
Survey Quality Indicator Measures: Response Rates and Alternatives

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MATHEMATICA
Policy Research

Background

- Survey goal is to provide high-quality data
- Response rate was considered an indicator of
 - Data collection goal: High response rate
- But the threshold for a high response rate has changed due to decreasing response rates (90% to 70%, or even lower) from the early 1990s to mid-2000s

- Non-response bias $b(\bar{y}) = (1 - \rho)(\bar{y}_r - \bar{y}_{nr})$

Background (cont'd.)

- **Response rates alone are not good indicators of nonresponse bias (Groves and Peytcheva 2008)**

- **Alternatives**
 - **Multiple thresholds of response rates by key domains**
 - **R-indicator (Schouten et al. 2009) measuring representativeness**
 - Measure of response propensity rate variation among respondents
 - Leading to focus on less representing subpopulations during a late stage of data collection

Objectives

- **Empirical evaluation of response rates and R-indicators using real survey data**
 - Observe the relationship between the two measures
 - Understand the relationship between each measure (response rate or R-measure) and potential nonresponse bias
- **Decision for data collection closeout**
 - Based on response rate, R-indicator, both or other alternative indicators?

Methods

- **Examine R-indicator and response rate trends over the data collection period**
- **Calculate key survey and frame variable estimates on a weekly basis during data collection**
- **Calculate upper-bound estimates for bias and root mean square errors for weekly estimates during data collection**

Data: National Survey of Recent College Graduates (NSRCG)

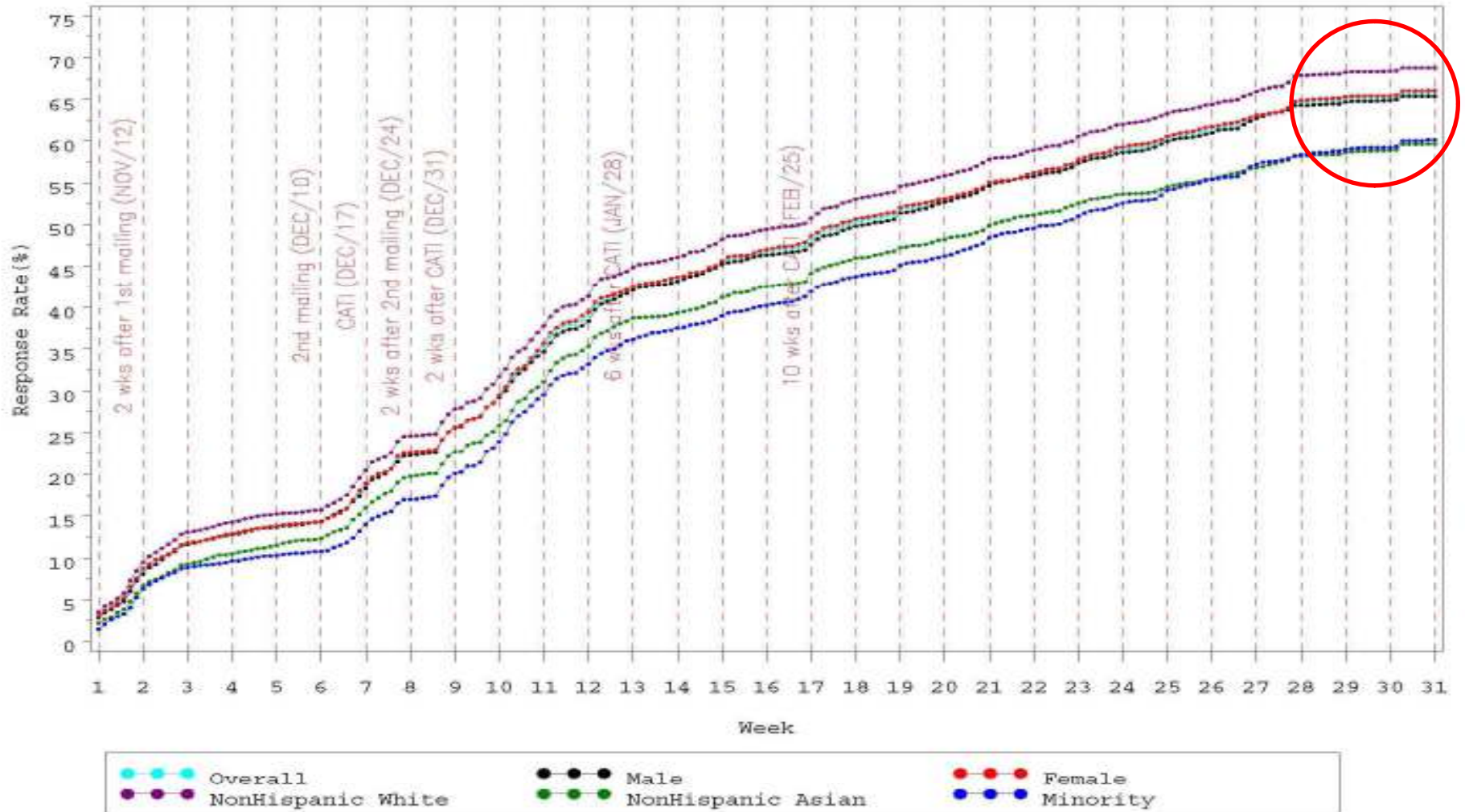
- **Sponsored by the National Science Foundation (NSF) and conducted every two or three years since 1974**
- **Targets recent graduates with bachelor's or master's degrees in science, engineering, or health**

