

# Risk Communication for Discrete Choice Experiments

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FROM THOUGHT LEADERSHIP TO CLINICAL PRACTICE

## Background and objectives

- Discrete choice experiments** (DCE) require respondents to (a) **understand** and (b) **compare** risks/benefits across treatment profiles to make well-informed choices.
- There is little empirical research systematically evaluating how different risk-communication practices perform in the DCE context.
- Primary aim:** to compare the performance of six risk-communication approaches in conveying information in the DCE context.
- Secondary aim:** to understand whether performance among risk-communication approaches varies between numeracy, graph literacy, and comprehension.

## Methods 1

### Overarching study:

- The risk-communication study was designed to inform a DCE to quantify **patients' acceptance of mortality risk associated with medical devices used in lower extremity revascularization for peripheral artery disease** (PAD) requiring 4 attributes:
  - Risk of symptoms returning leading to need for repeat revascularization at 2 and 5 years
  - Risk of death at 2 and 5 years

Risk-communication approaches to which respondents could be randomized:

- Evidence-based systematic modification of commonly used vertical icon array (Figure 1):<sup>1-3</sup>
  - integrated risk information for both medical events in one table cell versus separate cells
  - removed the icon arrays (text-only)
  - arranged time in horizontal, rather than vertical, direction (limited to the icon-array approaches)

Figure 1: 6 risk communication approaches

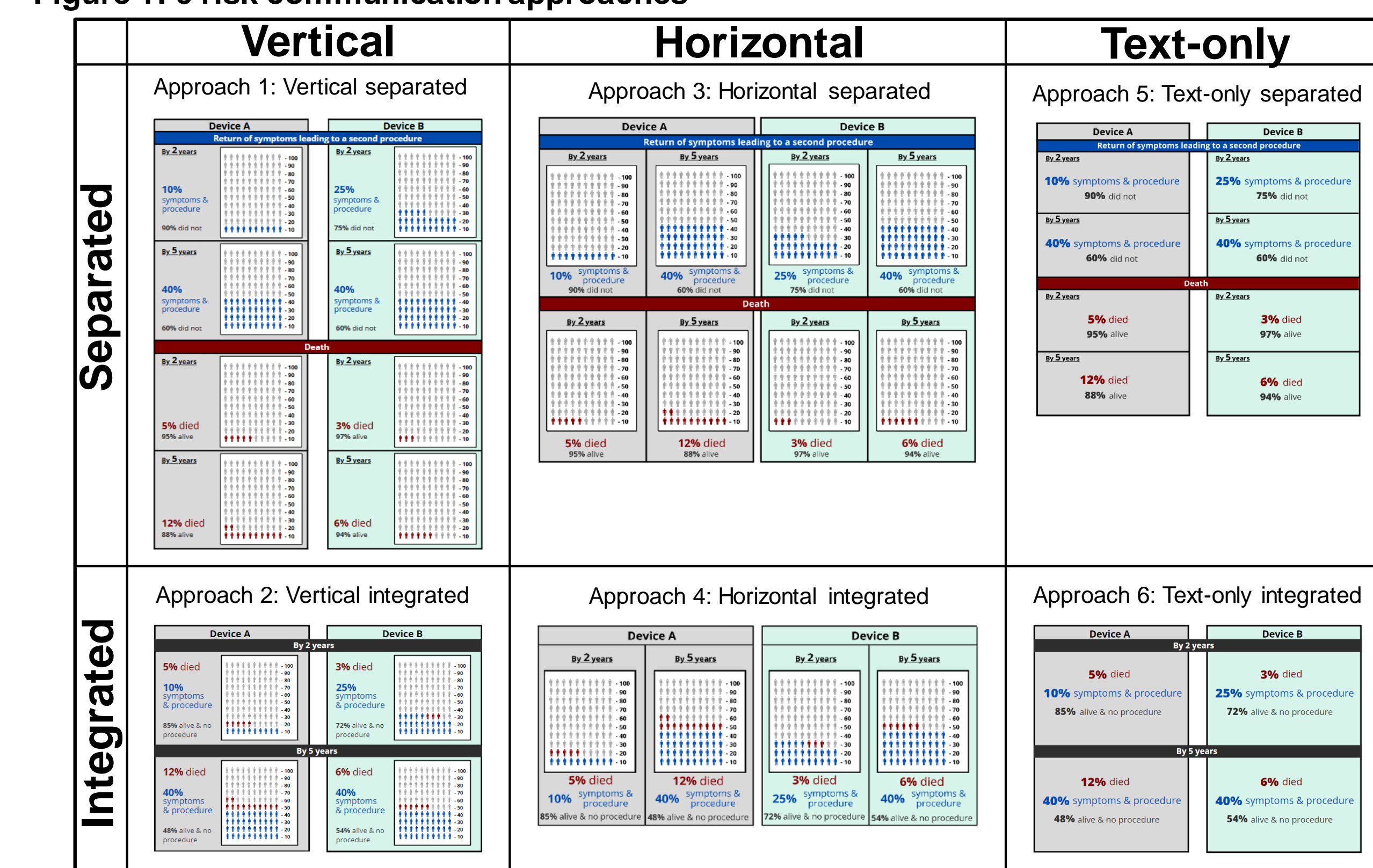
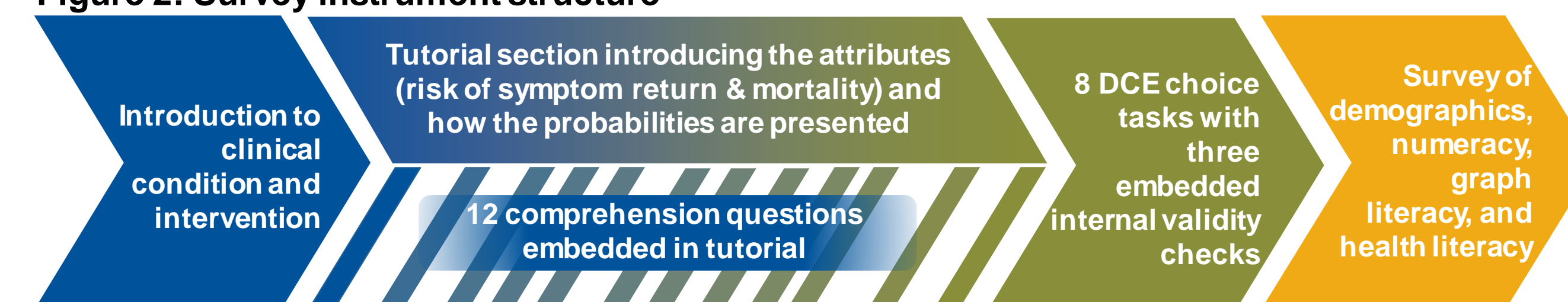


