



Published in final edited form as:

Int J Obes (Lond). 2015 March ; 39(3): 546–548. doi:10.1038/ijo.2014.147.

Racial/ethnic differences in accuracy of Body Mass Index reporting in a diverse cohort of young adults

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Abstract

Surveillance data describing the weight status of the U.S. population often rely on self-reported height and weight, despite likely differences in reporting accuracy by demographics. Our objective was to determine if there were racial/ethnic differences in accuracy of self-reported Body Mass Index (BMI) in a diverse nationally representative sample of young people. Using data from Wave III (data collected in 2001–2) of the National Longitudinal Study of Adolescent Health when respondents were aged 18–26, we used gender-stratified multi-variable linear regression models to examine the association of race/ethnicity and self-reported BMI controlling for measured BMI while also adjusting for factors known to be associated with weight self-perception. Black males and females ($b_{\text{Female}}=0.45$, CI: 0.19, 0.71; $b_{\text{Male}}=0.34$, CI: 0.17, 0.51) and Hispanic females ($b_{\text{Female}}=0.30$, CI: 0.08, 0.52) and Native American males ($b_{\text{NativeAmerican}}=0.87$, CI: 0.15, 1.58) reported higher BMIs than their similarly weighted White peers leading to more accurate BMI reporting in these groups at higher BMIs. Caution should be used in interpreting results from studies relying on self-reported BMI as they may exaggerate racial/ethnic differences in weight status.

Keywords

BMI; Self-report; race/ethnicity; bias

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Supplementary information is available at International Journal of Obesity's website.

CONFLICTS OF INTEREST: The authors have no conflicts of interest to report.

INTRODUCTION

Obesity remains one of the most significant public health problems today with certain sociodemographic groups bearing a disproportionate share of the burden. Specifically, African-American females, Hispanic males, and Native Americans have the highest rates of overweight/obesity.¹⁻³ However, our understanding of group-level differences in prevalence of overweight/obesity has largely been based on surveillance data relying on self-reported height and weight.

There are few large and diverse epidemiologic studies that include measured height and weight from which to derive a measured body mass index (BMI) — the National Health and Nutrition Examination Survey (NHANES) remains the notable exception.⁴ Group comparisons therefore depend heavily on the accuracy of individual reports of height and weight and presuppose that any bias in reporting follows similar patterns across demographic groups. In reality, studies have demonstrated that individuals commonly under-report their weight and over-report their height and that the accuracy varies by gender, sexual orientation, weight status, and race/ethnicity.^{5-7 8-10} However, information is lacking on racial/ethnic differences in accuracy of self-reporting weight status in young adults and in racial/ethnic groups beyond Whites, Blacks, and Hispanics. To address this gap, we set out to determine if there were racial/ethnic differences in accuracy of self-reported BMI in a diverse nationally representative sample of young people.

MATERIALS AND METHODS

Sample

We used data from Wave III (data collected in 2001–2 when respondents were aged 18–26) of the National Longitudinal Study of Adolescent Health (Add Health), a nationally representative longitudinal study of adolescents/young adults. After exclusions based on missing data as well as linear-regression based single imputations to address a high non-response rate for the two variables measuring socioeconomic status -- parent-reported maternal education and household income --our final analytic sample was 12,940. Maternal education and household income were imputed from mother's marital status, maternal employment status, spouse/partner's employment status, race, region, and census data including proportion of census tract who identify as white, median household income of census tract residents, proportion of residents living below the poverty line, and proportion of residents with high school diploma.

Outcome variable

BMI (kg/m^2) calculated from the participants' self-reported height (m) and weight (kg), referred to as self-reported BMI.

Primary predictor variables

Self-reported race/ethnicity (Asian/Pacific Islander, American Indian/Alaskan Native, Hispanic, Multi-racial, non-Hispanic White, non-Hispanic Black); and measured BMI

(kg/m²) calculated from height (m) and weight (kg) measured by staff (referred to as measured BMI).