NSRCG (cont'd.)

- **2008: AY06, AY07**
- **Two-stage sample design: school sample (first stage) and graduate sample (second stage)**
 - Sample sizes: 300 schools and 18,000 graduates
 - For more information, visit www.nsf.gov/statistics/srvyrecentgrads
- **Information collected on demographics, education, employment, etc.**
- **Mixed mode: Mail/Web with CATI follow-up**
- **Final response rates**
 - 71.4 (unweighted), 69.7 (weighted)

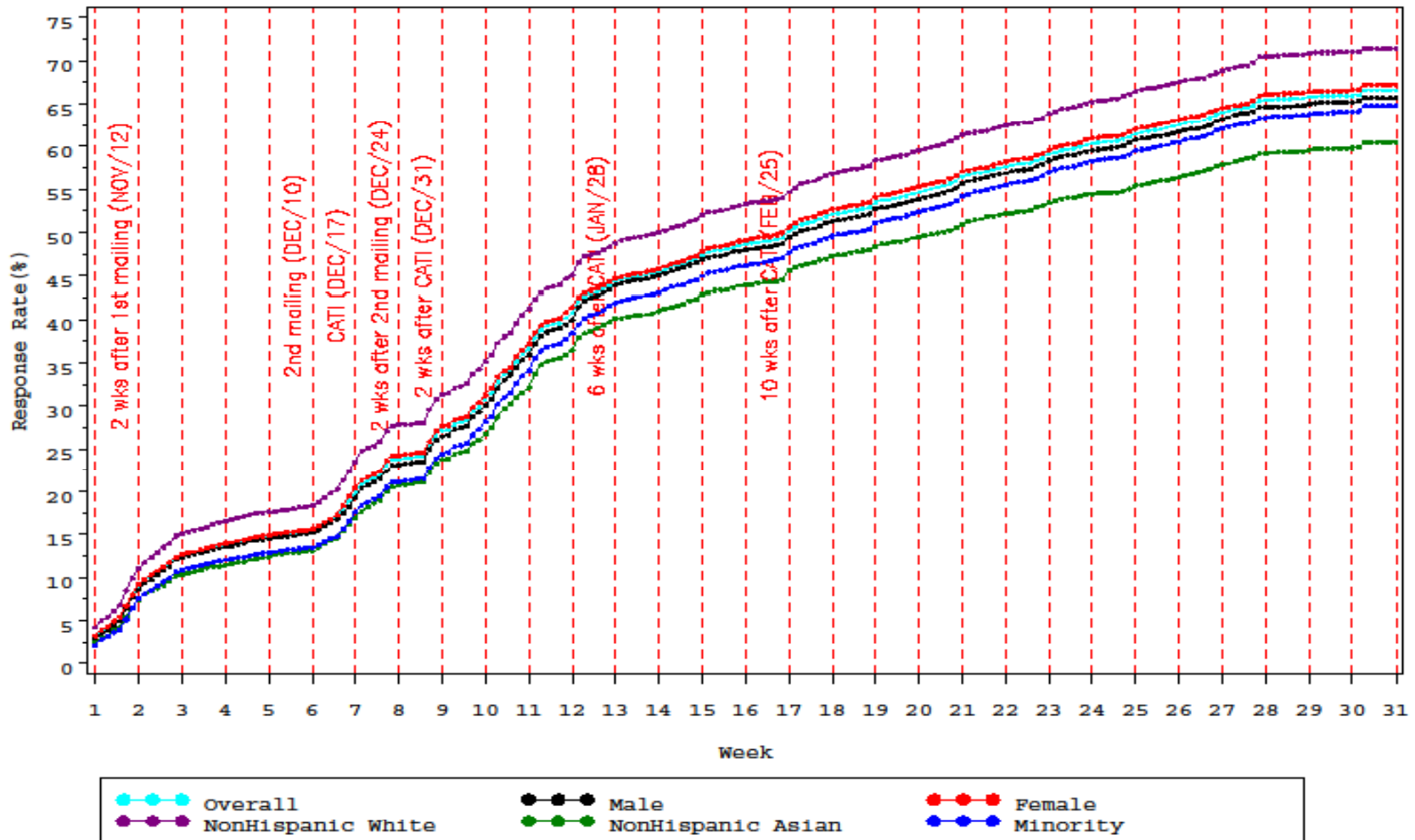
Response Rates (Weighted)

