Nonresponse Bias in a Dual Frame Sample of Cell and Landline Numbers

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DC-AAPOR Nonresponse Workshop

March 30, 2007
Outline

- Survey Context
- Estimation Theory
- Bias Indicators
- Conclusions
- Future research
Study Design

- Goal of JPSM Survey Practicum was to evaluate the feasibility of surveying cell phones in RDD-type survey.
- Dual frame sample with landline and cell phone number samples (July–Sept. 2004).
- See details on evaluation in current issue of *POQ 2007* (Brick, Brick, Dipko, Presser, Tucker Yuan).
Dual Frame Design

Land sample

Cell sample

Land frame

Cell phone-only households

Landline and cell phone households

Landline-only households

Cell frame
Interview

- Short screener
  - Verify 18+
  - Verify household member (land)
- 10-minute survey:
  - Phone ownership and usage
  - Attitudes toward cell phones
  - Social behaviors
  - Demographics
Response Rates by Frame

- Land:
  - Combined: 34.0%
  - Screener: 38.6%
  - Extended: 88.0%

- Cell:
  - Combined: 22.1%
  - Screener: 26.5%
  - Extended: 83.5%
Overlap Estimators

Land sample

Cell sample

$Y'_{ab}$

$Y''_{ab}$

Landframe

Cellframe

Landline-only households

Landline and cell phone households

Cell phone-only households
Estimation Theory

- Three unbiased estimators of overlap:
  - from cell sample households -- $y'_{ab}$
  - from land sample households -- $y''_{ab}$
  - compositing the two --
    \[ y'_\lambda = y'_a + y'_b + \lambda y'_{ab} + (1 - \lambda) y''_{ab} \]
- Nonresponse adjustment (via weighting classes) made prior to compositing
Estimates of Household Telephone Service by Sample Type

Landline households with cell phones:
- CPS: 52.4%
- Land Sample: 71.0% (1.9%)

Cell phone households with landlines:
- CPS: 88.5% (1.9%)
- Cell Sample: 77.5% (2.0%)
Topic/Salience Bias in Land Sample

- Advance letter and survey introduction:
  ".. research study about new technologies such as cell phones."

- Land sample underestimated landline-only percent, even controlling for covariates

- In addition, more land-only households from refusal conversion (24% land-only vs. 19% land & cell) – consistent with theory
Inaccessibility Bias in Cell Sample

- Inability to access some in Cell sample
  - CPS—31% of households with landline & cell phones receive very few or no calls on cell phones
- Cell sample underestimated percent of households with landlines
- Cell sample estimated 23% of HHs with cell phones are cell phone-only compared to CPS estimate of 11%
Estimation Strategies

- Simple – nonresponse adjusted composite
- Raked – overall to CPS marginals by status
- Separate – rake each sample then composite
- Service – full CPS status controls
- RDD – Land sample only
## Estimated Difference from CPS

<table>
<thead>
<tr>
<th>Telephone service</th>
<th>Difference from CPS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple</td>
</tr>
<tr>
<td>Cell &amp; Land</td>
<td>9.1%</td>
</tr>
<tr>
<td>Land-only</td>
<td>-16.9</td>
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<tr>
<td>Cell-only</td>
<td>7.8</td>
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</tbody>
</table>
Comparison to Other CPS Estimates

- No estimation strategy produced estimates that were consistently closer to the CPS estimates.
- Separate composite estimator performed worse than the others.
- RDD estimates had biases no larger than those from any other scheme, despite its noncoverage.
Discussion

- Nonresponse bias due to topic salience and household inaccessibility
  - Topic bias can be reduced
  - Accessibility bias more problematic since infrequent cell users difficult to reach
- Weighting was ineffective in reducing bias.
  - Controls by type of service unlikely to reduce some biases.
Design Options

- Need better auxiliary data for weighting
  - National totals by type of service AND usage are needed
- Use different design to sample cell phones (screen and only survey cell-only households)
  - “Inefficient” design but better if it reduces biases.
Future Research Topics

**Telephone Survey Topics**
- Cell sample in CHIS 2005
- Nonresponse follow-up in RDD surveys.

**Nonresponse Bias Topics**
- Better understanding of response propensity in a survey setting.
- Combine models of response propensity and models of amenability & accessibility to develop practical and useful bounds on nonresponse bias.