Figure 2: Survey instrument structure



## Methods 2

### Outcomes:

- Correct responses to the 12 comprehension questions
- Performance on three internal validity tests in the DCE

### Covariates:

- Sociodemographic characteristics
- Health literacy (Chew's 3-item),<sup>4</sup> objective numeracy (Berlin Numeracy Test),<sup>5</sup> subjective numeracy (Subjective Numeracy Scale),<sup>6</sup> and graph literacy (Short Graph Literacy Scale)<sup>7</sup>

### Recruitment:

- The target sample size: n~2,400 (400 respondents per approach) recruited by Dynata (Shelton, CT), a survey research company
- Inclusion criteria: age 40-75, living in the US, able to read English, and able to complete survey on a tablet or computer

### Analysis:

- Chi-square** and **ANOVA** to compare categorical variables and continuous variables across approaches.
- Linear regression** to model the **number of comprehension questions** as a function of integrated versus separated risk information, use versus absence of icon arrays, horizontal versus vertical layouts, numeracy, graph literacy, and health literacy.
- Logistic regression** to model **performance on internal validity tests in DCE** as a function of numeracy, graph literacy, health literacy, and risk-communication features.

## Results 1

- 2,242 respondents: 54.6% female; 21.9% Black
- Roughly half had at least a 4-year college degree (49.9%) and half had less formal education (50.1%).
- Demographic characteristics were similar across the six risk-communication approaches, but subjective numeracy scores differed (Table 1).

Table 1: Numeracy, graph literacy, and health literacy across 6 risk-communication approaches

