Survey Quality Indicator Measures: Response Rates and Alternatives

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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

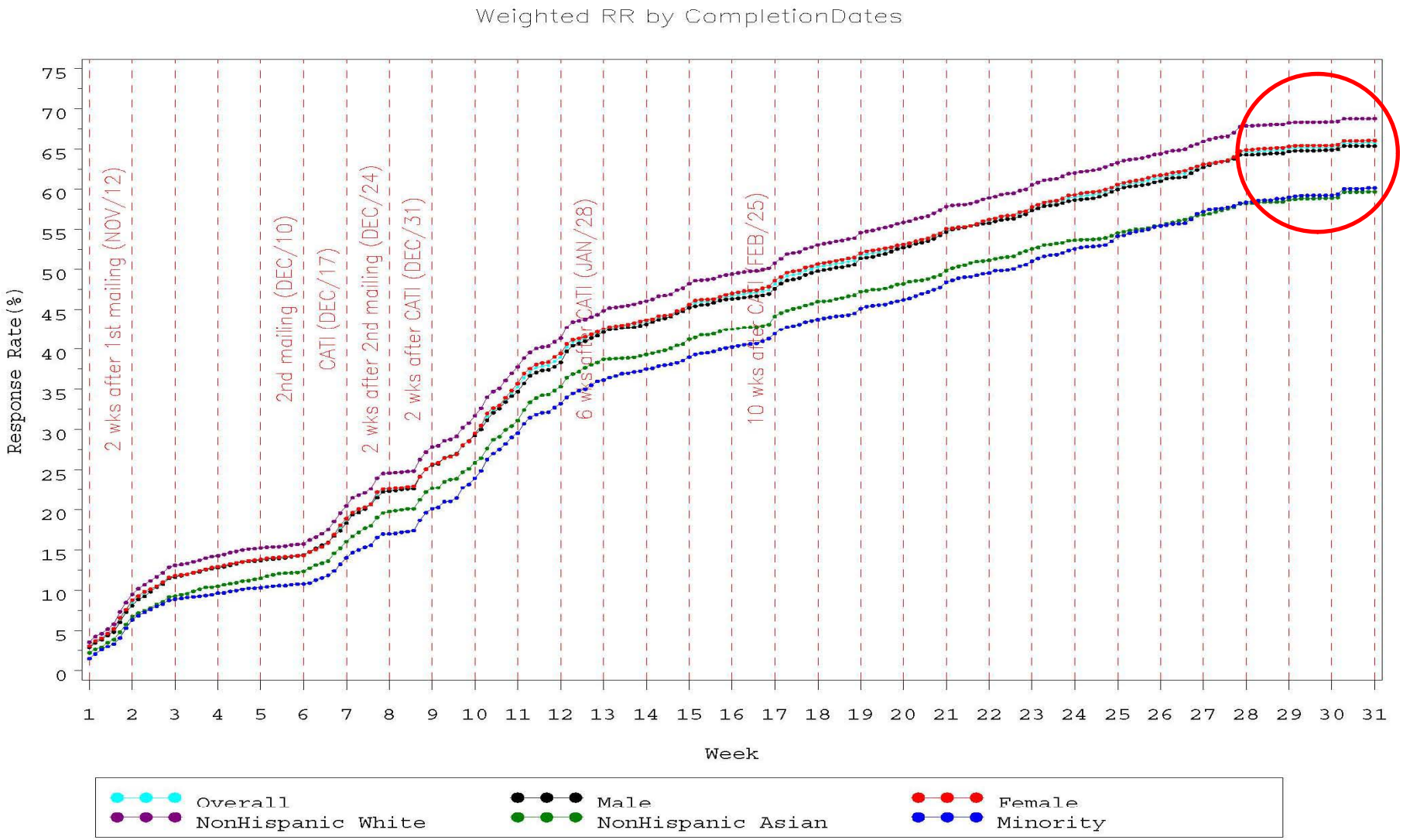
Data: National Survey of Recent College Graduates (NSRCG)

