# Finding the Right Auxiliary Information for Nonresponse Adjustment Models

## In Search of Zs with Desirable Properties

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# Outline

- What we are (usually) doing wrong
- What we should aim to be doing
- What we can be doing

# 1. Nonresponse adjustment models are generally bad

# Lack of Auxiliary Information in Household Surveys

- Few studies report model fit for nonresponse weight adjustment models
  - Generally poor model fit in general population surveys, relying on aggregate information (e.g., Census Block Group level)
  - Exceptions to this can be undesirable. Variables endogenous to nonresponse are strong "predictors" of nonresponse and can do more harm than good (more on this in a moment)
- Effort to use advanced statistical methods (e.g., machine learning algorithms) to identify complex interactions are limited by the lack of auxiliary information with desirable properties

# 2. Focus on explaining nonresponse is misplaced

# Common Nonresponse Adjustments Model Participation

- Strongest predictors of nonresponse generally do not help with bias reduction
  - Refusal on a prior call/contact attempt, number of calls/contact attempts (Wagner, Valliant, Hubbard, and Jiang, 2014)

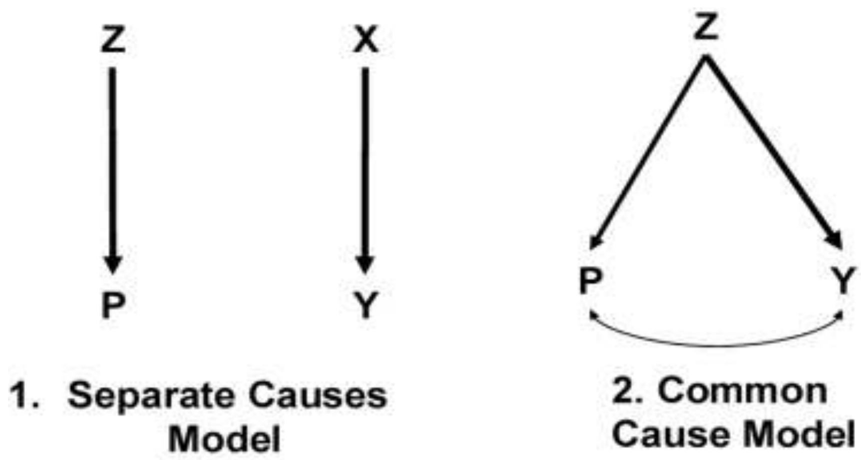
- Associations with nonresponse but not with survey variables of interest unduly increase the variance estimates (Little and Vartivarian, 2005)

| | Association with outcome | |
|---|---|---|
| Association with nonresponse | Low | High |
| Low | Bias: ---<br>Var: --- | Bias: ---<br>Var: ↓ |
| High | Bias: ---<br>Var: ↑ | Bias: ↓<br>Var: ↓ |

# 3. Commonly used auxiliary information lacks desirable properties

# Desirable Properties

- The ideal “Z” variable: an indicator for a common cause of both likelihood to respond and the survey outcome of interest




Note: Partial figure.

Source: Groves, R. M. (2006). Nonresponse rates and nonresponse bias in household surveys. *Public Opinion Quarterly, 70*(5), 646-675.

# Challenge in Practice

- The objective is seldom met in practice. Auxiliary variables tend to be associated with EITHER nonresponse OR survey variables

