


RTI(h)(s) RTI HEALTH SOLUTIONS



How Much Does Size Matter?
An Evidence-Based Approach to
Sample-Size Decisions in Choice-Format
Conjoint Studies

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Workshop Overview

1. Introduction
2. Review published CA studies
3. Simulation and meta-regression for 31 studies
4. Discussion of audience preference data on study design/precision tradeoffs

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What is the right sample size?
~~How big does the sample need to be?~~

- **How big is your budget?**
- **Potential sources of error**
 - Measurement Error
 - Poor attribute definitions
 - Innumeracy
 - Inattention
 - Cognitive burden and fatigue
 - Modeling error
 - Sampling error
 - Statistical error (experimental design)

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The Right Sample Size

- **Elicitation format**
- **Complexity of survey**
- **Need for subsample analysis**
- **Desired precision**

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Rules of Thumb

- **Hensher:** minimum of 50 subjects choose given alternative
Unlabeled choice probabilities set to 75%/25% → n=200
- **Orme:** number of observations available to estimate each parameter ≥ 250

Number of Choice Alternatives =	2		$\frac{n \times \# \text{ tasks}}{\text{max } \# \text{ levels}} \geq 250$					
Number of task repetitions =	5	6	7	8	9	10	11	12
Max number of levels for any one attribute =	Number of Respondents >=							
2	100	83	71	63	56	50	45	42
3	150	125	107	94	83	75	68	63
4	200	167	143	125	111	100	91	83
5	250	208	179	156	139	125	114	104
6	300	250	214	188	167	150	136	125

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Three Important Study-Design Decisions

- **Number of attributes**
 - More attributes provide more information on endpoint preferences
 - BUT: more attributes increase complexity and encourage simplifying heuristics
- **Number of attributes with probabilities for levels**
 - Probabilistic endpoints are realistic
 - BUT: Numeracy levels are low and encourages recoding probabilities to qualitative labels
- **Number of levels for each attribute**
 - More levels provide more preference detail about preferences and better correspondences to trial data
 - BUT: Requires estimating more parameters with same sample size

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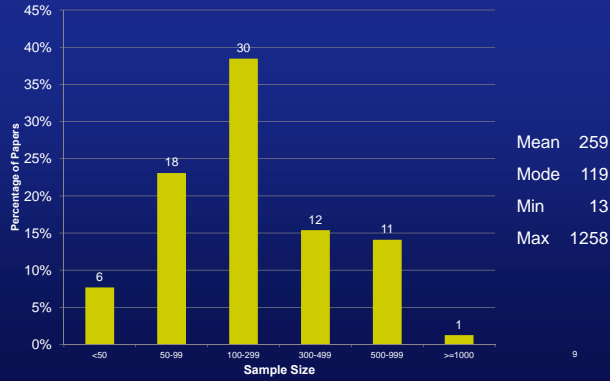
LITERATURE REVIEW



- English-language publications, 2005 through July 2008
- Informed by the process of developing ISPOR checklist for Good Research Practice in Conjoint Analysis
- Quantifies current practices and identifies degree of consensus among researchers

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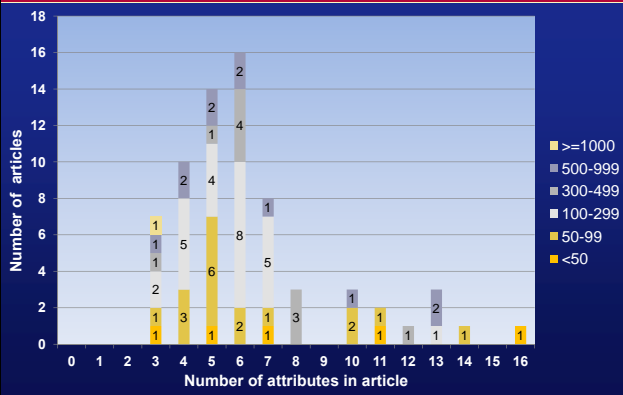
Sample Size (n=78)