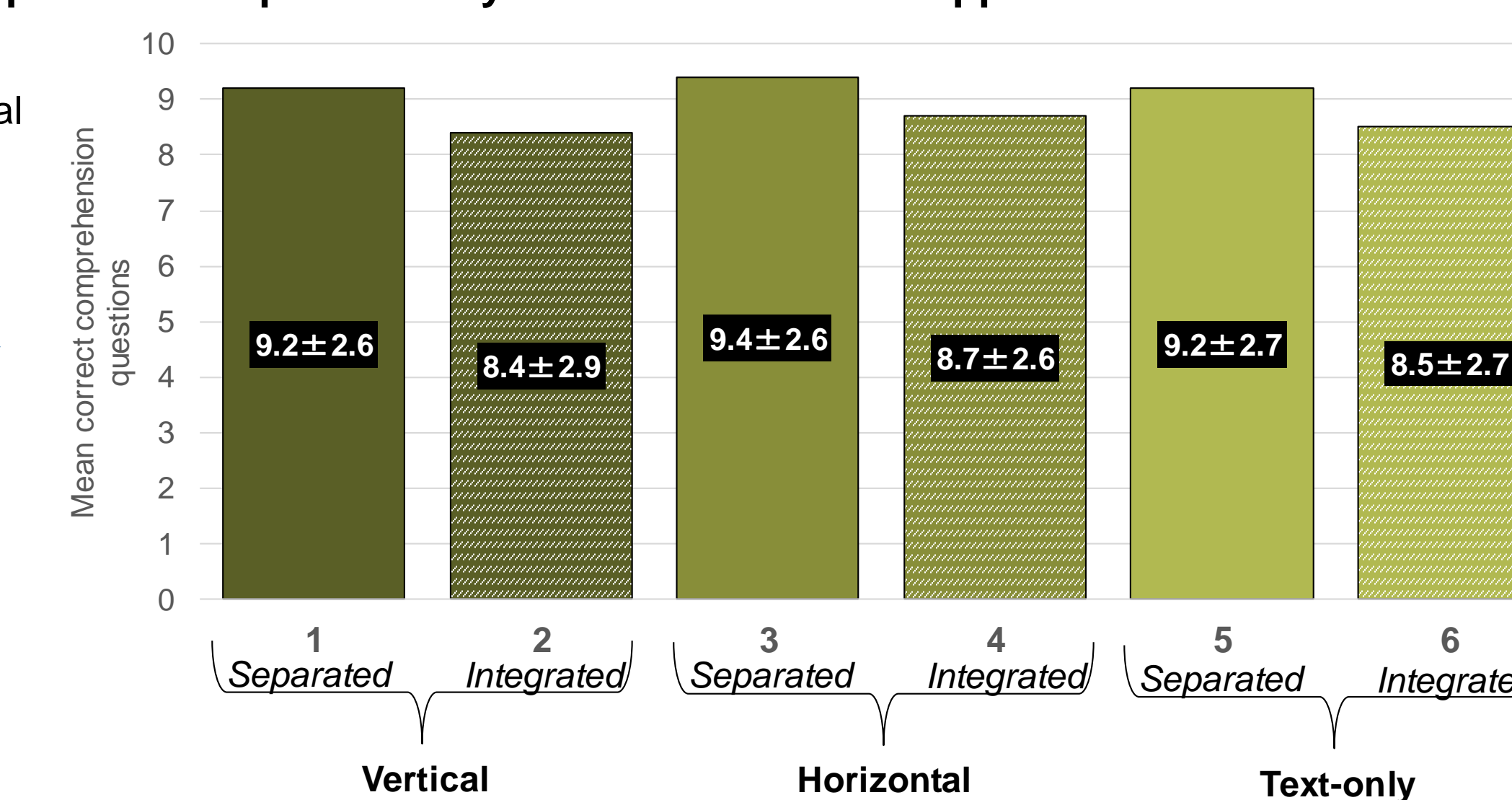
Characteristic	Approach 1 N=400 (%)	Approach 2 N=368 (%)	Approach 3 N=373 (%)	Approach 4 N=366 (%)	Approach 5 N=367 (%)	Approach 6 N=368 (%)	p value
<b>Subjective numeracy – mean (SD)</b>	4.4 (1.1)	4.3 (1.2)	4.5 (1.0)	4.3 (1.1)	4.5 (1.0)	4.3 (1.1)	0.004
<b>Objective numeracy score</b>							0.462
<b>1 (lowest)</b>	223 (55.8)	223 (60.6)	211 (56.6)	210 (57.4)	194 (52.9)	212 (57.6)	
<b>2</b>	122 (30.5)	88 (23.9)	107 (28.7)	107 (29.2)	111 (30.3)	106 (28.8)	
<b>3</b>	31 (7.8)	35 (9.5)	26 (7.0)	30 (8.2)	43 (11.7)	30 (8.2)	
<b>4 (highest)</b>	24 (6.0)	22 (6.0)	29 (7.8)	19 (5.2)	19 (5.2)	20 (5.4)	
<b>Graph literacy score</b>							0.201
<b>0 (lowest)</b>	40 (10.0)	55 (15.0)	32 (8.6)	32 (8.7)	33 (9.0)	37 (10.1)	
<b>1</b>	91 (22.8)	70 (19.0)	80 (21.5)	85 (23.2)	79 (21.5)	84 (22.8)	
<b>2</b>	131 (32.8)	140 (38.0)	124 (33.2)	121 (33.1)	124 (33.8)	123 (33.4)	
<b>3</b>	126 (31.5)	99 (26.9)	126 (33.8)	121 (33.1)	123 (33.5)	120 (32.6)	
<b>4 (highest)</b>	12 (3.0)	4 (1.1)	11 (3.0)	7 (1.9)	8 (2.2)	4 (1.1)	
<b>Health literacy problems</b>	53 (13.2)	45 (12.2)	54 (14.5)	44 (12.0)	50 (13.6)	47 (12.8)	0.927

