



2.4 Robert Groves: Survey Budgets, Cost Models, and Responsive Design Surveys

<p style="text-align: center;">Survey Budgets, Cost Models, and Responsive Design Surveys</p> <p style="text-align: center;">Robert M. Groves University of Michigan and Joint Program in Survey Methodology</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div>	<p style="text-align: center;">Focus of my Remarks</p> <ul style="list-style-type: none"> • Cross-section studies • Household populations • Interviewer-administered face-to-face surveys
<p style="text-align: center;">Outline</p> <ol style="list-style-type: none"> 1. Why is there such a sparse literature on survey costs? 2. A detour: Responsive Survey Designs 3. Observations and examples about survey costs 4. Towards a research agenda on survey costs 	<p style="text-align: center;">1. Why is there such a sparse literature on survey costs?</p> <ul style="list-style-type: none"> • What exists: <ul style="list-style-type: none"> – sample design optimization models (Neyman allocation) – project management tools (cost-to-complete analysis) – <i>Reducing the Costs of Surveys</i>, Sudman (1967) – costs of reducing nonresponse (e.g., incentive experiments) – two phase samples for nonresponse reduction • Barriers to a Rich Literature <ul style="list-style-type: none"> – sample design as a statistical problem versus field design as a management problem <ul style="list-style-type: none"> • field effort has escaped attention of design statisticians – quantitative decision-making versus professional expertise <ul style="list-style-type: none"> • our knowledge is not well-quantified – paradata needs for cost efficiency modeling versus focus on interview data <ul style="list-style-type: none"> • development and use of paradata is at its infancy
<ul style="list-style-type: none"> • In short, there are <ul style="list-style-type: none"> – production process model gaps – cost data gaps – organizational culture gaps 	<p style="text-align: center;">Outline</p> <ol style="list-style-type: none"> 1. Why is there such a sparse literature on survey costs? 2. A detour: Responsive Survey Designs 3. Observations and examples about survey costs 4. Towards a research agenda on survey costs
<p style="text-align: center;">Definition: Responsive Design</p> <p>Survey designs that:</p> <ol style="list-style-type: none"> 1. Preidentify a set of alternative features potentially affecting costs and errors of statistics 2. Identify a set of indicators of the cost and error properties of those feature 3. Monitor indicators in initial stages of data collection 4. Alter the active features of the survey based on cost/error tradeoff decision rules 5. Combine data from separate phases into a single estimator 	<p style="text-align: center;">An Illustrative Responsive Design Lifecycle</p> <div style="text-align: center;"> <p>Phase 1 (subsample)</p> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Design Option 1</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Design Option 2</div> <div style="text-align: center;">•</div> <div style="text-align: center;">•</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Design Option n</div> <div style="border: 1px solid black; padding: 2px; margin-top: 10px; width: 100%;">Cost Modeling</div> <div style="border: 1px solid black; padding: 2px; margin-top: 2px; width: 100%;">Para Data Assessment</div> <div style="border: 1px solid black; padding: 2px; margin-top: 2px; width: 100%;">Real-Time Estimation of Key Survey Statistics</div> </div>

Phase 1
(subsample)

Decision

Phase 2
(full sample)

Design Option 1

Design Option 2

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•

Design Option S

•

Design Option n

Cost Modeling

Para Data Assessment

Real-Time Estimation of Key Survey Statistics

Phase 1
(subsample)

Decision

Phase 2
(full sample)

Decision

Phase 3
(subsample)

Design Option 1

Design Option 2

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Design Option S

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Design Option n

Design Option T

Cost Modeling

Para Data Assessment

Real-Time Estimation of Key Survey Statistics

Definition: Design Phase

A design phase is a period of data collection during which the same set of sampling frame, mode of data collection, sample design, recruitment protocols, and measurement conditions are extant.

Definition: Complementary Design Features

Complementary design features are those that, when combined offer minimum error properties among a set of features

- they may be recruitment features that are attractive to different parts of the target population
- they may be measurement features or mode choices that best fit different statistics

Responsive Design from an Estimator's Viewpoint

Let

$$\hat{y} = \frac{\sum_{i=1}^n (\pi_i r_i)^{-1} y_i}{\sum_{i=1}^n (\pi_i r_i)^{-1}},$$

where π_i is fixed by sample design, and r_i is the cumulative probability of response over phases.

Further,

$$r_i = f(I_{d_k}, r_{d_k}), \text{ for all } k$$

where I_{d_k} is an indicator of using method d for the i -th unit on the k -th phase of the survey; and r_{d_k} is the response propensity for the i -th unit exposed to the method d at the k -th phase

and

$$C_i, \text{ the cost of the } i\text{-th unit} = f(I_{d_k}, d_{ik}), \text{ for all } k$$

