NCHS BSC Nonresponse Bias Workgroup, National Health and Nutrition Examination Survey

Andy Peytchev (Co-Chair), Ken Copeland (Co-Chair),
Scott Holan, and Robert Hauser

January 9, 2020

Need for Timely Feedback to DHANES

- Could not delay feedback to the next BSC meeting

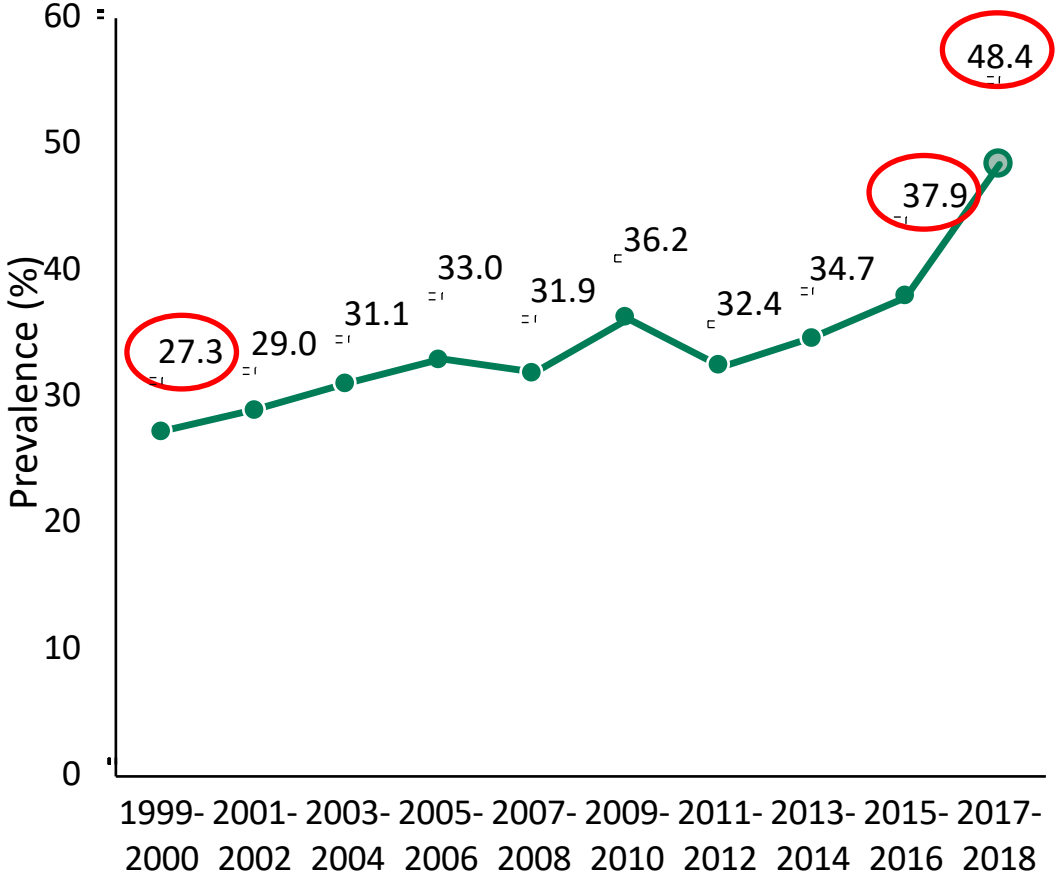
- October 21st in-person meeting for NHIS and NHANES
  - Understanding of the problem
  - Comment on efforts to address the issue
  - Followed up with initial findings/opinions (several days later)

- November 21st call to discuss changes based on the initial findings
  - Offered findings/opinions based on a second set of analyses
  - Objective to aid in prompt identification of a solution to implement

Statement of the Problem

- Unexpected changes in survey estimates in the 2017-2018 cycle
  - Obesity for non-Hispanic white men increased by over ten percentage points, a relative change of 28%
  - Weighted estimates showed the population to be less healthy
- Regardless of whether the changes are statistically significant, need to:
  - Identify the main cause(s)
  - If not true change in population prevalence, construct remedy

Trends in obesity prevalence among non-Hispanic white men aged 20 and over (age-adjusted): United States, 1999–2000 through 2017–2018