Models were additionally adjusted for factors known to influence weight perception: age, depressive symptoms score (derived from the Centers for Epidemiologic Studies Depression Scale-CESD),¹¹ sum of self-reported physical activity (times/last 7 days), and socioeconomic status of household of origin (i.e., parental report of their own academic achievement and of household income). We chose to include markers of SES of the household of origin given that this is an age group that is in transition. However, models with markers of participant SES showed no material difference from those presented.

Analyses

All analyses were performed using STATA/SE 12.0 and accounted for the complex survey design using svy commands in STATA applying weights to account for the unequal likelihood of being sampled for certain subpopulations. We used multi-variable linear regression to test for bias in reporting of BMI among different racial/ethnic groups, accounting for objectively measured BMI. We tested for evidence of effect modification of the relationship between race/ethnicity and self-reported BMI by: measured BMI, gender, and depressive symptom score. In males, there was improvement of fit of the model with the addition of the interaction terms for race/ethnicity and measured BMI ($p=0.02$ for overall fit). However, of those interaction terms, only that of Native American males \times measured BMI was significantly associated with self-reported BMI and demonstrated improvement in accuracy of self-report with increasing BMI ($\beta=0.20$). There was no evidence of effect modification in females. Given the lack of evidence for effect modification of the effect of race/ethnicity by gender in all but the smallest group, we have concern that this finding is spurious and thus, we present our fully adjusted model without interaction terms. We also tested for model fit with and without a quadratic term to insure that the best fitting model was not curvilinear (e.g., U-shaped or asymptotic) and found no improvement in fit with the addition of the quadratic term. Thus we present the relationships between self-reported and measured BMI in a linear fashion. Regression diagnostic procedures showed no evidence of multicollinearity, heteroscedasticity, or substantial influence from outliers.

RESULTS

There were significant racial/ethnic differences in both measured and self-reported BMIs. In females the measured BMI ranged from an average of 23 kg/m² in Asians to 29 kg/m² in Native Americans. The self-reported BMIs ranged from 22 kg/m² to 28 kg/m² in the same groups. In males the self-reported BMI ranged from 26 kg/m² in Asians to 30 kg/m² in Native Americans while self-reported BMIs were 25 kg/m² and 30 kg/m² in the same population. Anthropometric measures and demographic factors by gender and racial/ethnic groups are presented in Appendix Table 1.

We found variation in the degree of misreporting by race/ethnicity (Table 1). Among females, Blacks ($b_{\text{Black}}=0.45$, CI: 0.19, 0.71) and Hispanics ($b_{\text{Hispanic}}=0.30$, CI: 0.08, 0.52) reported significantly higher BMIs relative to their similarly weighted White peers. Similarly, Black ($b_{\text{Black}}=0.34$, CI: 0.17, 0.51), and Native American ($b_{\text{NativeAmerican}}=0.87$,

CI: 0.15, 1.58) males reported higher BMIs than their White peers, accounting for measured BMI. There were no significant differences in accuracy of self-reported BMI among other racial/ethnic groups relative to Whites in either gender.

Figure 1 demonstrates racial/ethnic differences in accuracy of self-reported BMI for males and females using prototypical plots adjusting for income, education, physical activity and depression variables to derive predicted self-reported BMI for specific racial/ethnic groups. In females with a measured BMI beyond approximately 21, all groups under-report their BMI but Blacks do so to a lesser degree than other racial/ethnic groups. While Blacks over-report their BMI at lower measured BMIs, White, Asian, and Multi-racial females underreport their BMI across all measured BMIs. In males with measured BMIs in the overweight/obese range, all but Native American males underreport their BMI though Blacks do so to a lesser degree than other racial/ethnic groups. Native American males begin underreporting their BMIs at higher measured BMIs. Unadjusted plots showed similar patterns with regards to relative accuracy by different racial/ethnic groups; unadjusted plots are not presented.