- 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)



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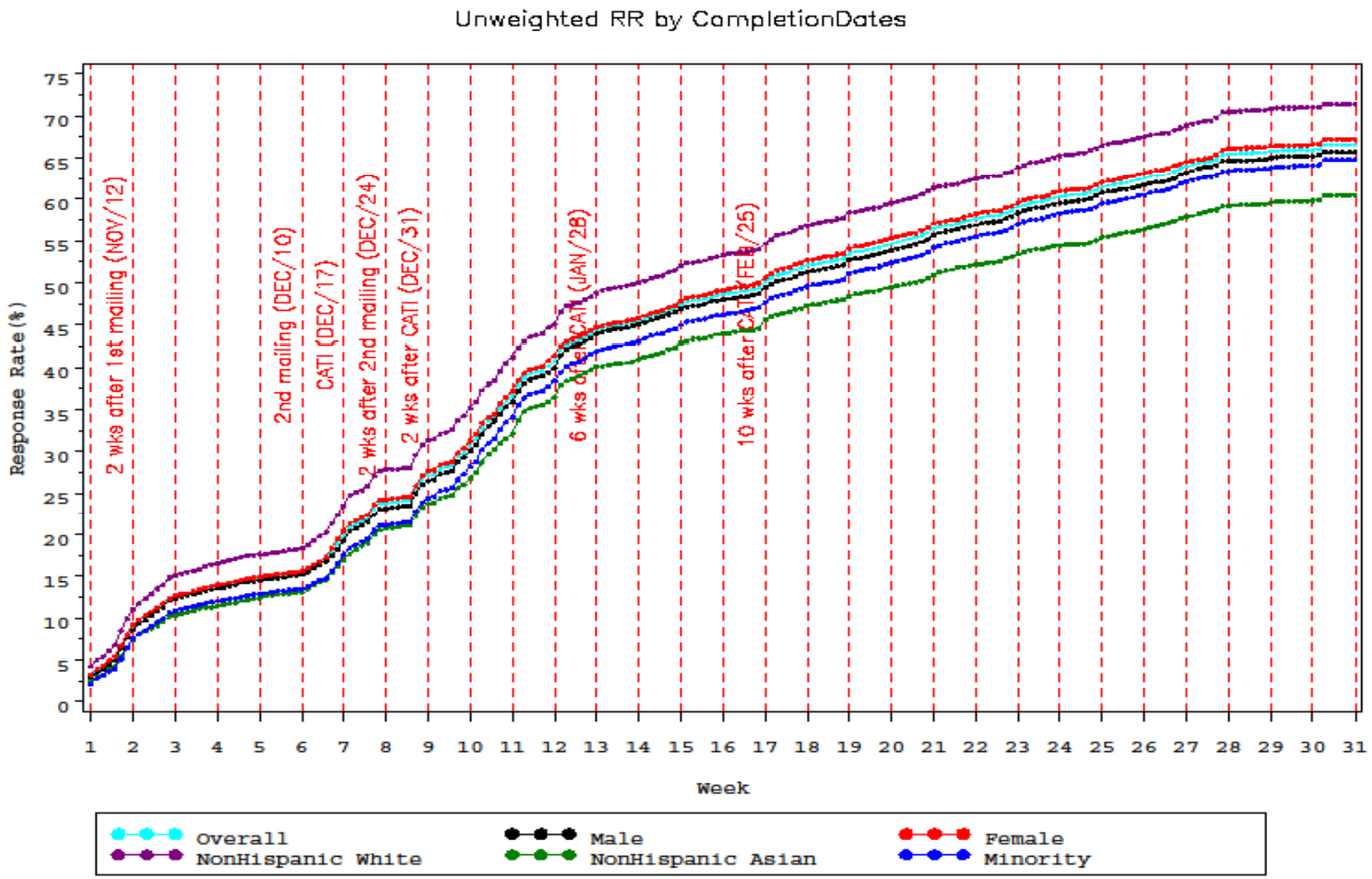
Response Rates (Unweighted)



