid comprehension question across studies
- To examine whether the proportion providing an incorrect response varies systematically with type of respondent and type of recruiting source

METHODS

- Reviewed data from 46 stated-preference surveys that included a risk grid comprehension question
 - Respondent type:** 37 surveys were conducted with patients, 6 were conducted with caregivers (parents, guardians, and informal caregivers such as spouses or children providing care for patients), and 3 were surveys of the general population
 - Recruitment source:** 30 used an opt-in online panel of individuals who were engaged to participate in research, 5 used a patient organization, 4 used clinical sites, and 7 used a mixture of sources (online panel, physician referral, patient organizations, advertising)
- The risk grid comprehension question was worded similarly in all surveys
- The proportion of respondents who failed the comprehension question was calculated and summarized by recruiting source and respondent type
- The stated-preference studies' results were estimated using the full samples (including respondents who answered the risk grid comprehension question incorrectly) and were examined for extreme disordering (i.e., worse levels of a naturally ordered attribute are preferred to better levels) and imprecision (large confidence intervals)

Table 1. Reasons for Incorrect Responses and Possible Implications

| Reason for Incorrect Response | Implication(s) |
|--|---|
| Any reason listed below | Uncertain implications for data quality: The respondent may understand the graphic after explanation of correct response and/or seeing the risk information in the format provided in the choice questions (i.e., including words, ratios, and percentages; see Figure 2) Possible survey design problem: Comprehension question may be poorly worded or poorly designed |
| Not paying attention to comprehension question | Uncertain implications for data quality: See above Data may be biased or random: If a respondent does not pay attention to the choice questions and uses systematic, simplifying heuristics to answer the questions, then the preference estimates may be biased; if a respondent answers randomly because they are not paying attention, then including their responses will only add noise to the data Possible survey design problem: See above |
| Thought more gray figures meant more risk, not less risk | Uncertain implications for data quality: See above Appear to be risk-loving: If respondent continued to misunderstand even after receiving the explanation and seeing the additional information, then they would appear to prefer higher levels of risk in their choice data Possible survey design problem: See above |
| Did not understand what the risk grid was showing in isolation | Uncertain implications for data quality: See above Responses may not be valid: If a respondent does not understand the concept of numeric probability or the depiction of numeric probability, the numeric interpretations of their responses are suspect (i.e., their choices may suggest they are willing to accept risk, but maximum acceptable risk cannot be estimated because they thought of the risk only as "big" or "small") Possible survey design problem: See above |
| Misinterpreted the question (e.g., thought the question was asking their opinion about side effect risk, had trouble counting the number of figures in color) and answered incorrectly, even though they understood the question and the risk grid | None: Respondent understood risk grid Possible survey design problem: See above |

Figure 2. Risk Pictogram in Example Discrete-Choice Experiment Question

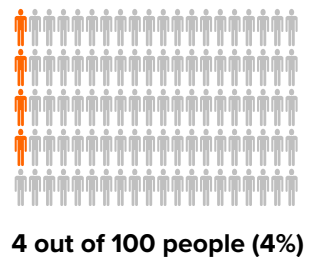
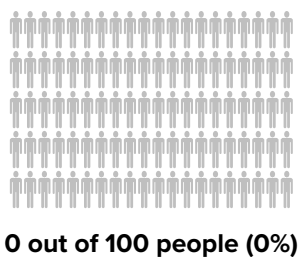
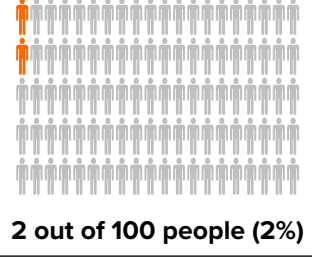
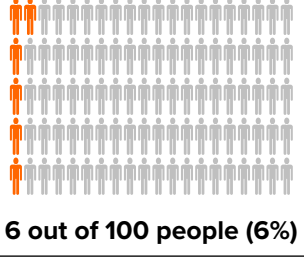
| Treatment Feature | Treatment A | Treatment B |
|--|---|--|
| Benefit | High | Low |
| Chance of liver damage |  4 out of 100 people (4%) |  0 out of 100 people (0%) |
| Chance of serious infection from the treatment |  2 out of 100 people (2%) |  6 out of 100 people (6%) |
| Which would you choose? | <input type="checkbox"/> | <input type="checkbox"/> |