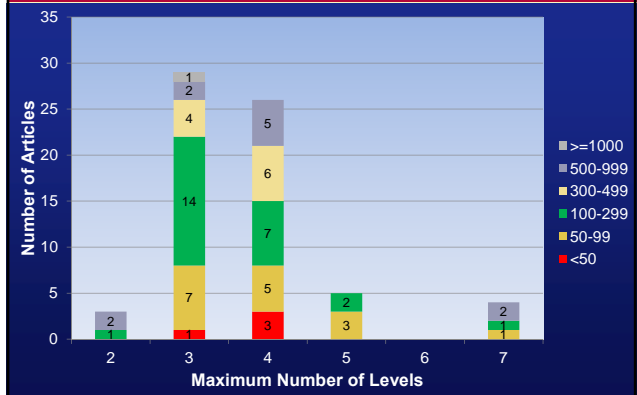
Key Survey Design Characteristics

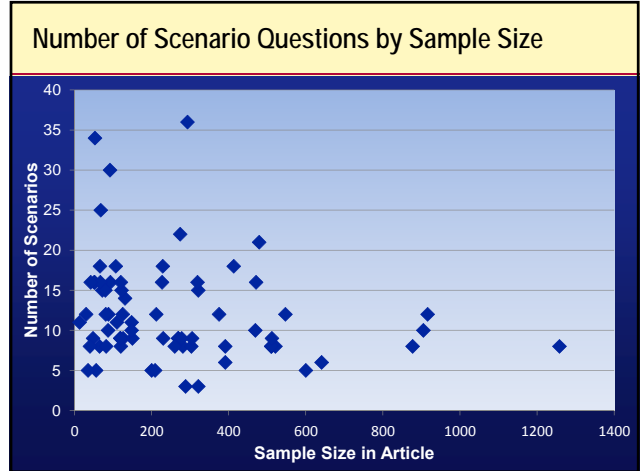
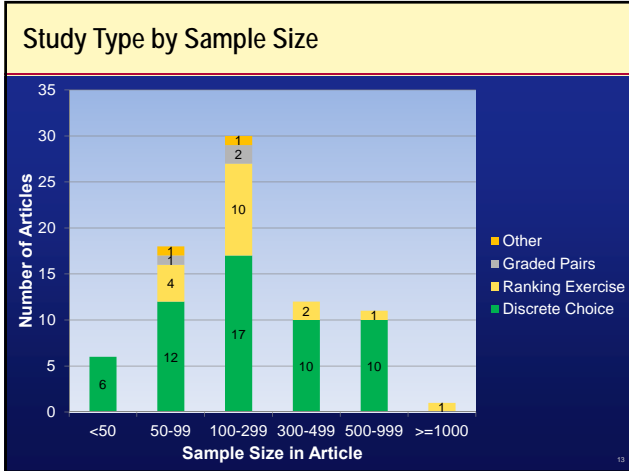
	Sample size	# of attributes	Max # of levels	# of scenarios
Mean	259	6	4	12
Median	192	6	4	10
Mode	119	6	3	8
Min	13	3	2	3
Max	1258	16	6	36
N	78	69	67	73