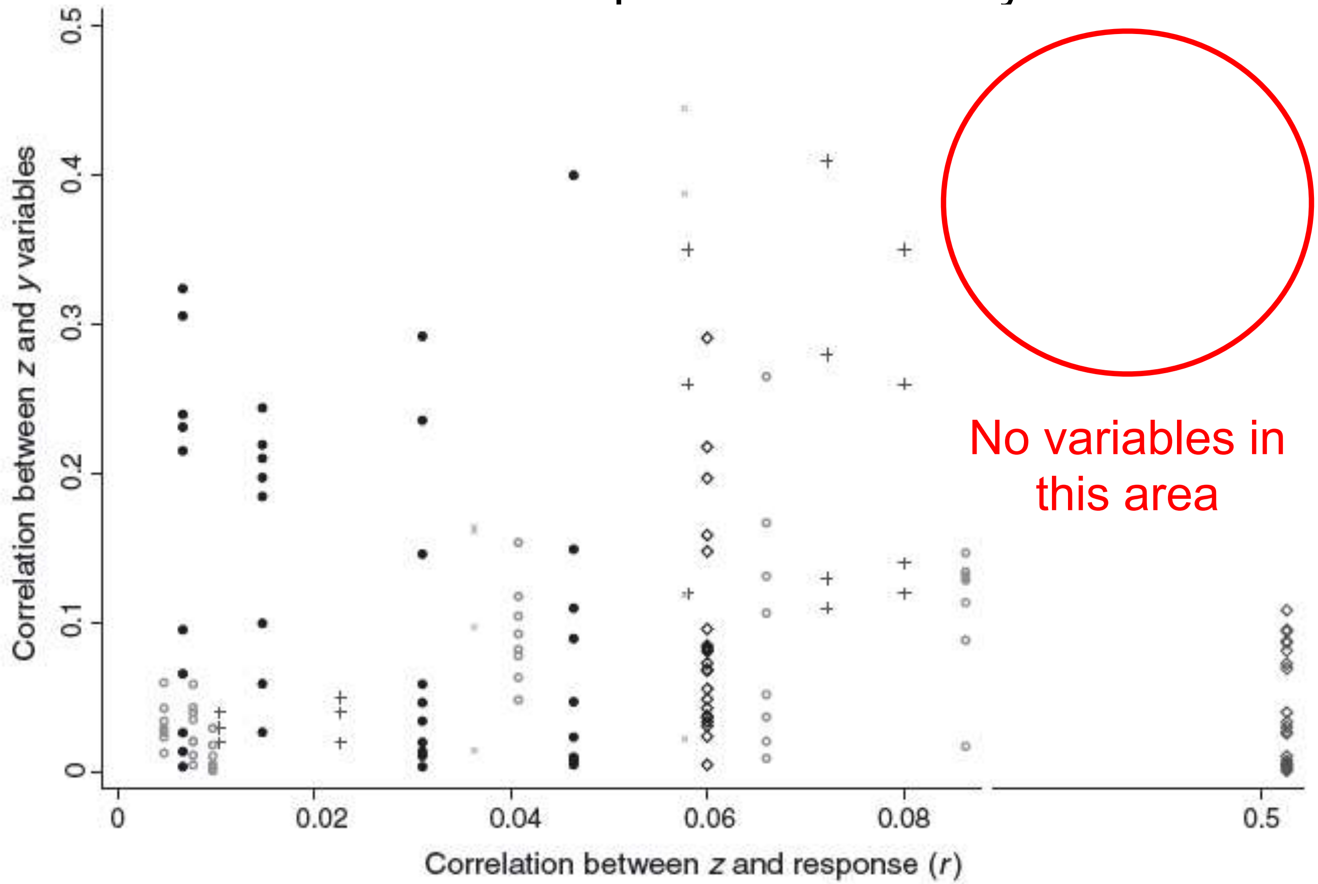



**Fig. 1.** Relationship between the correlation of *z*- and *y*-variables and correlation of *z* and response in five surveys (all correlations are shown as absolute values): +, UMTRI; ×, MEPS; ○, ESS; ◇, ANES; ●, NSFG

Source: Kreuter, F., Olson, K., Wagner, J., Yan, T., Ezzati-Rice, T. M., Casas-Cordero, C., . . . Raghunathan, T. E. (2010). Using Proxy Measures and Other Correlates of Survey Outcomes to Adjust for Nonresponse: Examples from Multiple Surveys. *Journal of the Royal Statistical Society, Series A (Statistics in Society), 173*(2).

# 4. Promising avenues for improvement

# Potential for Improving Nonresponse Adjustments

- Designed paradata
  - Interviewer observations
  - Proxy reports
- Embed survey content for weight calibration
  - Consider calibration beyond traditional demographic characteristics
- Administrative data
  - E.g., student information
- Statistical methods
  - E.g., tree-based methods (limited utility depending on auxiliary data)
  - Multiple imputation for unit nonresponse, particularly for swiss-cheese pattern of missing auxiliary data and improved efficiency

# Designed Paradata

- National Survey of Family Growth's interviewer observations of sexual activity (used in nonresponse weighting adjustments)

