An Investigation of Nonresponse Bias and Sample Characteristics in the 2017−2018 National Health and Nutrition Examination Survey

The decline in the response rate for the 2017-2018 National Health and Nutrition Examination Survey (NHANES), compared to previous cycles, required that a thorough investigation into potential biases in the estimates be performed. This investigation delayed the release of the data. This document highlights the outcomes of the evaluation carried out to assess the potential for bias in the 2017-2018 data. The full report detailing these analyses will be released later in 2020. The report will include the results of the preliminary analyses, the extra steps taken to reduce bias in the outcome statistics, and the evaluation of the bias reduction that was achieved through changes in the weighting methodology used.

In summary, the objective of this investigation was to determine the impact of unit nonresponse (when a sampled person does not participate in the survey) and the characteristics of the sample locations on the 2017−2018 cycle of NHANES. The analysis of unit nonresponse extended the analyses previously done for the 2013-2014 and 2015-2016 cycles[1] given the lower response rate.

Unit nonresponse error, like all sources of error, is composed of bias and variance. In our analyses, we focused on unit nonresponse bias using four methodological approaches based on the Groves and Brick (2005)[2] typology: (1) comparisons to external data (benchmarking); (2) studying variation in the sample; (3) studying variation within the respondent set; and (4) comparing alternative post survey adjustments.

Preliminary nonresponse bias analyses showed that the 2017-2018 NHANES weights required additional adjustments compared to previous cycles. Multiple types of adjustments were considered and evaluated separately before the 2017-2018 weights were finalized.

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[1] https://wwwn.cdc.gov/nchs/data/nhanes/2011-2012/analyticguidelines/nonresponse_executive_summary_13_16.pdf

[2] Groves, R.M. and Brick, M. (2005). Practical Tools for Nonresponse Bias Studies. JPSM Short Course Material.

Nonresponse bias analyses on these weights showed that enhanced weighting adjustments that included calibration to education and income groups, along with race and Hispanic origin, sex, and age groups, sharply reduced nonresponse bias. However, these additional adjustments resulted in increases in variance for some survey estimates.

NHANES uses a stratified, multi-stage probability sample design within each 2-year survey cycle and thus, sample locations vary between each two-year cycle. The impact of the varying sample locations was investigated by two sets of comparisons: the socioeconomic and health characteristics of the 30 primary sampling units (PSUs, which are single counties or small groups of contiguous counties) in the 2017-2018 sample were compared 1) to characteristics of samples in prior cycles, and 2) to characteristics of the stratum from which the selected PSU was sampled to determine how closely the sample represented the population.

The analyses indicated that some characteristics of the NHANES PSUs sampled in 2017-2018 deviated from the three previous cycles to some degree. The characteristics include household income, proportions of college graduates, and prevalence rates of certain health conditions at the PSU level. However, the evaluation showed that these differences are within a reasonable range given the random variation associated with sample selection that was expected under the NHANES 2015-2018 sample design, and that these differences were taken into account when the final enhanced weights were created.

In summary, the analyses showed that any errors of representation resulting from sample location characteristics and nonresponse were minimized with enhanced weighting adjustments. To further reduce any error, combining the 2017-2018 data with data from previous cycles is recommended.