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A rigorous evaluation of a method to adjust BMI for self-report bias

Zachary J. Ward, PhD[1,*], **Steven L. Gortmaker, PhD**[2]

[1]Center for Health Decision Science, Harvard T.H. Chan School of Public Health, Boston, MA

[2]Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, Boston, MA

Keywords

BMI bias correction

We read with interest the article by Flegal et al.[1] aimed at evaluating our bias-correction method for self-reported body mass index (BMI).[2] Although we support the general cross-validation approach using data from the National Health and Nutrition Examination Survey (NHANES) to evaluate the method, we have concerns with its implementation.

First, examining individual-level misclassification is misleading. The goal of our analysis was to estimate unbiased population-level estimates, overall and by subgroup.[2] Without perfect knowledge, it seems inevitable that any method of bias-correction will over-estimate BMI for some individuals and under-estimate it for others, while still providing accurate estimates of the population BMI distribution. Second, not using the NHANES sample weights is mistaken. Sample weights are necessary to accurately estimate BMI quantiles and account for differential sampling of subgroups. Lastly, only performing 1 iteration of cross-validation (and an additional 5 as a 'sensitivity analysis') is insufficient to rigorously characterize the properties of any method, especially given the relatively small sample size. It is unclear to what degree the reported results are artefacts of random noise, especially as no measures of uncertainty are reported.

We agree however with the importance of considering demographic composition. Flegal et al. note that errors in self-reported BMI may vary by demographic factors.[1] However, they fail to note that as these factors are themselves associated with BMI, differentially adjusting

*Corresponding author: Zachary J. Ward, MPH, PhD, Center for Health Decision Science, Harvard T.H. Chan School of Public Health, 718 Huntington Ave, Boston MA, 02115, zward@hsph.harvard.edu, Tel: 617-432-2019, Fax: 617-432-0190.

self-reported BMI by quantile will attenuate (and potentially eliminate) marginal differences in self-report bias.

To assess whether our method is impacted by residual differential self-report bias by subgroup after adjusting for reported BMI, we performed 1,000 iterations of cross-validation using (weighted) data from NHANES 1999-2018, described in the Appendix. We applied our bias-correction method by sex, and by sex and age group, as in recent work.[3]

Adjusting by sex, the 95% CIs for differences in mean BMI and obesity prevalence contain 0 for all subgroups except adults age 65+, with a mean error in obesity prevalence of −1.77% (95% CI −3.13% to −0.41%) – a relatively small difference, and far more accurate than self-reported BMI. Adjusting by both sex and age group resolves this difference, yielding mean errors for all subgroups statistically similar to 0 (Figure 1).

It is therefore unlikely that our previous estimates[2] are substantially impacted. Indeed, our state-level obesity estimates are similar to those from a (computationally intensive) statistical matching approach adjusting self-reported BMI by joint demographic subgroup (sex, age, race/ethnicity, income), with a correlation coefficient of 0.95 and mean difference of <1 percentage point.[2,4]

Our sensitivity analysis using unadjusted BMI also revealed large increases in obesity in every state and subgroup, supporting the central findings of our analysis.[2] The critique by Flegal et al.,[1] while perhaps methodologically interesting, diverts attention from the main issue at hand, especially as they do not propose any alternative method of bias-correction.