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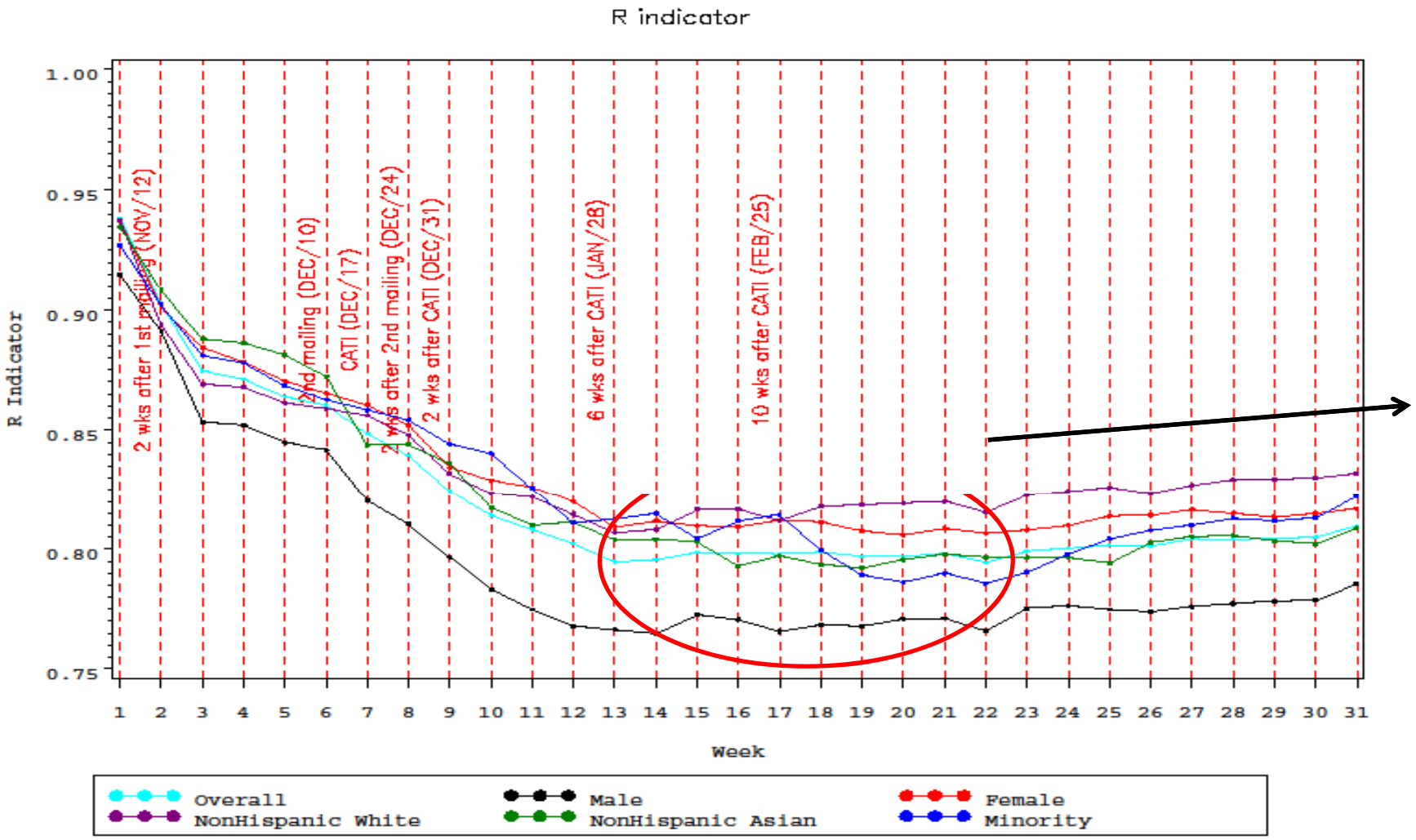
R-Indicator

- **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.)