Outline

1. Why is there such a sparse literature on survey costs?

2. A detour: Responsive Survey Designs

3. Observations and examples about survey costs

4. Towards a research agenda on survey costs

Some Premises

• Real costs are often poorly known at design time

• Most current attention to costs is driven by uncertain difficulty of

- contacting sample unit
- gaining cooperation of sample unit
- interviewer variation in efficiency

not necessarily

- sample strata cost differences

3.1. Survey Budgets Tend to Have Unsuitable Structures

Category/Tasks	Units/dollars	Percentage
1. Sampling		10.1%
2. Questionnaire development		--
3. Pretesting		1.3
4. Interviewer training		11.2
5. Materials		4.3
6. Central office operations staff		4.9
7. Field salaries		38.0
8. Field travel		19.8
9. Communications		7.0
10. Editing/Processing		2.3
11. Analysis		0.9

A Continuous Production Model is Needed

• Inputs

- interviewer hours
 - administrative time
 - technical help time
 - travel time
 - call attempts without contact
- contacts without interviews
- contacts with interviews

• Outputs

- eligibility determination
- contacts with sample units
- resolved noninterview cases
- interview data

Needed Survey Cost Components

- We need to track cost of inputs that are related to outputs
 - many times these are not identical to the categories in a typical survey budget
- We need to link outputs to quality components

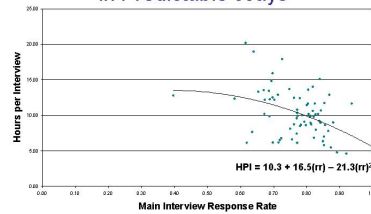
Percentages of Time Spent Interviewing, Traveling, and in Other Tasks by Organization, (Sudman, *Reducing the Costs of Surveys*, Table 6.6)

Organization	Interviewing	Traveling	Other	Total
NORC- (Probability)	34	40	26	100
NORC (block-quota)	40	32	28	100
Census	26	24	50	100
CPS	31	49	20	100
Survey Research Center	28	37	35	100

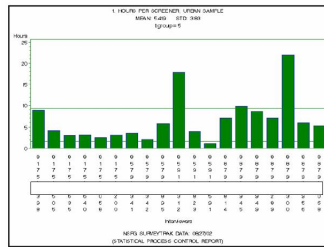
3.2. Cost Components often vary greatly across production units

- With surveys having high response rate targets, missing data are more expensive than reported data
 - callback costs exceed most interviewing costs
- Variation in response propensities (across PSU's and interviewers) is a large source of cost variation

Response Rates and Costs Co-vary in Predictable Ways



Interviewers Vary in Productivities



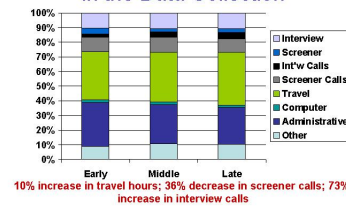
3.3. Knowing Components are Key to Responsive Design Features

- Managers/Designers face decisions about allocation of effort
- Without knowing the linkage between alternative efforts on outputs, they are ineffective
- Responsive design attempts to quantify the costs and estimate sensitivities to guide those decisions

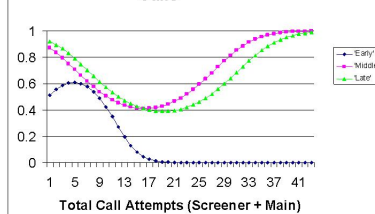
3.4 Cost Components Vary over the Lifecycle of a Data Collection Period

- Four common nested steps of measurement of a sample unit
 - determination of unit eligibility
 - contact with unit
 - screening for person-level eligibility
 - cooperation for main interview
- Each of these steps requires time and effort to attain

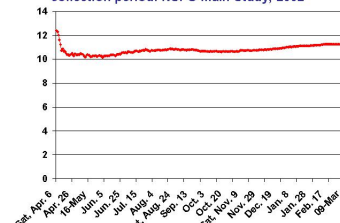
Distribution of Interviewer Hours Per Day by Activity at Three Points in the Data Collection



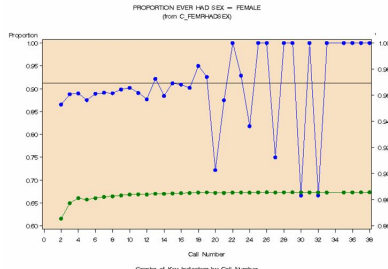
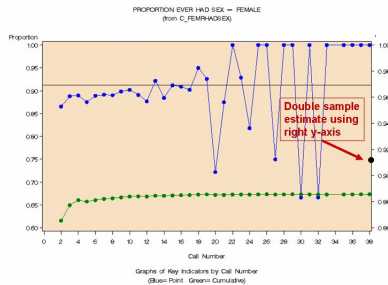


Estimated Pr(Main Interview) by Total Calls



Cumulative ratio of interviewer hours to number of main interviews completed by day of the data collection period: NSFG Main Study, 2002