We examined similar models with height and weight as our outcomes and found that there was a general pattern of overreporting height (slightly more pronounced in males) and underreporting weight in both males and females. We have chosen to focus on the differences in BMI as this is the measure that is generally the focus of public health surveillance data focused on obesity prevalence.

Of note, we found a positive relationship between the depression score and self-reported BMI in males and females (i.e. those with higher depressive symptoms were more accurate in their self-report) and a negative association between physical activity level and self-reported BMI in females.

DISCUSSION

In this nationally representative sample of racially/ethnically diverse young adults, we find differential misreporting of BMI by race/ethnicity and gender. While the overall population of both males and females underreported their BMIs in the higher range, Hispanic and Black males and females and Native American males reported their BMIs more accurately than their White peers. This is the first study of which we are aware to examine accuracy of BMI reporting in racial/ethnic groups beyond Whites, Blacks, and Hispanics.

Understanding differential reporting bias in BMI among racial/ethnic groups is key to gaining deeper understanding of racial/ethnic disparities in weight status. Many large state-run surveys such as the Centers for Disease Control and Prevention's Youth Risk Behavior Surveillance System¹² and Behavioral Risk Factor Surveillance System¹³ continue to rely on self-report, thus necessitating an understanding of the accuracy of these data. Our findings raise concerns that racial/ethnic disparities in weight status found in self-reported studies may, in part, be due to differential misclassification and may thereby exaggerate the differences. When possible, measured height and weight should be used to understand group differences.

Supplementary Material

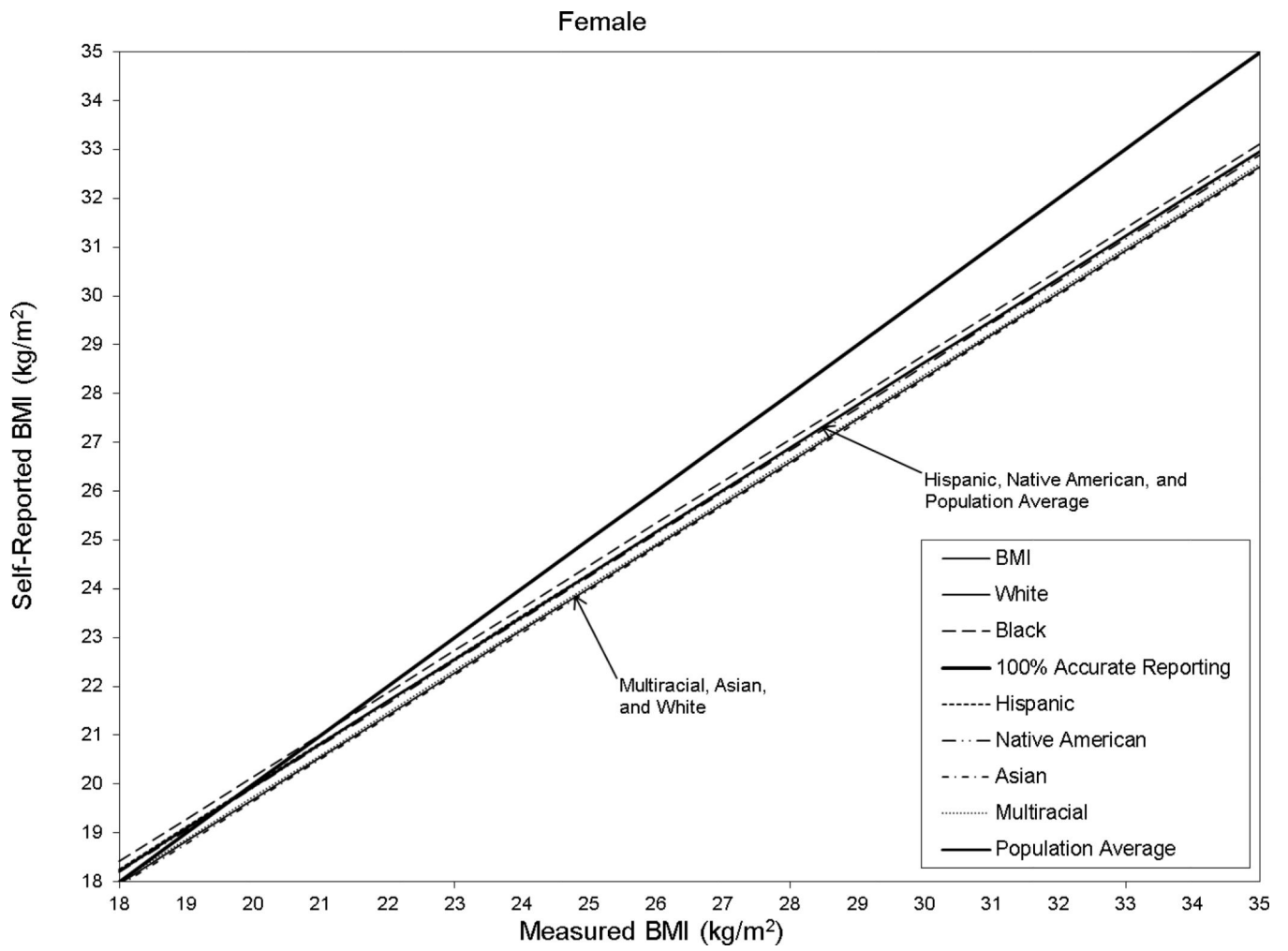
Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGEMENTS