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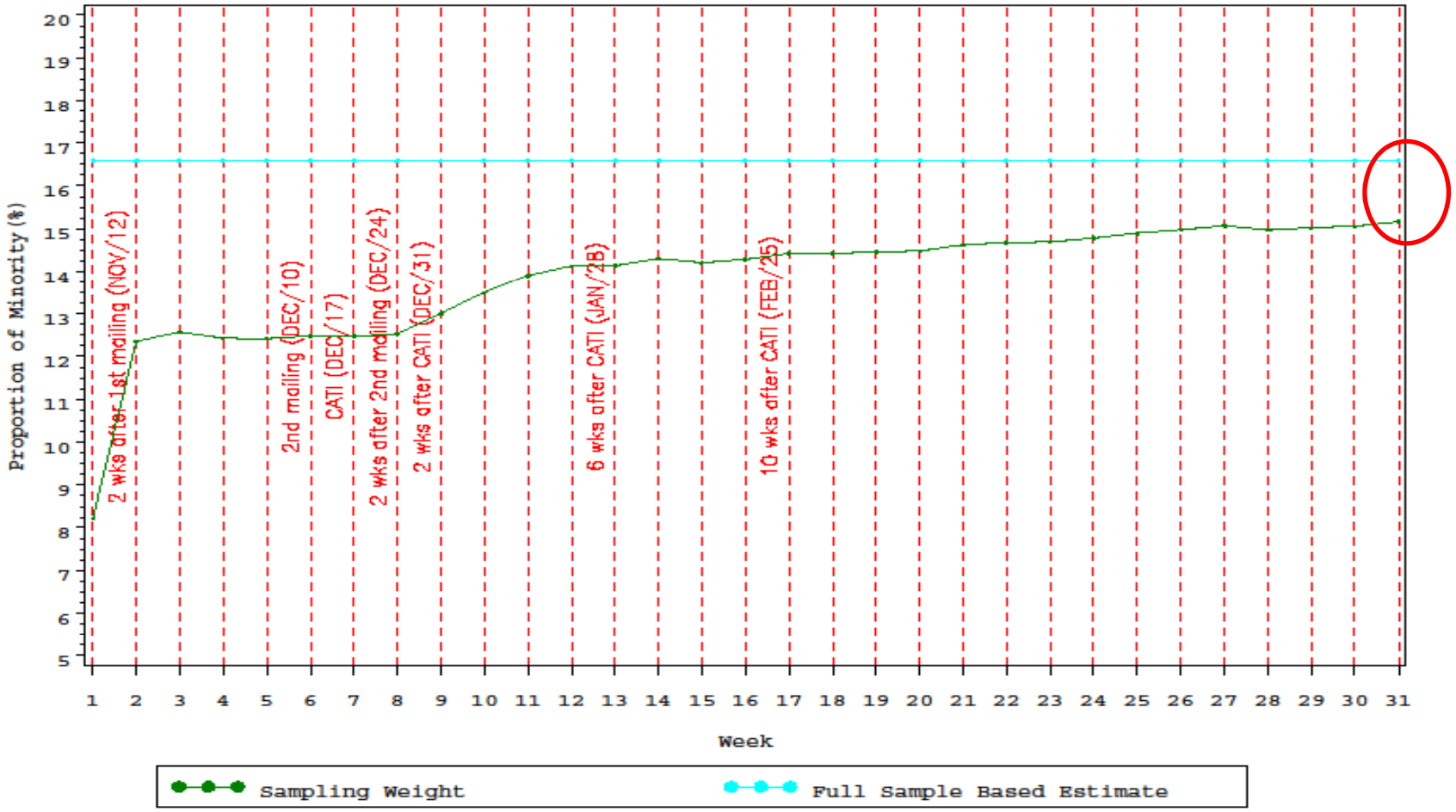
Tracking Estimates for Frame Variables