Number of Attributes by Sample Size



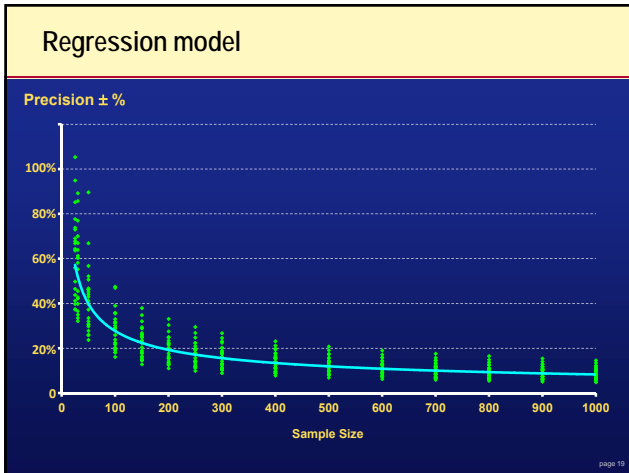
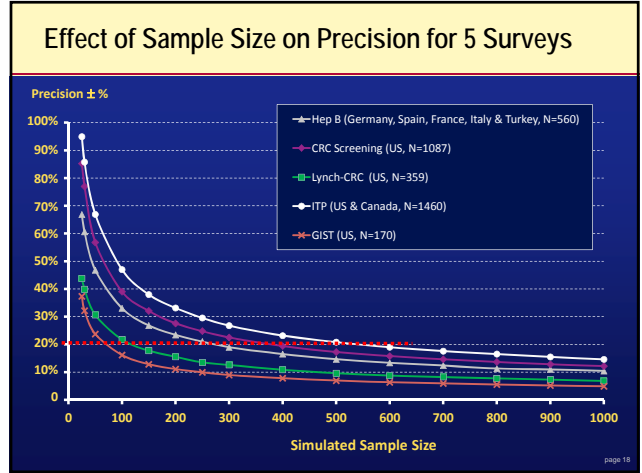
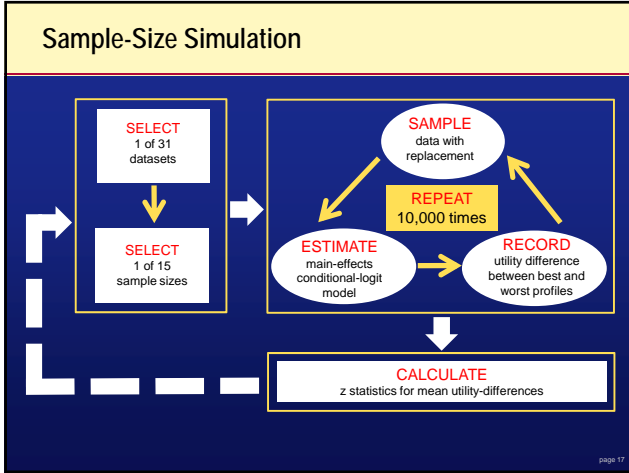
Maximum Number of Levels by Sample Size





DATA SIMULATION AND META REGRESSION

- ### Data and Analysis
- **Insufficient independent variation in published studies**
 - **RTI data**
 - 31 studies with similar “look and feel”
 - But sample sizes confounded with particular study features
 - **Analysis**
 - Simulate variable sample sizes by resampling with replacement from each study dataset
 - Regress normalized measure of precision on study characteristics and simulated sample sizes



Model Specification

$$\text{Precision} = \beta_{\text{const}} + \beta_1 \frac{1}{\sqrt{N}}$$

$$+ (\beta_2 + \beta_{13} \cdot N) \text{NTASK}_{-8} + (\beta_3 + \beta_{14} \cdot N) \text{NTASK}_{-8} + (\beta_4 + \beta_{15} \cdot N) \text{NTASK}_{-8}$$

$$+ (\beta_5 + \beta_{16} \cdot N) \text{MAXLEV}_{-4} + (\beta_6 + \beta_{17} \cdot N) \text{MAXLEV}_{-4} + (\beta_7 + \beta_{18} \cdot N) \text{MAXLEV}_{-4}$$

$$+ \beta_9 \text{NATTRIB}_{-6} + \beta_{10} \text{NATTRIB}_{-6}$$

$$+ \beta_{11} \text{OPTOUT}$$

$$+ \beta_{11} \text{NUMPROBAB}$$

$$+ \beta_{12} \text{PATIENTGRP}$$

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STUDY DESIGN PREFERENCES

Study-Design/Precision Tradeoff Question

Question 1

		Study A	Study B
Study Characteristics	Total Number of Attributes	5	10
	Number of Probabilistic Attributes	2	4
	Number of levels per attribute	5	2
Precision of Preference Estimates		± 15%	± 25%
Which study design do you think is better?			

Tradeoff Survey Experimental Design and Analysis

- 3 Attributes
- 2 levels for each attribute
- Orthogonal array in 4 rows for alternative A
- Attribute-level foldover for alternative B
- Each respondent evaluated the full experimental design
- 16 possible combinations of A and B choices with corresponding main-effects relative importance weights

Preferences and Precision Costs

PLEASE SEE NOTES FOR THIS SLIDE!