We are grateful for the help of Grace Kennedy in preparing the figure. Tracy Richmond is funded by the NIH Career Development award (NICHD K01 HD058042).

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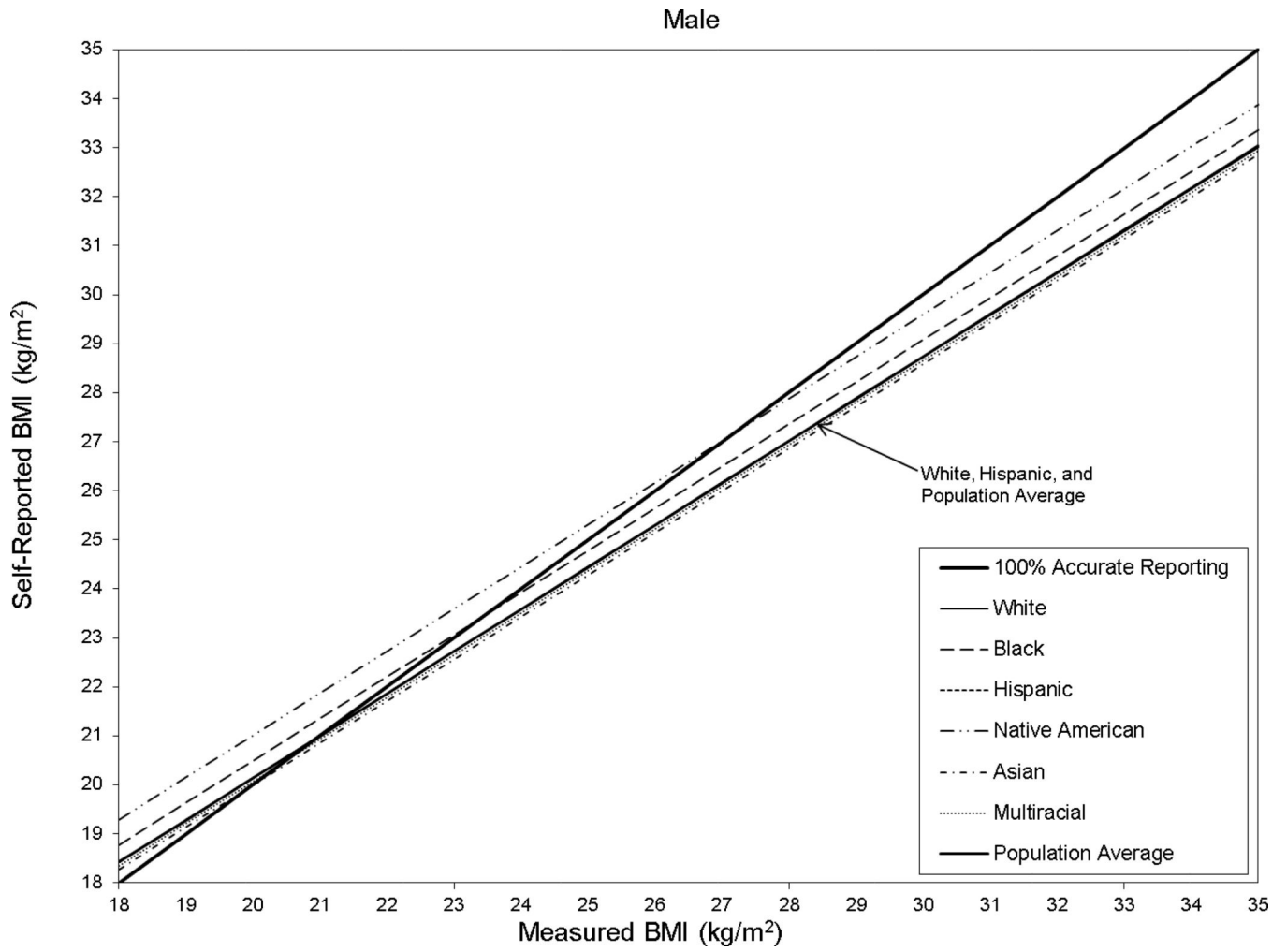