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



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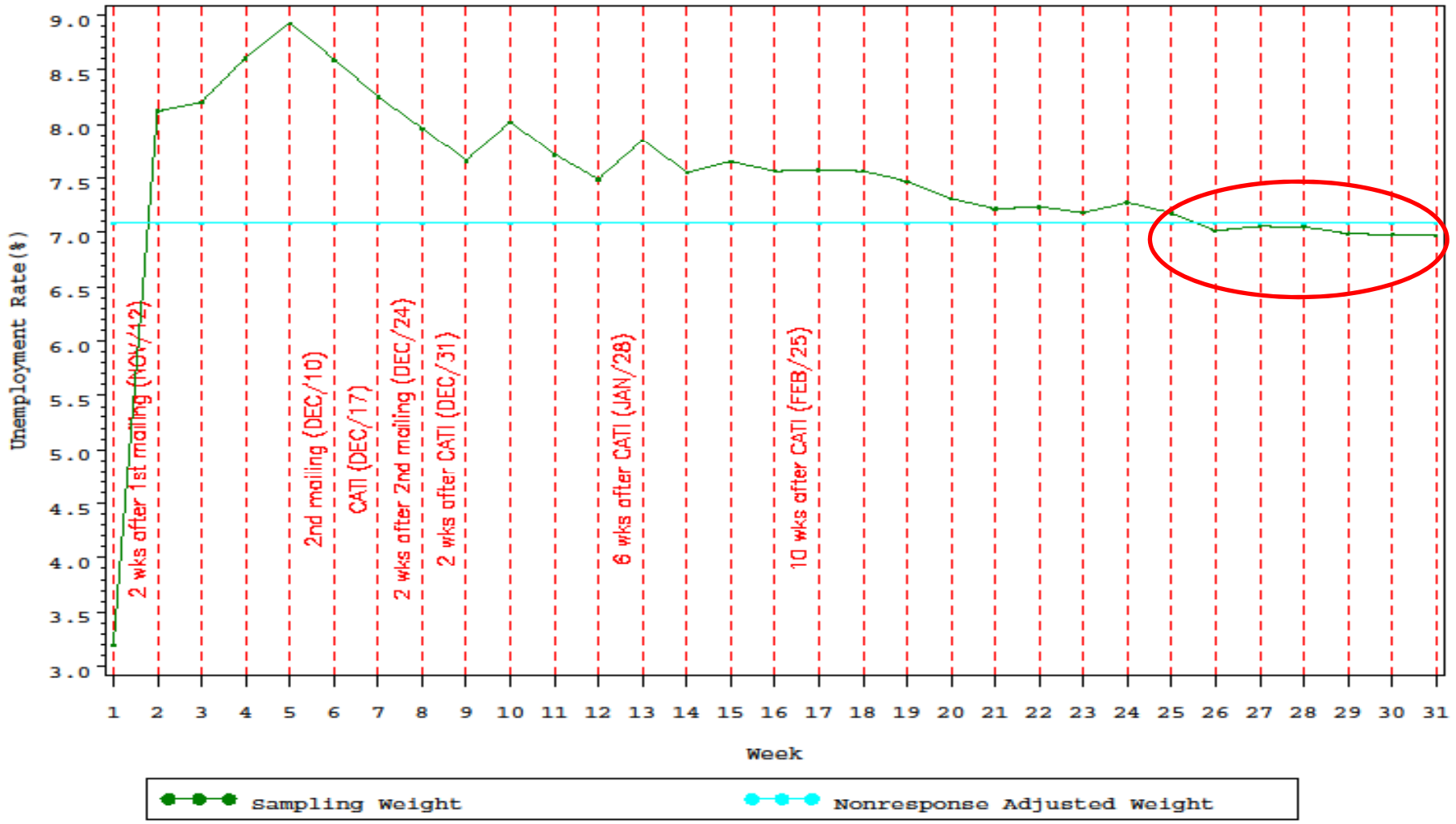
Tracking Estimates for Survey Variables

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



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Upper Bounds for Bias and Root Mean Square Error