<h3>3.4. Propensity Models are Key to Responsive Designs</h3> <ul style="list-style-type: none"> They are a key linkage between inputs and outputs of data collection 	<h3>Paradata Structures</h3> <p>Interviewer: Tenure Pre-study obs. Training grades ... Historical Resp.Rate</p> <p>Segment: PSU Characteristics Stratum ... Segment Obs</p> <p>Address: Pr(sell) Observ. data Tot calls 1st cont call ... Status</p> <p>Calls for Screener: 1 Fer Time Date Informant Behavior Outcome 2 Fer Time Date Informant Behavior Outcome ... n Fer Time Date Informant Behavior Outcome</p> <p>Household: Composition Informant Behavior Sample Resp. Char.</p> <p>Calls for Main: 1 Fer Time Date Informant Behavior Outcome 2 Fer Time Date Informant Behavior Outcome</p>
<h3>Paradata Structures</h3> <p>Interviewer: Tenure Pre-study obs. Training grades ... Historical Resp.Rate</p> <p>Segment: PSU Characteristics Stratum ... Segment Obs</p> <p>Address: Pr(sell) Observ. data Tot calls 1st cont call ... Status</p> <p>Calls for Screener: 1 Fer Time Date Informant Behavior Outcome 2 Fer Time Date Informant Behavior Outcome ... n Fer Time Date Informant Behavior Outcome</p> <p>Household: Composition Informant Behavior Sample Resp. Char.</p> <p>Calls for Main: 1 Fer Time Date Informant Behavior Outcome 2 Fer Time Date Informant Behavior Outcome</p>	<h3>3.5. Phase Designs Are Based on Forecast Models of Costs and Quality</h3> <ul style="list-style-type: none"> Designer needs to anticipate the moment of phase capacity Dynamic relationships between effort expended and output need to be anticipated
<h3>Predicted vs Actual Interviews by Hours Worked</h3>	<h3>Outline</h3> <ol style="list-style-type: none"> Why is there such a sparse literature on survey costs? A detour: Responsive Survey Designs Observations and examples about survey costs Towards a research agenda on survey costs
<h3>Data Resource Needs</h3> <ul style="list-style-type: none"> Interviewer costs are a large component of variable costs We need real-time disaggregated effort allocation data Much of the data can be computer-generated 	<h3>We are very close to a breakthrough in face-to-face CAPI cost data...</h3> <ul style="list-style-type: none"> With better batteries... <ul style="list-style-type: none"> more comfort in leaving laptops booted up With sample administration software... <ul style="list-style-type: none"> prevalent cost data on calls on cases With GPS components... <ul style="list-style-type: none"> cheap data on segment visits and mileage With broadband access... <ul style="list-style-type: none"> cheap updates to central office
<h3>Research on Cost/Effort Data</h3> <ul style="list-style-type: none"> New data development <ul style="list-style-type: none"> travel costs to segments, between segments time at segment not in contact attempts computer software generation of cost data Estimation of costs to collect cost data Decomposition of sample characteristics and interviewer characteristics for costs Effective partnerships between statistical analysis of costs of field management 	<h3>Statistical Modeling 1</h3> <ul style="list-style-type: none"> Forecasting models are key <p>For example, what respondent counts/distributions will result from different allocations of effort (incentives, callbacks to noncontacts, refusal conversion)?</p>

<h3>Statistical Modeling 2</h3> <ul style="list-style-type: none"> Nonlinearities abound <ul style="list-style-type: none"> thresholds on productivity (phase capacity) <p>For example, when has a phase reached its capacity?</p>	 <p>PROPORTION EVER HAD SEX - FEMALE (from C_FEMRHADSEX)</p> <p>Graphs of Key Indicators by Cell Number (Blue=Point, Green=Cumulative)</p>
<h3>Statistical Modeling 3</h3> <ul style="list-style-type: none"> Identifying threshold efficiency changes associated with recruitment protocols <p>For example, double samples of nonrespondents attracting different types of persons than the first phase</p>	 <p>PROPORTION EVER HAD SEX - FEMALE (from C_FEMRHADSEX)</p> <p>Graphs of Key Indicators by Cell Number (Blue=Point, Green=Cumulative)</p> <p>Double sample estimate using right y-axis</p>
<h3>Outline</h3> <ol style="list-style-type: none"> Why is there such a sparse literature on survey costs? <ul style="list-style-type: none"> research vs. management culture barriers A detour: Responsive Survey Designs <ul style="list-style-type: none"> tool for reacting to realized costs Observations and examples about survey costs <ul style="list-style-type: none"> 3.1 Survey Budgets Tend to Have Unsuitable Structures 3.2 Cost Components often vary greatly across production units 3.3. Knowing Components are Key to Responsive Design Features 3.4. Propensity Models are Key to Responsive Designs 3.5. Phase Designs Are Based on Forecast Models of Costs and Quality Towards a research agenda on survey costs <ul style="list-style-type: none"> 4.1 Data Resources 4.2 Statistical modeling 	<h3>References</h3> <p>Groves, R., and Heeringa, S. (2006) "Responsive Design for Household Surveys: Tools for Actively Controlling Survey Nonresponse and Costs," <i>Journal of the Royal Statistical Society, Series A</i>, forthcoming.</p> <p>Groves, R., Benson, G., Mosher, W., Rosenbaum, J., Granda, P., Axinn, W., Lepkowski, J., Chandra, A. (2005) <i>Plan and Operations of Cycle 6 of the National Survey of Family Growth</i>, National Center for Health Statistics, Vital Health Statistics, 1(42).</p> <p> </p>