	Preference Weights (B-B-B-B)	Precision Model Coefficients
Total Number of Attributes	14.3	-0.018
Number Probabilistic Attributes	15.3	-0.039
Number of Levels	8.8	-0.035

	Relative Importance	Relative Precision Price	Decision
$\Delta\text{NATTR}/\Delta\text{NPROB}$	0.9	0.5	Max total attributes No probabilistic
$\Delta\text{NATTR}/\Delta\text{NLEV}$	1.6	0.5	Max total attributes Minimize levels (=2)

Trade-off Survey Results ADD NUMBER OF RESPONDENTS FOR EACH CASE AND DELETE ZERO ROWS

Choice Pattern	Preferred Study Design			Number of Respondents
	Total Attrib	Probab Attrib	Levels	
A A A A	12	0	2	[to be added]
A A A B	?	?	?	
A A B A	5	0	2	
A A B B	5	0	5	
A B A A	5	5	2	
A B A B	5	0	5	
A B B A	5	0	5	
A B B B	5	0	5	
B A A A	12	0	2	
B A A B	12	5	2	
B A B A	5	5	2	
B A B B	5	5	2	
B B A A	12	0	2	
B B A B	12	0	2	
B B B A	?	?	?	
B B B B	12	0	2	

X's Preferences X X X X [Move X's into response boxes]

Question 1

	Study A	Study B
Total Number of Attributes	8	10
Number of Probabilistic Attributes	2	4
Number of levels per attribute	3	2
Precision of Preference Estimates	± 18%	± 23%
Which study design do you think is better?		

Question 2

	Study A	Study B
Total Number of Attributes	8	10
Number of Probabilistic Attributes	4	2
Number of levels per attribute	2	5
Precision of Preference Estimates	± 18%	± 23%
Which study design do you think is better?		

Question 3

	Study A	Study B
Total Number of Attributes	10	8
Number of Probabilistic Attributes	2	4
Number of levels per attribute	2	5
Precision of Preference Estimates	± 23%	± 20%
Which study design do you think is better?		

Question 4

	Study A	Study B
Total Number of Attributes	9	10
Number of Probabilistic Attributes	2	4
Number of levels per attribute	2	3
Precision of Preference Estimates	± 20%	± 20%
Which study design do you think is better?		

Y's Preferences X X X X

Question 1

	Study A	Study B
Total Number of Attributes	8	10
Number of Probabilistic Attributes	2	4
Number of levels per attribute	3	2
Precision of Preference Estimates	± 18%	± 23%
Which study design do you think is better?		

Question 2

	Study A	Study B
Total Number of Attributes	8	10
Number of Probabilistic Attributes	4	2
Number of levels per attribute	2	5
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Which study design do you think is better?		

Question 3

	Study A	Study B
Total Number of Attributes	10	8
Number of Probabilistic Attributes	2	4
Number of levels per attribute	2	5
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Which study design do you think is better?		

Question 4

	Study A	Study B
Total Number of Attributes	9	10
Number of Probabilistic Attributes	2	4
Number of levels per attribute	2	3
Precision of Preference Estimates	± 20%	± 20%
Which study design do you think is better?		

Trade-off Survey Estimates HIDDEN

CHOICE PATTERN	N ATTRIB Weight	N PROBAB Weight	N LEVELS Weight
A A A A	-3.9	-11.0	-5.2
A A A B	0.0	0.0	0.0
A A B A	-2.8	0.0	-0.1
A A B B	-5.1	16.0	6.5
A B A A	0.3	-7.5	-0.2
A B A B	2.6	-6.5	4.2
A B B A	-5.1	-15.5	6.3
A B B B	1.1	0.4	6.5
B A A A	0.5	0.3	-5.4
B A A B	2.7	6.8	-4.3
B A B A	-4.9	15.5	-6.7
B A B B	0.2	7.3	-0.1
B B A A	2.9	-6.4	-4.9
B B A B	2.8	0.1	-0.2
B B B A	0.0	0.0	0.0
B B B B	2.9	7.6	4.4