Figure 1. Prototypical plots of measured versus self-reported BMI adjusted for SES, depression, and physical activity in males and females across racial/ethnic groups

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Table 2Characteristics associated with accuracy of self-reported BMI, height and weight in *females and males*

Covariates	Parameter Estimate (95% CI)	
	MALES	FEMALES
	BMI	BMI
Intercept	2.02 ^{***} (1.27, 2.77)	2.11 ^{***} (1.19, 3.04)
Measured BMI/Height/Weight	0.86 ^{***} (0.84, 0.87)	0.86 ^{***} (0.85, 0.88)
Race		
White	Ref.	Ref.
Black	0.35 ^{***} (0.18, 0.52)	0.46 ^{**} (0.20, 0.72)
Hispanic	0.002 (-0.19, 0.20)	0.30 ^{**} (0.08, 0.52)
Asian	-0.15 (-0.33, 0.03)	-0.04 (-0.26, 0.17)
Native American	0.87 [*] (0.16, 1.57)	0.24 (-0.58, 1.06)
Multi-racial	-0.07 (-0.35, 0.21)	0.05 (-0.33, 0.43)
Age	0.05 ^{**} (0.02, 0.08)	0.02 (-0.01, 0.06)
Depression Score	0.01 [*] (0.001, 0.03)	0.02 ^{**} (0.004, 0.03)
Physical activity	0.004 (-0.007, 0.014)	-0.02 ^{**} (-0.03, -0.01)
Maternal Education		
Less than High School	Ref.	Ref.
High School Graduate	-0.21 [*] (-0.40, -0.02)	-0.11 (-0.39, 0.18)
Some College or Trade School	-0.17 (-0.37, 0.04)	-0.20 (-0.47, 0.08)
College Graduate or Above	-0.17 (-0.37, 0.04)	-0.22 (-0.50, 0.06)
Household income of origin (\$ thousands)	-0.0004 (-0.002, 0.001)	-0.001 (-0.002, 0.001)

Key:*
p<0.05;**
p<0.01;***
p<0.001