Weighted RR by CompletionDates



Response Rates (Unweighted)

Unweighted RR by CompletionDates



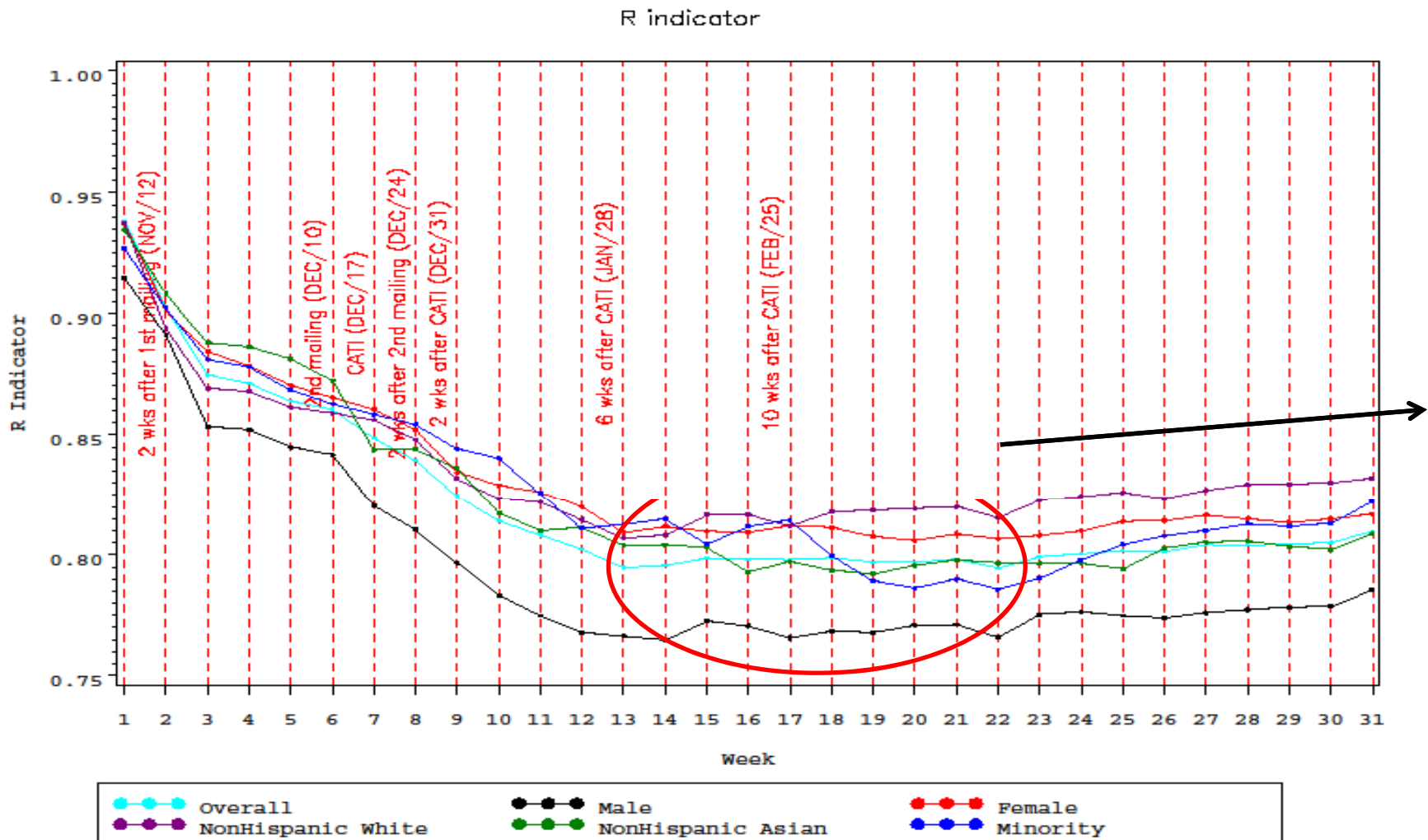
R-Indicator

- Measures similarity or dissimilarity of response propensities
- A measure independent of specific outcome variables (similar to response rate)