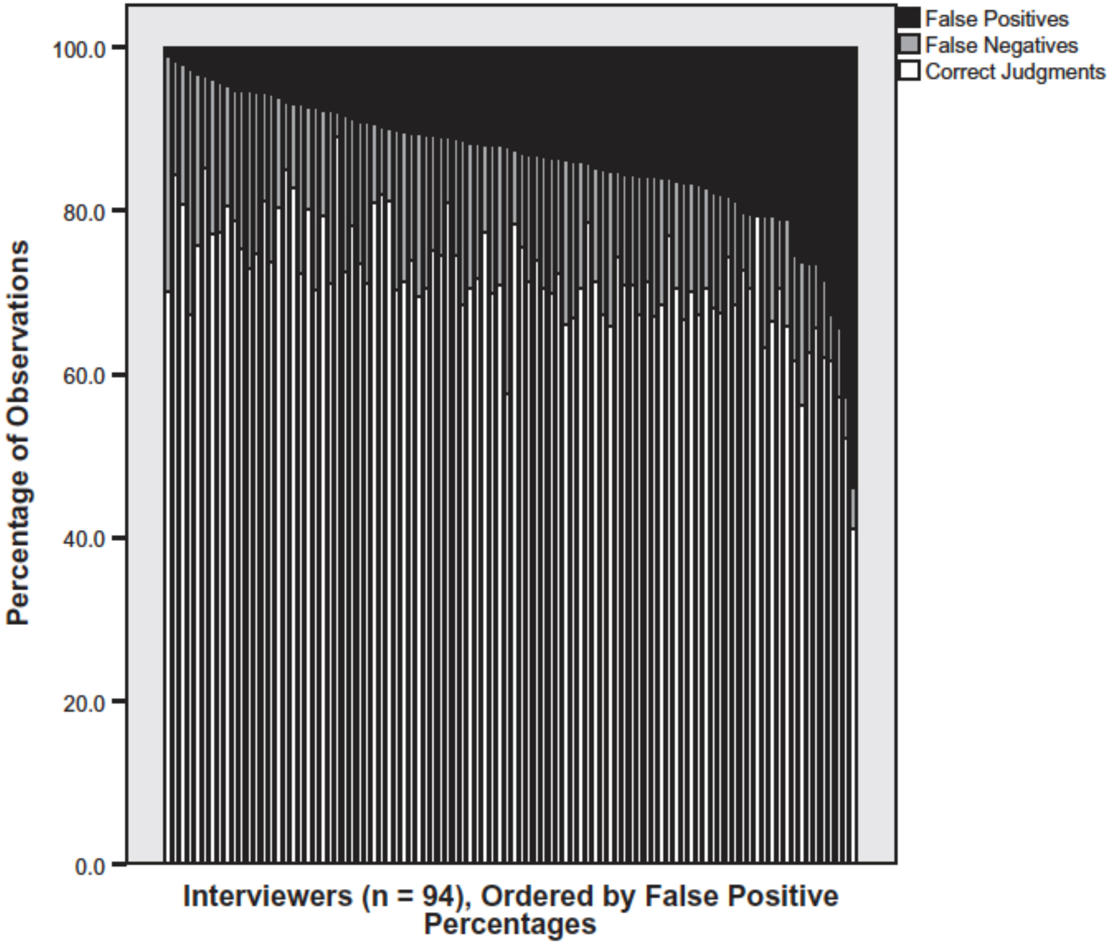
**Table 3.** Accuracy Rates for the Interviewer Judgments of Current Sexual Activity in the Last Four Quarters of the NSFG (2006–2010).

| | Quarter 13 | Quarter 14 | Quarter 15 (I) | Quarter 16 (I) |
|---|---|---|---|---|
| Accuracy rate | 0.7709 | 0.7700 | 0.7809 | 0.7915 |
| False positive rate | 0.5732 | 0.5989 | 0.4514 | 0.5380 |
| False negative rate | 0.1328 | 0.1249 | 0.1488 | 0.1124 |

Source: West, B. T., & Kreuter, F. (2014). A Practical Technique for Improving the Accuracy of Interviewer Observations of Respondent Characteristics. *Field Methods*.

# Designed Paradata

- Interviewer variance in interviewer observations




Source: West, B. T., & Kreuter, F. (2013). Factors Affecting the Accuracy of Interviewer Observations: Evidence from the National Survey of Family Growth. *Public Opinion Quarterly, 77*(2), 522-548.

# Designed Paradata—Another Cautionary Tale

- 2015 California Health Interview Survey
  - Two-stage design with screener and main interview
  - Ask about health conditions for each selected household member (often a proxy report)

- Found substantial measurement error in the screener reports

- Measurement error was correlated with nonresponse

- Underreporting was correlated with nonresponse

Source: Peytcheva, E., Peytchev, A., Currivan, D. & Jans, M. (2017). Measurement error in proxy measures of key survey variables to estimate, reduce, and adjust for nonresponse bias. Paper presented at the ESRA annual conference, Lisbon.

# Combining Statistical Properties with Social Science

- What behaviors are related to processes generating nonresponse decisions, and are likely associated with many survey variables?
  - Highly correlated with nonresponse and substantive survey variables
- Two example studies using General Social Survey data (Peytchev, Presser, and Zhang, 2018)
  - Voting
  - Volunteering
- Calibrate survey weights using benchmark estimates from a source that is not subjected to high nonresponse