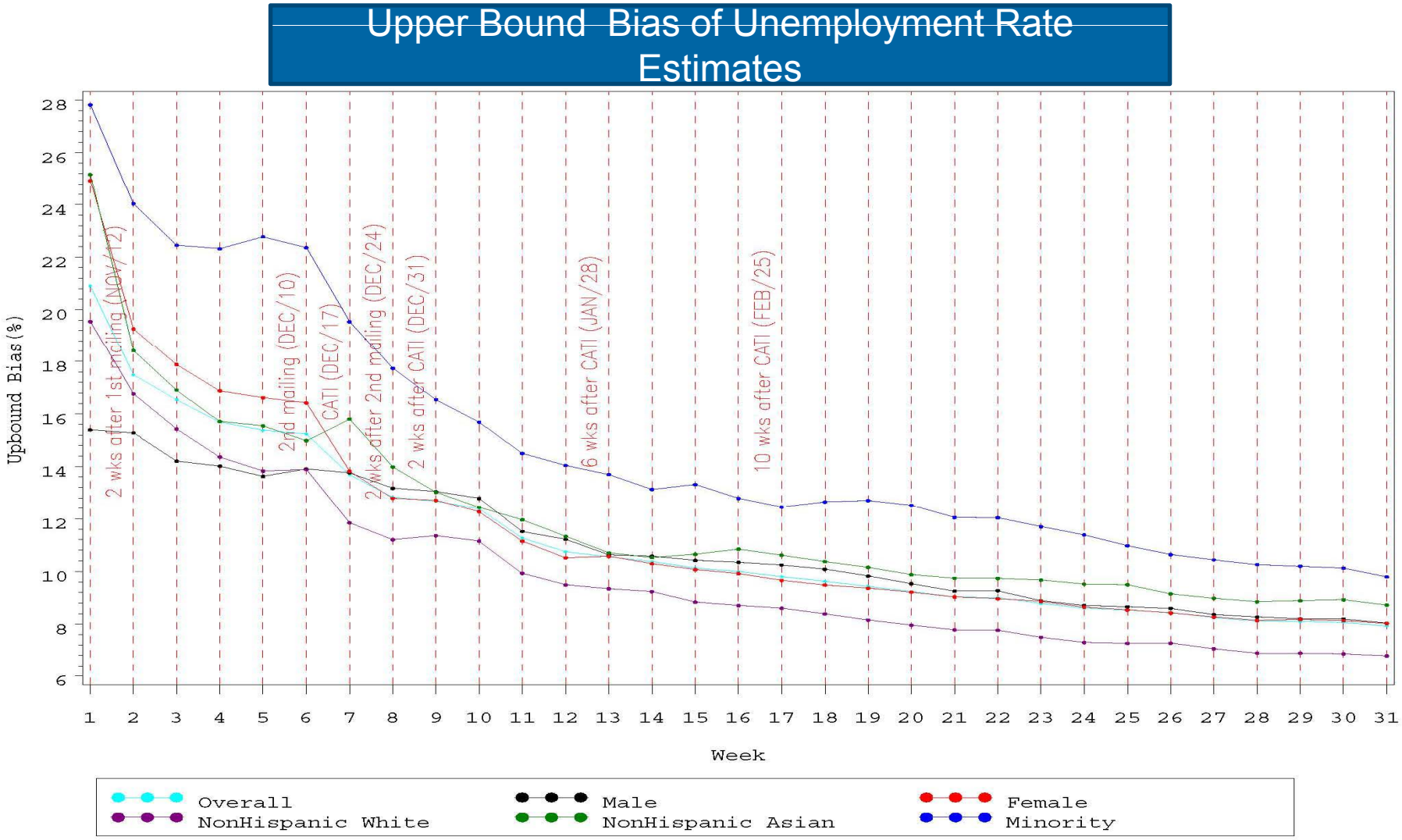
- **Upper bounds of bias and root mean square errors can be estimated using survey response data:**