We show that although in theory our method could be impacted by differential residual self-report bias, in practice it is not. The assertion by Flegal et al. that it “does little to correct measurement errors”, and that “the results are unpredictable, and the degree of agreement is improved at the overall population level, not at the individual or subgroup level” is thus not supported by empirical findings. Our corrected results are not “unpredictable” but “unbiased”, and demonstrably improve estimates for the overall population and subgroups.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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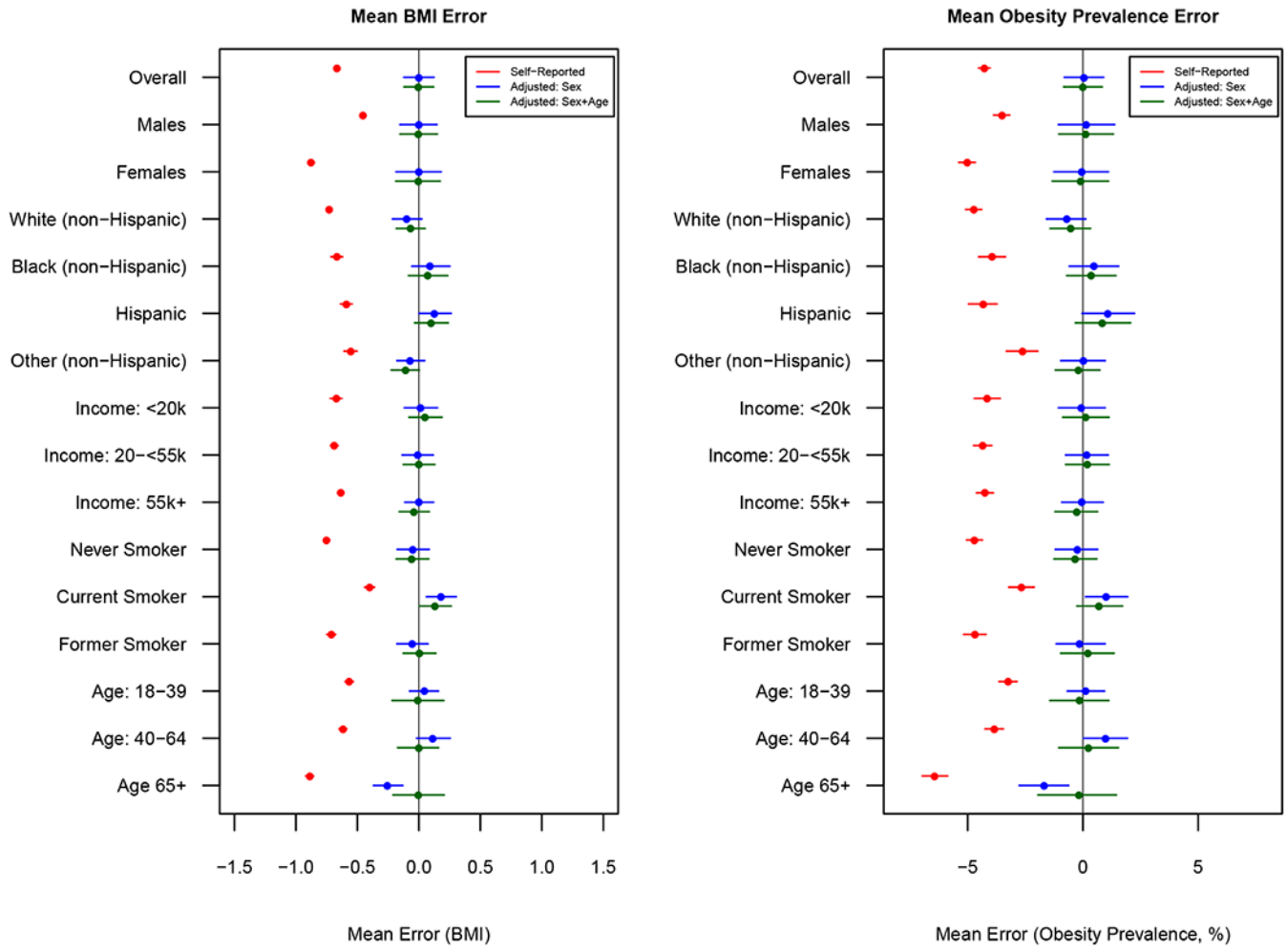

Figure. Mean Error in Individual-Level BMI and Obesity Prevalence by Subgroup

Shown are the weighted bias-correction results. Dots = means. Lines = 95% confidence intervals, estimated as the 2.5 and 97.5 percentiles of the simulation results. Errors are calculated compared to measured BMI in NHANES.