Source: NCHS

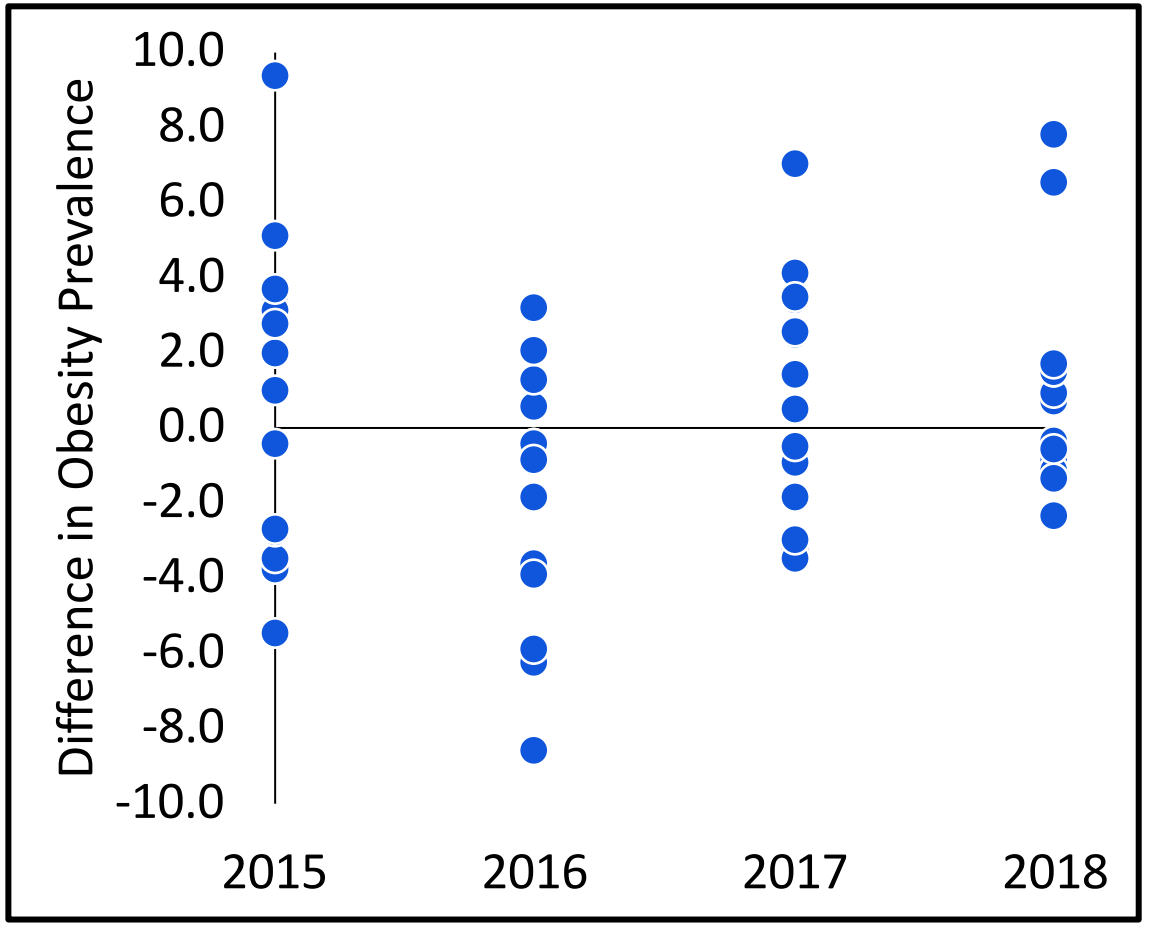
Potential Causes

- Study design changes
  - Sampling design altered, but implemented in the prior (2015-2016) cycle
- True change in population prevalence
  - BMI, for example, does not have such year to year change
- Nonresponse bias
  - Response rates had declined, but they had also done so in the previous cycle
  - Estimates seemingly different from NHIS, but in 2016-2017 markedly different
- Sampling variability
  - Only 15 PSUs per year, 30 per cycle

Sampling Variance

- The 2017-2018 NHANES sample had a lower proportion of higher income adults, college graduates, and residing in large metro areas
  - Not included in the current weighting design
- PSU-level male obesity prevalence, for example, was consistently higher in 2017 and 2018

PSU-level Male Obesity – Stratum-level Male Obesity



Source: NCHS, based on BRFSS data

Alternative Survey Weights

- Sequential addition of raking to education and urbanization
- Introduction of a generalized regression (GREG) adjustment for income at the PSU-level

Workgroup Findings from October 21st

Finding 1: PSU-level GREG adjustment is warranted but seems insufficient and has an undesirable impact on variance estimates.

- It is not a desirable solution for future samples, and if used, preferably would be restricted to use only on 2017-2018 data.
- If augmentation of the household- and person-level calibration reduces the impact of the PSU-level adjustment on obesity and other key estimates, it would be prudent to drop this adjustment in favor of improved precision.

Workgroup Findings from October 21st

Finding 2: Rapidly declining response rates and the highly clustered design increase reliance on weighting adjustments. It would be beneficial to consider additional calibration variables at the household- or person-level.

- The current three-dimensional poststratification (age by race and ethnicity by sex) can be substituted with raking (or other iterative modeling approach) to multiple two-way cross-classified population totals.
- Additional population controls could include marital status, household composition, and some level of geography.
- Consider health insurance status if definitions used on NHANES and on the reference source can be aligned.
- Weight calibration can be applied separately within each of the four sampling state health groups.

Workgroup Findings from October 21st

Finding 3: Using change in key estimates such as BMI over time, which exhibit stable trends, is an appropriate way to validate the ability of the modified weights to correct for differences due to sampling variance. However, it should not be used to determine which variables to use in calibration, but rather, to determine whether a set of adjustments is sufficient.

Additional Alternative Weights

1. Reduce dimensionality of the cross-classified adjustment variables

2. Augment the GREG adjustments with additional variables
   - Models could not be estimated

3. Drop GREG adjustment and use census tract adjustment for income

Workgroup Opinions from November 21st

Opinion 1: The workgroup found the last set of weights, which do not include a GREG adjustment but implement raking to tract-level income, most suitable.

- It controls for income without reliance on a change in methodology.
- It produces an estimated loss in precision due to weighting that is considerably lower than that under the GREG adjustment for income.
- It is not subjected to bias associated with different measurement of income in NHANES and ACS.

Workgroup Opinions from November 21st

Opinion 2: Applying this new set of weights to prior NHANES years could help identify any adjustment factors that go beyond correcting for imbalances in the 2017-2018 sample.

- This is consistent with the second criterion used in the selection of adjustment variables (imbalances identified in 2017-2018 should not be present for prior years) and provides an overall evaluation with all adjustments applied.

Workgroup Opinions from November 21st

Opinion 3: The additional adjustments may be beneficial for future years.

- The need for the additional controls in future years may not be known prior to collection of the data.
- Additional analyses may be useful if considering retention of expanded raking models. For example, variables that were not deemed useful for 2017-2018 based on the first variable selection criterion (differences in observed distributions), may be reconsidered for future samples.

Questions for the Workgroup / Discussion