$$R(\rho) = 1 - 2\sqrt{\frac{1}{N-1} \sum_{i=1}^N (\rho_i - \bar{\rho})^2} \longrightarrow \hat{R}(\rho) = 1 - 2\sqrt{\frac{1}{\hat{N}-1} \sum_{i \in R} w_i (\hat{\rho}_i - \hat{\bar{\rho}})^2}$$

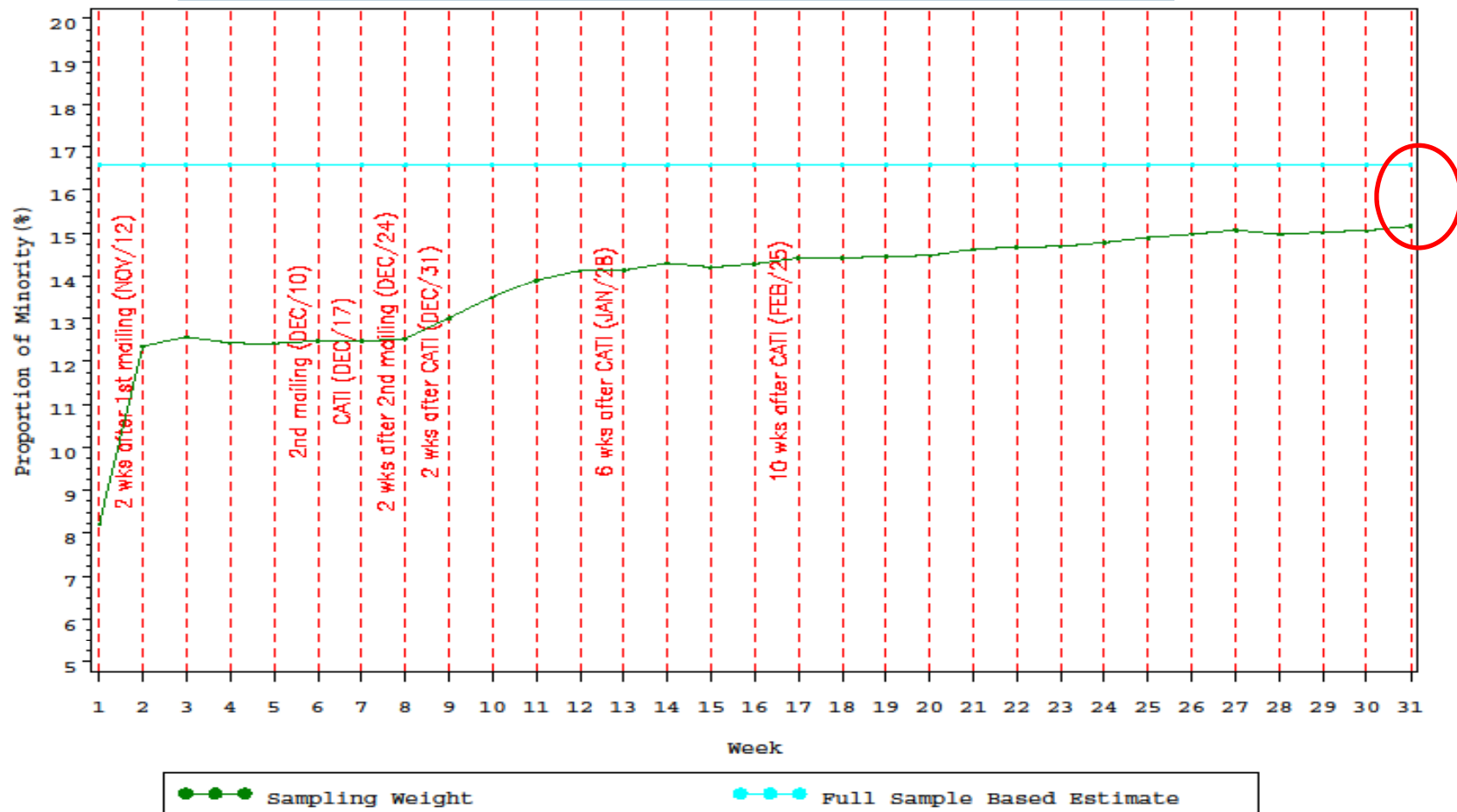
where ρ_i is an individual response propensity

