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Original article

Validity of self-reported height and weight and predictors of bias in adolescents

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Abstract

Purpose: The purpose of this study was to assess the validity of self-reported height and weight, the accuracy of screening for overweight and obesity using these data, and the predictors of bias in self-reported height and weight in adolescents.

Method: The Health Behavior in School-Aged Children (HBSC) survey was used to assess self-reported and measured height and weight in a community sample of 418 students in year 11 from 21 secondary schools in Wales. Participants also provided self-report data on dieting and body perception.

Results: Self-reported and measured height and weight were highly correlated but a bias of underreporting of body weight by an average of .52 kg contributed to underestimation of the prevalence of overweight and obesity. Based on self-report data, 13.9% of the sample was identified as overweight and 2.8% was identified as obese, but measured data showed rates of 18.7% and 4.4%, respectively. Overweight and obese participants showed greater bias and variability in self-reported weight than normal/underweight participants. Body mass index (BMI) and body dissatisfaction predicted bias in self-reported weight.

Conclusion: Self-report bias had significant consequences for the accuracy of a screen for overweight and obesity. Actual and perceived body size each contribute to underreporting body weight. Self-reports will remain an important health surveillance tool but should not be relied on exclusively to detect weight problems. Accuracy checks of self-report data may improve surveys of weight problems in young people.

Keywords: Adolescence; Body height; Body mass index; Body weight; Obesity; Self-assessment; Sensitivity; Specificity

Increasing rates of childhood obesity is a global public health concern [1,2]. In industrialized countries, point prevalence rates of overweight and obesity have more than doubled during the past 2 decades [3,4]. Childhood obesity is linked to immediate health and psychosocial problems and increases the risk for adult obesity, as well as chronic health disorders such as type II diabetes, hypertension, and cardiovascular disease [5]. Accurate monitoring of weight problems in young people is essential to health policy.

For reasons of convenience or cost, self-reported weight and height often replace actual measurements in health surveys. Studies show that self-reports correlate highly with measured data in adolescents and adults [6–11]. Self-reported height and weight also are reliable. A study of 2,032 high school students showed 2-week test-retest reliability coefficients of .93 for both height and weight [7]. But although the reliability of self-reports may be high, their

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validity remains unclear. Correlations between self-report and measured data conceal bias caused by method variance or social desirability [12].

Four studies examined the accuracy of self-report screens for weight problems in adolescents [6–9]. Three of these studies showed that self-reports yielded few false positives but missed a large number of cases. Goodman et al. [6] compared self-reported and measured heights and weights from 15,483 adolescents aged 12–17 years. They found that self-reports and measurements were correlated strongly (*rs* > .9), but because of underreporting of weight by an average of 1.02 kg for girls and .19 kg for boys, self-reports detected only 72.2% of obese cases based on body mass index (BMI) cut-off points. Brener et al. [7] also found high correlations between self-reported and measured height and weight, *rs* = .90 and .93, respectively, but because body weight was underreported by an average of 1.6 kg, their self-report screen for obesity showed 99.2% specificity and just 54.9% sensitivity, missing nearly half the cases of overweight and obesity in their sample. Similar findings came from an Australian study of 572 adolescents aged 15–19 years in which self-reported height and weight correctly classified 84.4% of its sample to normal weight, overweight, and obese groups, with 98.1% specificity and 69.0% sensitivity [8]. Another study from Saudi Arabia actually found higher specificity (91.3% in girls, 93.2% in boys) than sensitivity (77.0% in girls, 80.1% boys) in self-report screens for weight problems in 2,860 students [9]. However, these results are suspect given that 60% of the sample could not self-report weight and height.

Discrepancies between the specificity and sensitivity of a self-report measure can result from systematic error. Adult studies indicate that underreporting body weight is more common among women than men, among dieters than non-dieters, and among overweight and obese individuals than normal/underweight individuals [10,11,13]. These trends have yet to be tested fully on adolescents. Brener et al [7] found age and ethnic differences in bias whereby older and Caucasian adolescents overreported their height more than their younger and African-American and Hispanic counterparts. These researchers also found that girls underreported their weight more than boys, but they did not examine dieting and body dissatisfaction. A study by Wang et al. [8] showed that underreporting body weight was more common among overweight and obese adolescents than in normal/underweight adolescents, but their analysis did not control for gender, dieting, and body dissatisfaction.

The existence of self-report bias in body height and weight generally is well established, but the factors that influence this bias are not well understood, particularly among adolescents. It is unclear whether thoughts and behaviors relating to body size, such as dieting and body perceptions, contribute to self-report bias in adolescents as they do in adults [13]. The objectives of the present study were to examine agreement between measured and self-reported height and weight in adolescents, to determine the sensitivity and specificity of self-reports in estimating rates of overweight and obesity, and to study physical and behavioral predictors of self-report bias in self-reported height and weight.