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

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

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

Upper Bound Bias



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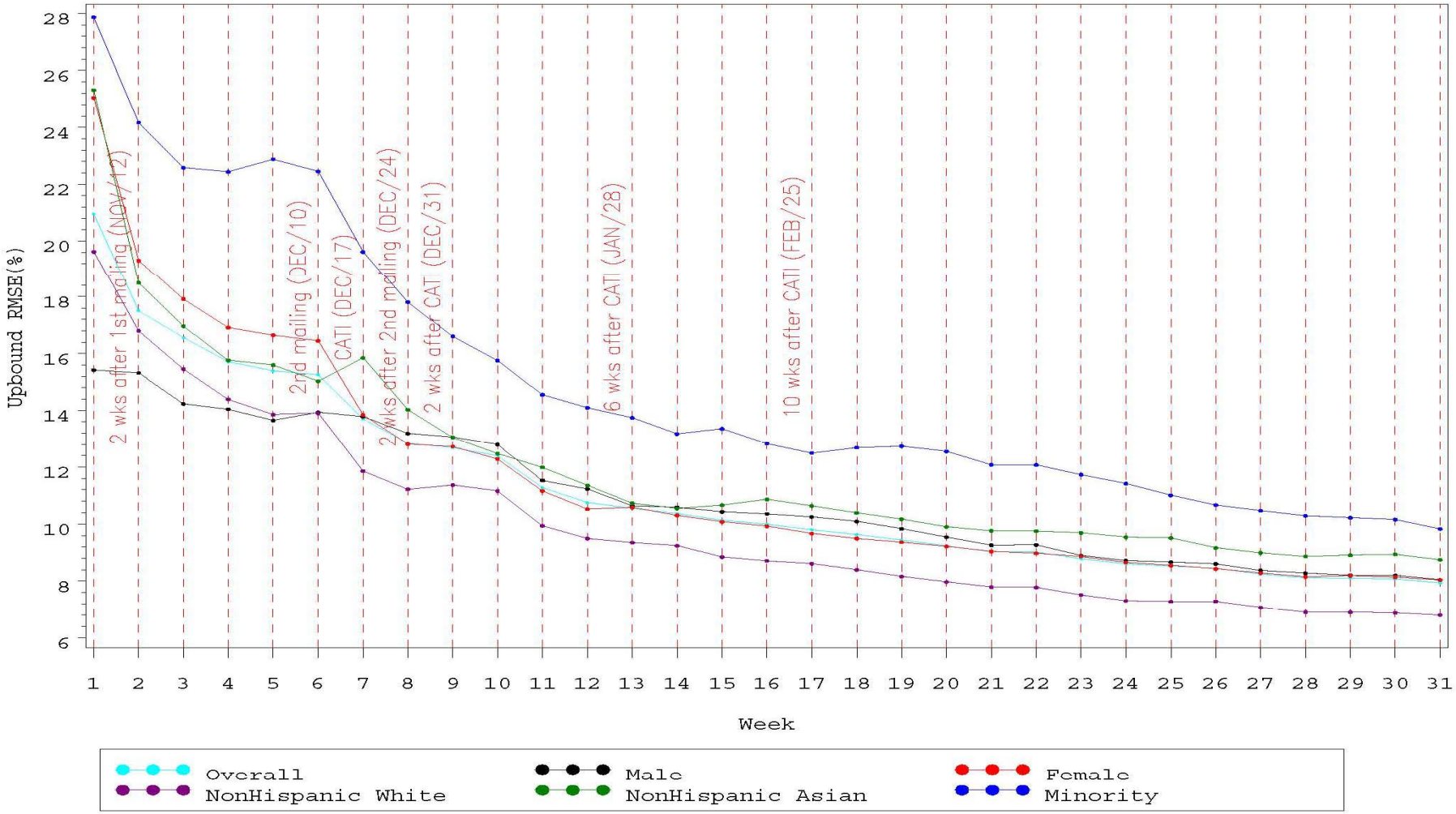
Upper Bound Root Mean Square Error

Upper Bound Root Mean Square Error for Unemployment Rate Estimates



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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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- 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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