R-Indicator (cont'd.)



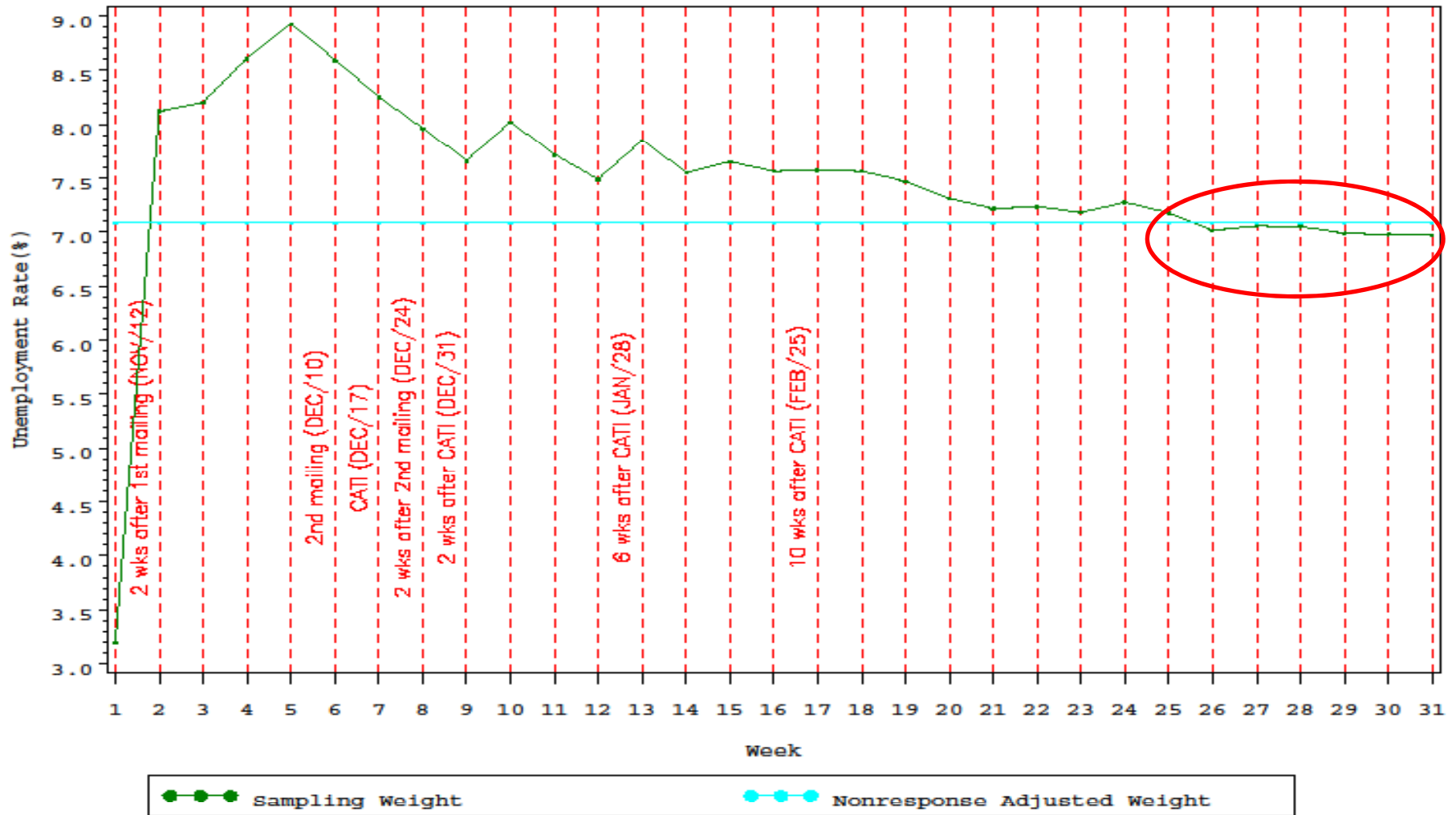
Tracking Estimates for Frame Variables

Percentages of Minority group
(Hispanic, Black, American Indians)



Tracking Estimates for Survey Variables

Unemployment rate estimates for Minority group
(Hispanic, Black, American Indians)