### References

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## Results 2

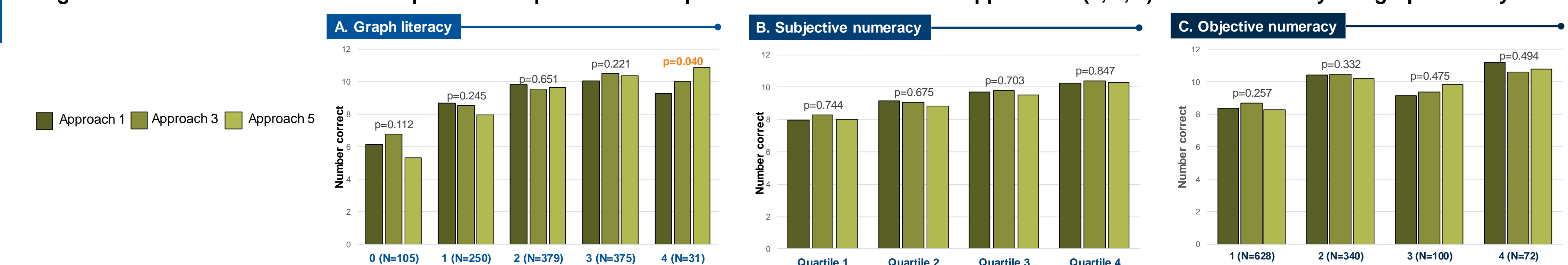
Figure 3: Mean correct number of comprehension questions by risk communication approach



- Respondents randomized to the three approaches in which risks for each medical event were presented **separately performed better** than respondents randomized to the three approaches with **integrated** risk information (**p < 0.001**).
- Horizontal** (versus vertical) and **text-only** (versus icon arrays) risk-communication approaches **did not** lead to significant differences in comprehension question performance (p = ns).
- Graph literacy, subjective numeracy, objective numeracy, and health literacy were all also significantly associated with correct responses to comprehension questions (all p < 0.001).

- The percentages of respondents passing all three internal-validity checks **did not differ significantly** across the six risk-communication approaches (range 25.3 - 29.3%, p = 0.70).
- Logistic regression showed that **the only significant predictors of internal-validity check performance were number of comprehension questions correct** (aOR 1.11 per question, 95% CI 1.06-1.16, p < 0.001) and **subjective numeracy score** (aOR 1.22, 95%CI 1.10-1.36, p < 0.001).

Figure 4: Mean correct number of comprehension questions for separated risk-communication approaches (1, 3, 5) across numeracy and graph literacy levels



- Multivariable regression showed that when comparing the vertically aligned formats with and without icon arrays (approach 1 vs. approach 5), **the difference between respondents with lower graph literacy (score 0) and respondents with higher graph literacy (scores 3 or 4) was significantly greater for approach 5 (vs. 1)** (p = 0.041 and p = 0.004, respectively).

## Conclusions

- Our work can inform decisions about how to convey multiple probabilistic attributes in DCE choice tasks in ways that may elicit higher quality preference data.**
- Integrated** risk information in a DCE context was associated with **fewer correct responses** to questions about the risks being portrayed.
- Horizontal versus vertical and text-only versus icon array risk-communication approaches did **not** lead to worse performance on comprehension questions.
- However, **performance on comprehension questions was more strongly affected by graph literacy among respondents who received the text-only format.**
- Performance on comprehension questions** was one of only two variables **significantly associated with correct completion of internal-validity checks**, suggesting that comprehension questions embedded in the tutorial sections of DCEs may also help to illuminate the quality of choice data.
- This study has informed how we have designed the DCE choice-task formats for our upcoming investigation of PAD patient preferences surrounding revascularization devices, but it **does also have limitations:**

- Though we based our choice of risk-communication approaches on prior literature, it is possible that other, more effective approaches exist
- Pretesting was limited to 3 PAD patients

These findings suggest that **separated** horizontal, vertical, (or text-only, depending on target population) arrays can be used when appropriate or convenient in a particular context without undue concern.