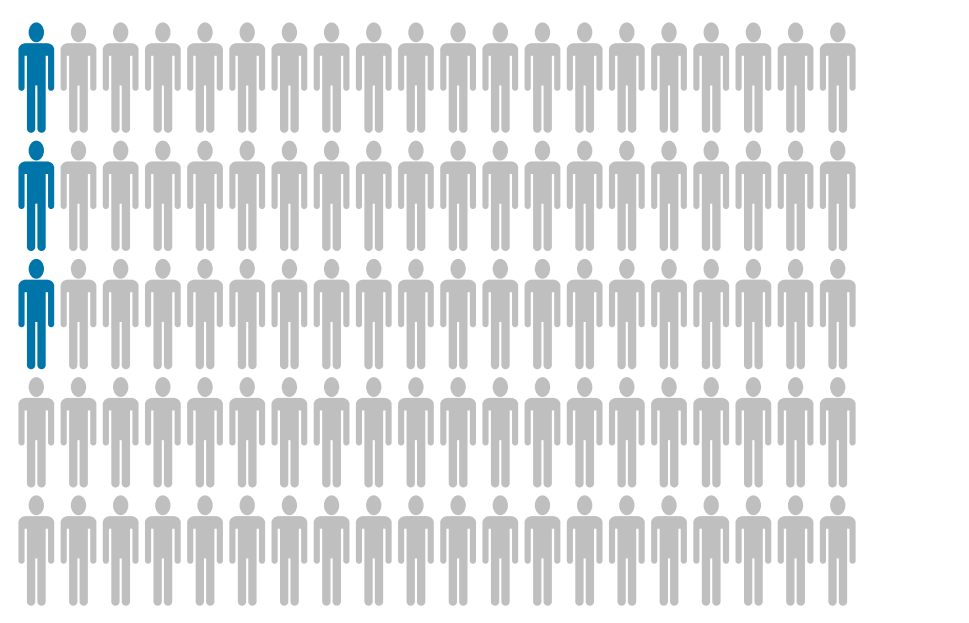
Figure 1. Generic Risk Grid Explanation, Comprehension Question, and Follow-up

The picture on this page may help you think about how many people might get a side effect. Look at the example picture below.

- Each figure in the picture below represents 1 person who is taking a medicine
- There are 100 figures in the picture (20 columns of figures and 5 rows of figures)
- The figures shown in color indicate people who will get a side effect because of medicine
- The figures shown in gray indicate people who take a medicine and will not get a side effect
- The more figures shown in color, the more likely it is that you would have a side effect because you took a medicine

In this example:
5 of the figures are shown in blue. That means that 5 people out of 100 (5%) will get the side effect when they take the medicine.
95 of the figures are shown in gray. That means that 95 people out of 100 (95%) will not get the side effect when they take the medicine.

Please look at the example in the picture below:



1. If each figure in the picture is one person who takes the medicine, how many people will get the side effect?

3 out of 100 (3%) [Correct Answer]
 97 out of 100 (97%)
 5 out of 100 (5%)
 85 out of 100 (85%)

[If answer is not 3% or if question is skipped]
Remember, each figure in the picture represents one person who is taking the medicine. In the picture above, there are 100 figures, and 3 of them are blue, while the rest are gray. This means that 3 people out of 100 people (or 3%) will get the side effect when they take the medicine. The correct answer is 3 out of 100 (3%).

[If answer to Q1 is 3%]
You are correct. Each figure in the picture represents one person who is taking the medicine. In the picture above, there are 100 figures, and 3 of them are blue, while the rest are gray. This means that 3 people out of 100 people (or 3%) will get the side effect when they take the medicine. The correct answer is 3 out of 100 (3%).