Upper Bounds for Bias and Root Mean Square Error

- Upper bounds of bias and root mean square errors can be estimated using survey response data:

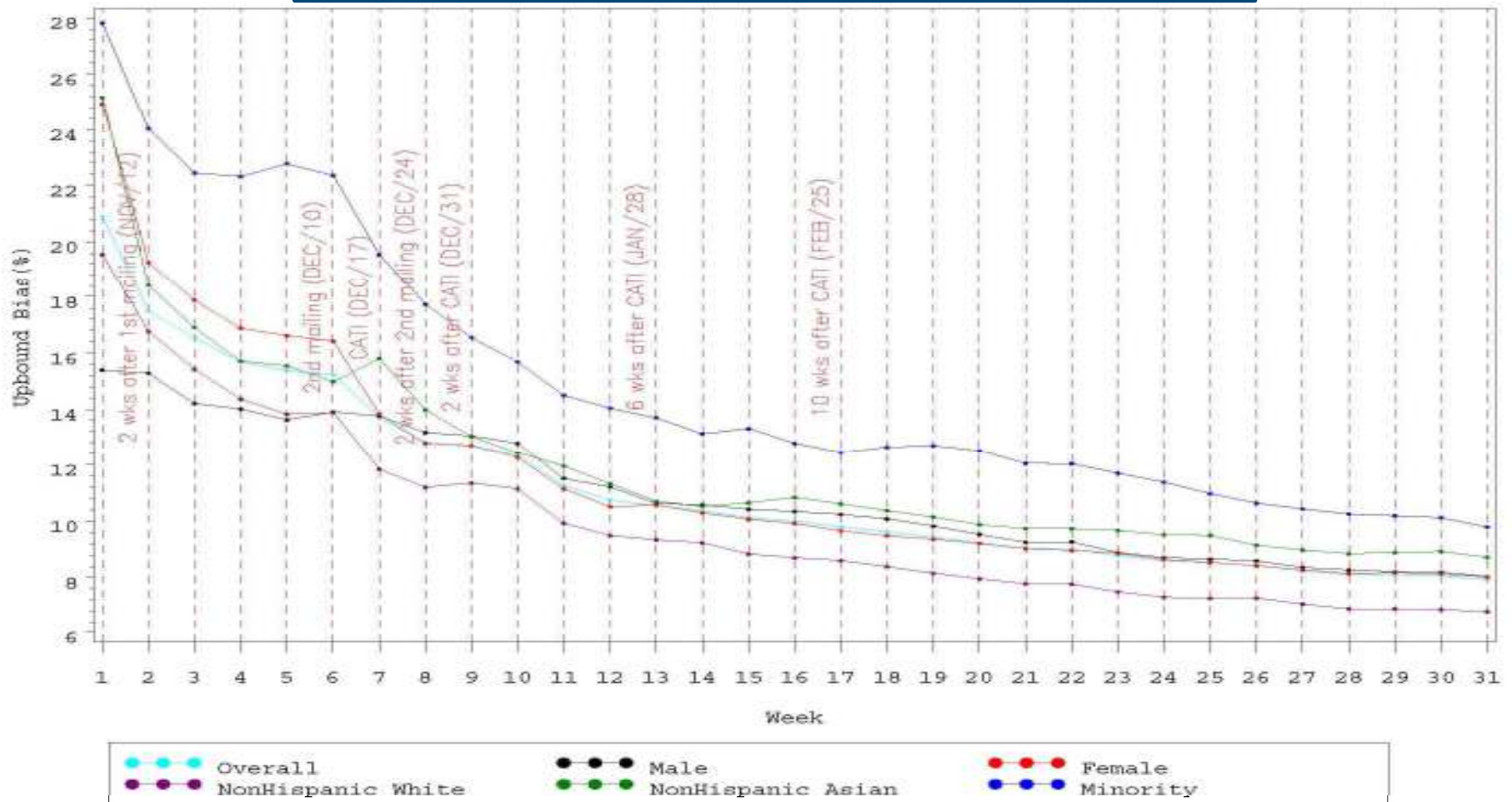
$$\hat{B}_U(\hat{y}) = \frac{(1 - \hat{R}(\rho))\hat{S}(y)}{2\hat{\rho}} \quad \widehat{RMSE}_U(\hat{y}) = \sqrt{\hat{B}_U^2(\hat{y}) + v(\hat{y})}$$

