

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

**Brick, Dipko, Presser, Tucker, Yuan**

**DC-AAPOR Nonresponse Workshop**

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# Outline

- **Survey Context**
- **Estimation Theory**
- **Bias Indicators**
- **Conclusions**
- **Future research**

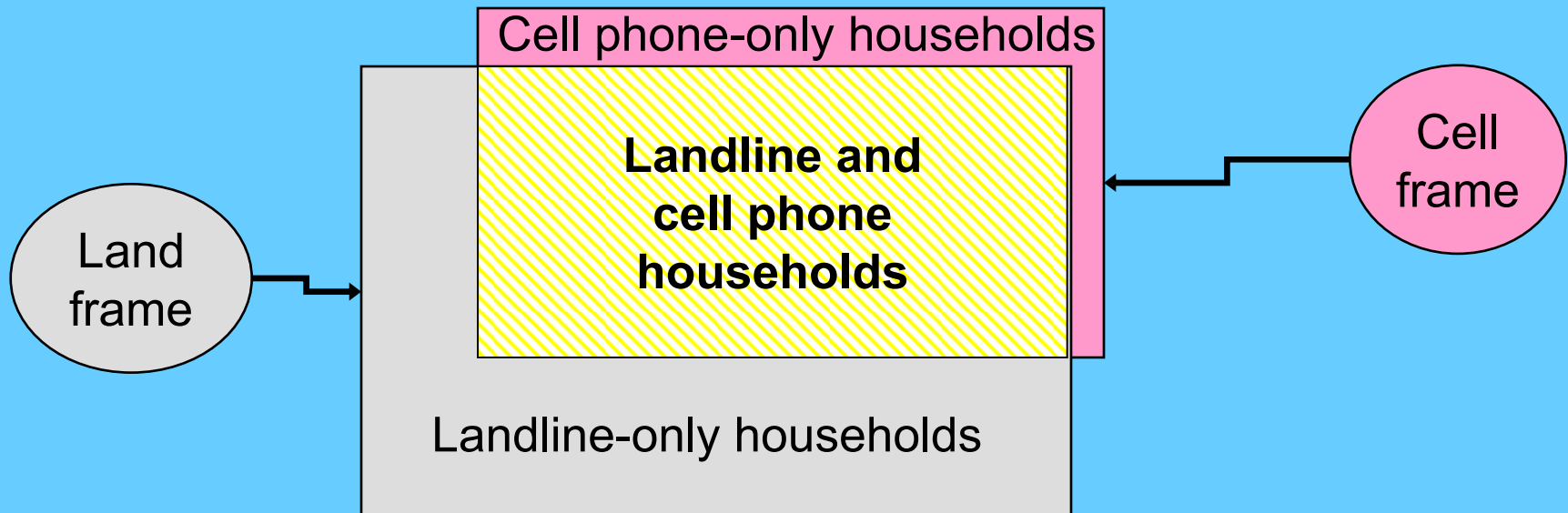