RESULTS

- The percentage of respondents answering incorrectly on the risk grid comprehension question ranged from 3% to 44% (Table 2)
- Table 2 summarizes the results for the full sample of studies and by recruiting source and respondent type
- The highest rates of incorrect responses to the risk grid comprehension question were observed among patients recruited through an online panel
- Despite variation in the percentage of respondents answering the risk grid comprehension question incorrectly, none of the 46 surveys had extreme disordering or imprecision in the preference study results

Table 2. Summary of the Percentage Who Answered Risk Grid Comprehension Question Incorrectly by Recruitment Source and Respondent Type

| Sample | Mean Percentage Answering Incorrectly (SD) | Minimum Percentage Answering Incorrectly | Maximum Percentage Answering Incorrectly |
|--|--|--|--|
| Full sample (n = 46) | 19% (10%) | 3% | 44% |
| Recruited through online panel (n = 30) | 25% (8%) | 9% | 44% |
| Recruited through patient organization (n = 5) | 11% (4%) | 5% | 15% |
| Recruited through clinical sites (n = 4) | 8% (3%) | 5% | 13% |
| Recruited through mixed methods (n = 7) | 10% (6%) | 3% | 17% |
| Patient respondents (n = 37) | 18% (10%) | 3% | 44% |
| Caregiver respondents (n = 6) | 22% (9%) | 13% | 36% |
| General population respondents (n = 3) | 25% (10%) | 17% | 36% |

SD = standard deviation.

DISCUSSION

- We provide a summary of the percentage of respondents who answered a risk grid comprehension question incorrectly across multiple studies against which other researchers can compare their studies
- Data sets with a percentage of incorrect responses as high as 44% still produced reasonable estimates of preference weights (no extreme disordering or large confidence intervals)
- The implications of answering the comprehension question incorrectly are uncertain and depend on the reasons for incorrect answers
- Strategies for collecting and modeling these data may help improve understanding (Table 3)

Table 3. Strategies for Analyzing Comprehension Questions

| Approach | Benefit |
|---|--|
| If a respondent answers incorrectly, explain and ask the question again one or two more times or ask the risk grid comprehension question again later in the survey | Measure whether respondents' likelihood of an incorrect answer (due to a mistake or a lack of understanding) decreases with more information by repeating comprehension questions or other similar strategies ² |
| Ask several different types of comprehension questions (e.g., comprehension questions about other attributes, comprehension questions about which treatment in a discrete-choice experiment question has more risk) | Assess whether there is a pattern in the data; if a respondent gets all or most comprehension questions incorrect, that may be a stronger indication that the respondent is not able to provide reliable data |
| Test to see if any respondent characteristics are associated with answering the comprehension question incorrectly | Learn more about respondents who answer the questions incorrectly and whether they are similar in ways that might explain why they answered incorrectly |
| Estimate a subgroup analysis comparing the preferences of respondents who answer the comprehension questions incorrectly with those who answer correctly | Test whether respondents who answer incorrectly have different preferences for certain attributes (e.g., are they more risk averse, do they dominate on certain attributes, do their responses add noise to the data but no bias?) |
| Estimate the preference model with and without respondents who answered the comprehension question incorrectly | Test whether the respondents who answer incorrectly are systematically affecting the conclusions that are drawn from the data |
| Estimate a latent class model and include whether the respondent answered the comprehension question incorrectly as a predictive variable in the class-probability function | Test whether respondents who answer incorrectly are associated with a particular preference class |
| Estimate a scale-adjusted model that includes whether the respondent answered the comprehension question incorrectly as a predictive variable | Test whether respondents who answer the comprehension question incorrectly have a different scale factor and whether adjusting for scale affects the conclusions that are drawn from the data |

CONCLUSIONS

- Our experience suggests that comprehension questions help respondents learn
- Respondents may provide incorrect responses for many reasons, and that does not necessarily mean the responses to the choice questions are invalid
- The percentage of the sample answering incorrectly varied across studies, but at a general level, the rates observed in these studies did not produce results that looked unreasonable

- We recommend retaining respondents who answer the comprehension questions incorrectly and analyzing the data to understand the respondents and their responses to the stated-preference questions
- Various survey design and modeling strategies can help researchers understand how incorrect responses impact the results and inform how data from these respondents should be handled
- Careful pretesting and analysis of comprehension questions can also help improve the quality of the questions and text in survey instruments

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