where $v(\hat{y})$ is a variance estimator of \hat{y} and

$$\hat{S}(\hat{y}) = nv(\hat{y}) / deff(\hat{y})$$

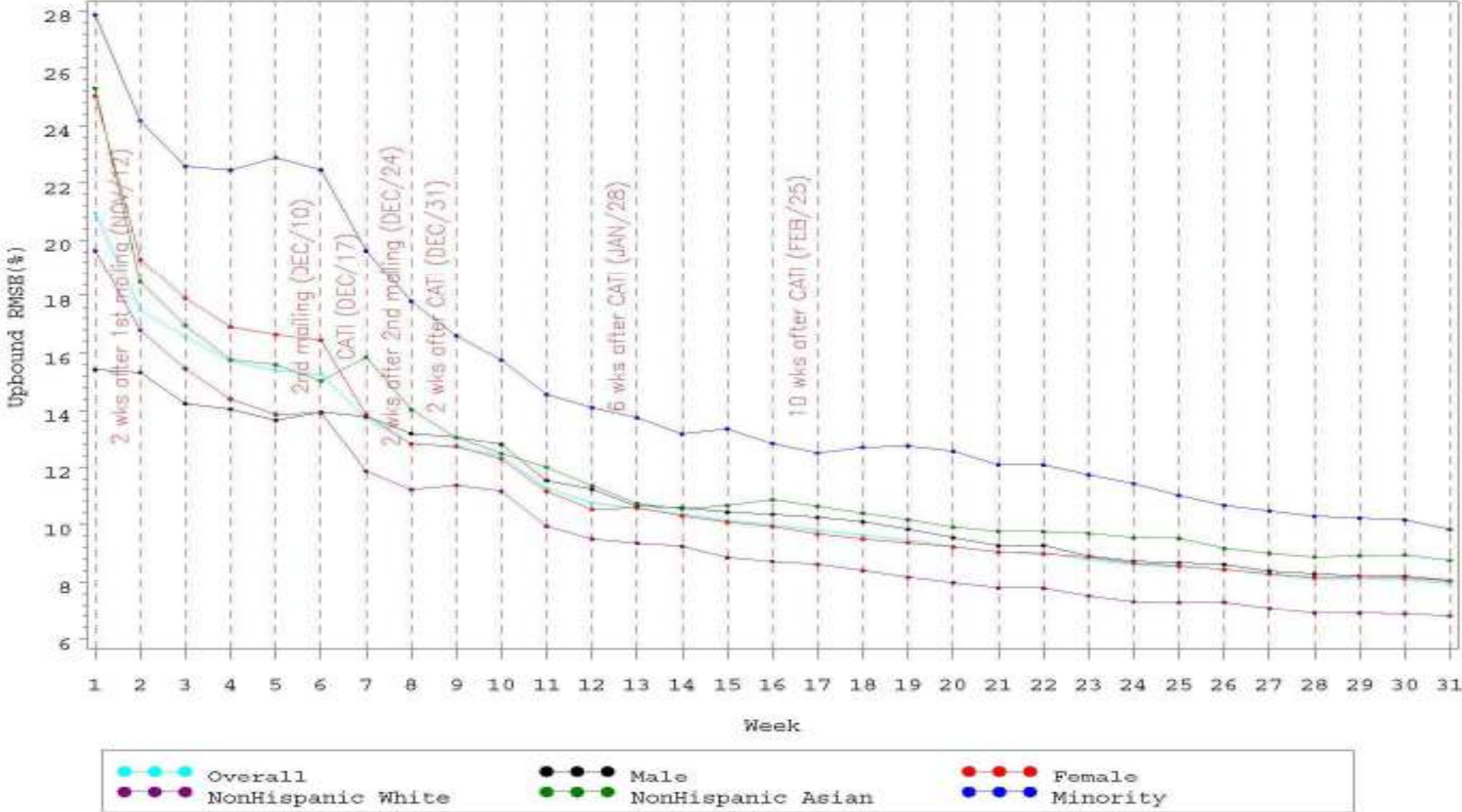
Upper Bound Bias

Upper Bound Bias of Unemployment Rate Estimates



Upper Bound Root Mean Square Error

Upper Bound Root Mean Square Error for Unemployment Rate Estimates



Results

- **Response rate curves are monotonically increasing, but in increments of only 1% across all key domains (gender and race/ethnicity) during the last three weeks (weeks 29–31)**
- **R-indicator curves are U-shaped, with the lowest values between week 13 (RR = 44%) and week 22 (58%) overall and for key domains**
 - **After week 22, R-indicator values for most domains steadily increase but not much**

Results (cont'd.)

- **The percentage of minority graduates among respondents is less than that of the full sample at the end of data collection, indicating the importance of weighting adjustment**
- **Survey estimates for “unemployment rate” of Minority group seem steady after week 25**
- **The upper bounds of potential bias indicators (bias and RMSE) for “unemployment rate” estimates are steadily decreasing, although the rates of decrease over the last few weeks are minimal**

Discussion

- **The last three weeks of 2008 NSRCG data collection added, at most, 1% point to the response rate—supporting the data collection closeout decision at week 31**
- **Other measures may have supported the**
 - **Though R-indicator showing a steady upward trend, the slope was very small**
 - **Key survey estimates stabilized after 20+ weeks**

Discussion (cont'd.)

- **Other measures may have supported the closeout of the data collection (cont'd.)**
 - Bias and RMSE upper bound measures showed consistent results with response rates, R-indicators, and survey-estimate tracking
- **Importance of tracking various measures during data collection—response rates, R-indicators, frame variables, key survey estimates, bias indicator measures**
- **The decision to close out data collection can be based on quality measures and other practical considerations: budget and data-dissemination schedule**

For More Information

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References

- Groves, R.M., and E. Peytcheva. “The Impact of Nonresponse Rates on Nonresponse Bias.” *Public Opinion Quarterly*, vol. 72, 2008, pp. 1–23.
- Schouten, B., F. Cobben, and J. Bethlehem. “Indicators for the Representativeness of Survey Response.” *Survey Methodology*, vol. 35, 2009, pp. 101–113.
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