# Study Design

- **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

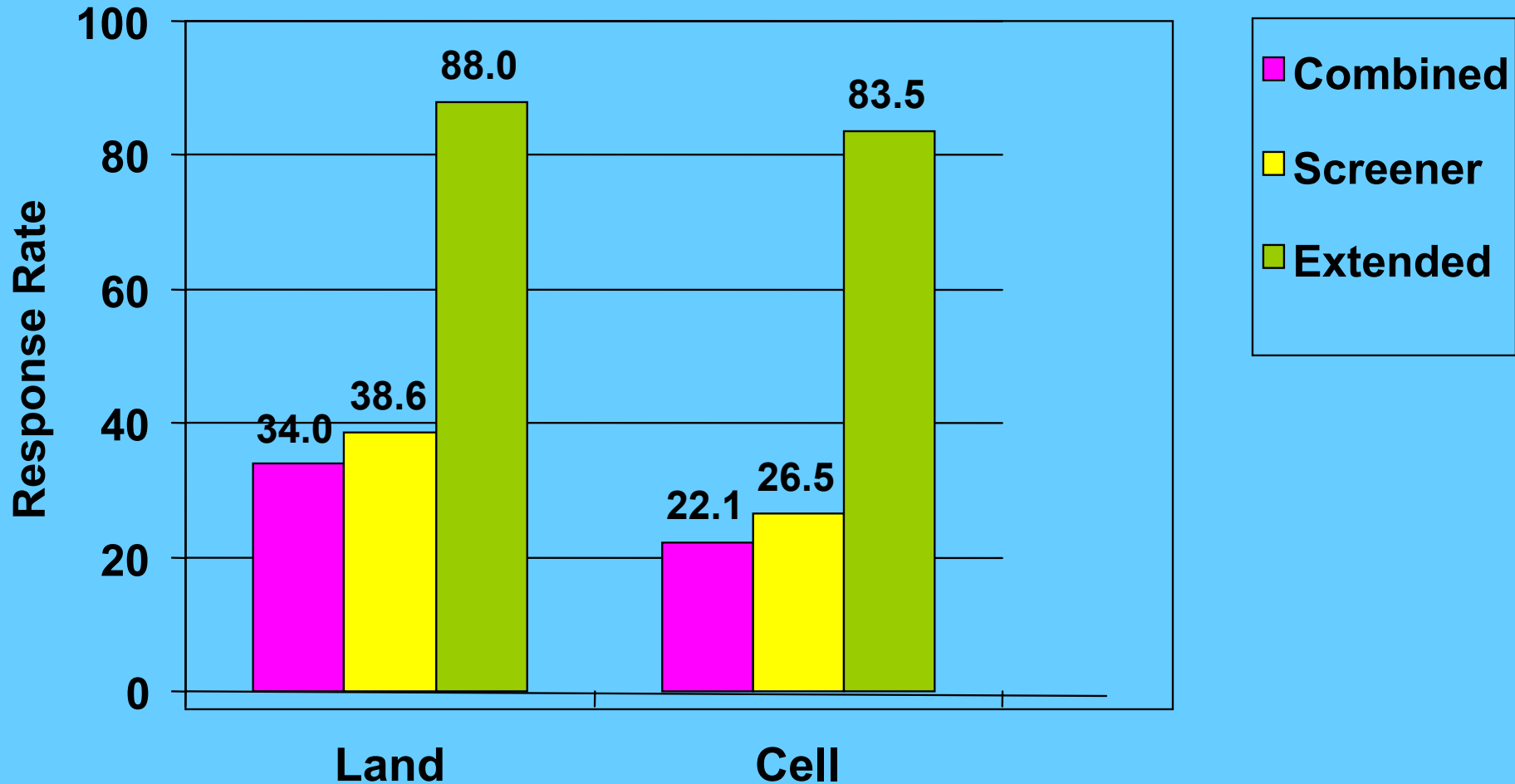
Cell sample



# Interview

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

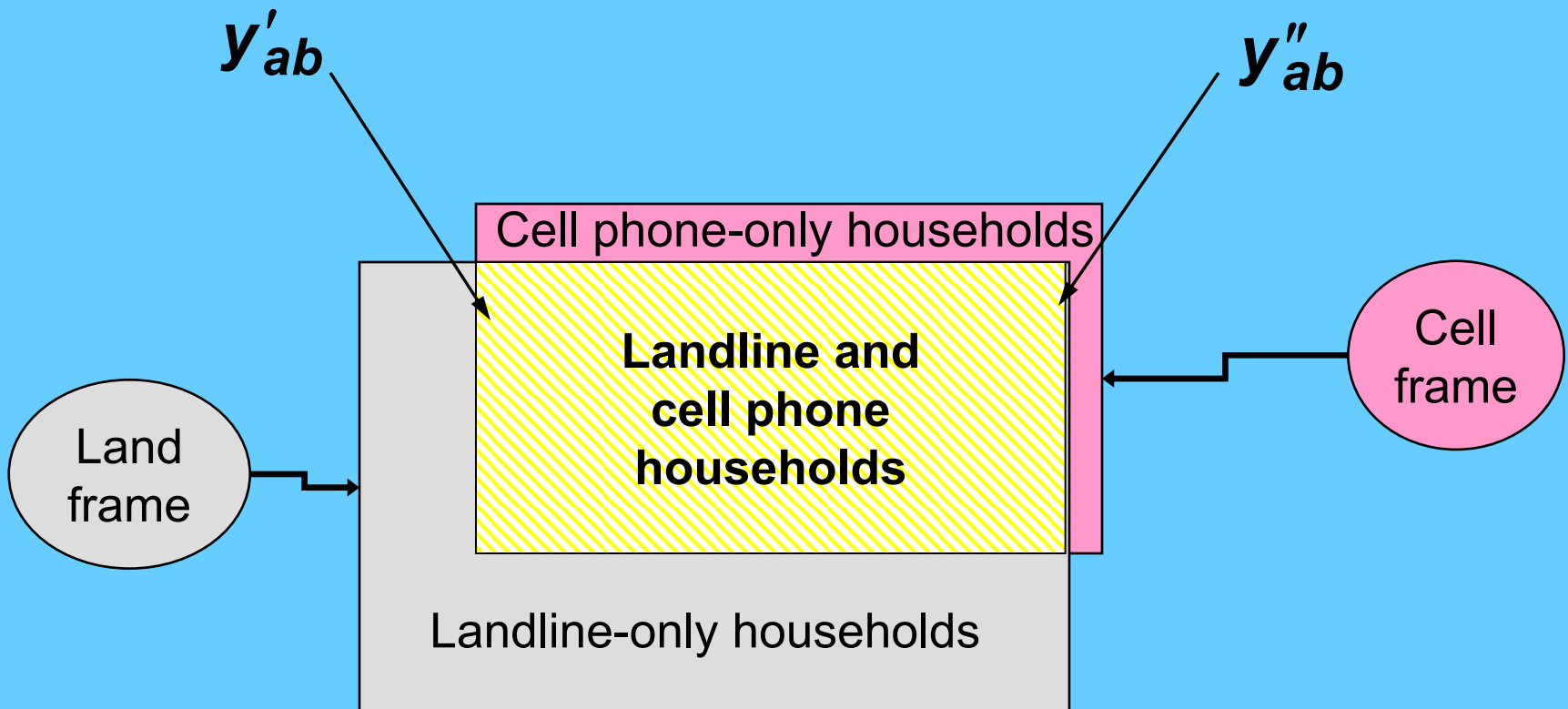
# Response Rates by Frame



# Overlap Estimators

Land sample

Cell sample



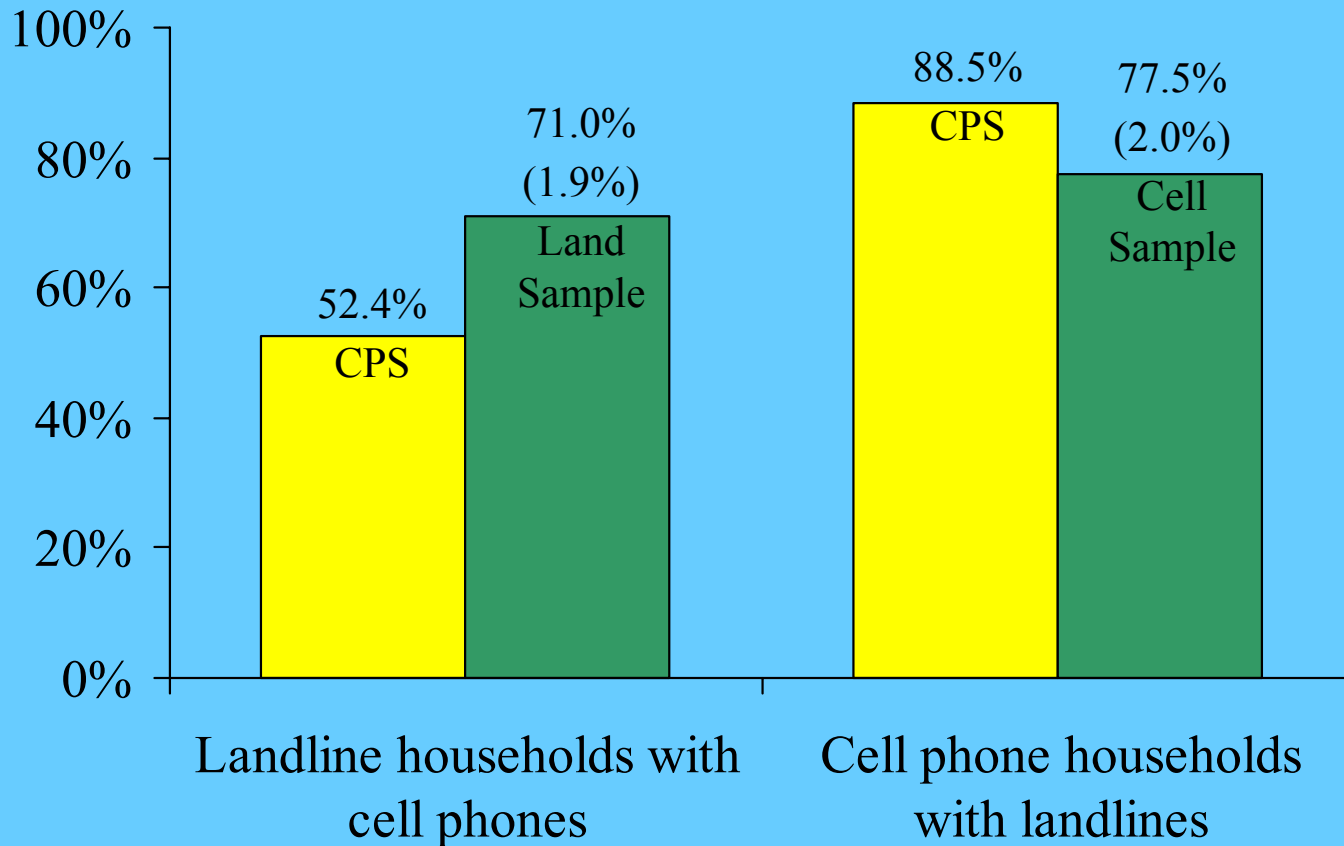
# Estimation Theory

- 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



# Topic/Saliency 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

	Difference from CPS			
Telephone service	Simple	Raked	Separate	RDD
Cell & Land	9.1%	11.2%	19.2%	21.4%
Land-only	-16.9	-17.1	-23.5	-15.0
Cell-only	7.8	5.9	3.6	-6.4

# 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.