Methods

Participants

Data were used from the 1998 Welsh sample of the Health Behavior School-Aged Children (HBSC) study [14,15]. Before data collection, the study procedures were approved by the Health Promotion Division of the Welsh Assembly Government and the World Health Organization for formal endorsement of its conformity with the Organization's standards for ethical research practices.

A cluster sample of 51 schools represented a national distribution of schools by size, geographic location (stratified by local education authority), and language of instruction (English and Welsh). Half the schools were selected randomly to measure height and weight in year 11 students in addition to administering survey questionnaires. Twenty-one schools agreed to perform these procedures, resulting in a sample of 418 year 11 pupils (190 boys, 225 girls; gender data missing from 3 cases), with an average of 13–31 participants per school. The mean age of the sample was 16.30 years (SD, 6.30 y; range, 15–17 y). Permission to conduct the survey was obtained at the school and classroom levels so an exact response rate was difficult to determine. Field-workers reported that 5%–10% of pupils were absent on the day of the survey, inevitably creating the possibility of nonresponse bias caused by illness and truancy. Youth in private and special-needs schools and street and incarcerated youth were excluded.

HBSC questionnaire

The HBSC questionnaire assessed health indicators and the behaviors and social factors that influence physical and psychosocial health [14]. A detailed study protocol and list of questionnaire items are available online at www.hbsc.org. Items relevant to the present study measured body height and weight and dieting behavior ("Are you on a diet to lose weight? [no my weight is fine; no but I do need to lose weight; yes, I am on a diet]"). Two items assessed perceptions of body size; one item asked "Do you think your body is (much too thin; a bit too thin; about right size; a bit too fat; much too fat)?" and another question used a scale of 7 body silhouettes that ranged from very thin to very large and asked "Which one is most like you?"

Procedure

Assessments took place in classroom settings in February 1998. Trained staff assessed all sampled pupils who attended school on the day of the survey. Pupils who were absent because of illness or other reasons were not followed-up. Participants were not told that they would be measured for height and weight until after they had all completed the questionnaire. Height and weight measurements were taken (clothes and shoes on) by using a standard height chart and weight scale. It was undetermined whether and how often participants may have weighed and measured themselves before the study.

Statistical analysis

SPSS version 12.0 for Windows (Chicago, Illinois) was used for data management and statistical analyses. BMI (kg/m^2) was calculated on self-reported and measured height and weight. Overweight and obesity were identified using age- and gender-appropriate international cut-off points that pass through BMI values of 25 and 30 kg/m^2 at age 18 [16,17]. Differences between self-reported and measured values were calculated to the nearest .01 kg (weight), .01 m (height), and .01 kg/m^2 (BMI). Group comparisons were performed using analysis of variance or χ^2 tests as appropriate. Bland-Altman plots displayed agreement between self-reported and measured data [12]. Brown-Forsythe tests (between-groups analyses of variance on deviations from group medians) were used to compare data variance in normal/underweight and overweight/obese groups. Regression analysis was used to study influences of age, gender, measured BMI, dieting, and body dissatisfaction on bias in self-reported height and weight. Hierarchical regression models were used to test whether bias was influenced by deviation of body size from perceived body size.

Results

Descriptive statistics on measured and self-reported weight, height, and BMI are shown in Table 1. Self-reported weight was less than measured weight in girls, t(159) = 4.45, $p < .001$, but not in boys. There were no differences found between self-reported height and measured height in boys or in girls. BMIs based on self-report data were lower than BMIs based on measured data in both boys (t(140) = 2.18, $p = .03$) and girls (t(149) = 2.25, $p = .03$). The degree of self-report bias in weight, height, and BMI did not differ between boys and girls.

Correlations between self-reported and measured weight, height, and BMI were high: in boys, r(148) = .94 (weight), r(149) = .87 (height), r(141) = .88 (BMI), $ps < .001$, and in girls, r(203) = .95 (weight), r(177) = .76 (height), and r(150) = .88, $ps < .001$.

Based on self-reports, prevalence estimates of weight problems were 13.9% for overweight and 2.8% for obesity, but according to measured data were 18.7% for overweight and 4.4% for obesity (Table 2). Self-reports led to underestimation of overweight by 4.8% (χ^2[df 1] = 77.00, $p <$ .001), and obesity by 1.6% (χ^2[df 1] = 132.07, $p < .001$). Self-report screening was highly specific in identifying cases of overweight (94.7%) and obesity (99.6%), but only moderately sensitive to these conditions (52.2% overweight, 55.6% obesity). There were no gender differences in sensitivity and specificity.

As shown in Figure 1, Bland-Altman plots revealed an approximately normal distribution of error in self-reported height but an uneven distribution of error in self-reported weight, with heavier weight relating to greater variance. This observation was confirmed by Brown-Forsythe tests in which overweight/obese participants showed more variance in self-reported weight than normal/underweight participants (F[1, 109.45] = 6.64, $p = .011$). No such heterogeneity of variance was found in self-reported height.

To quantify contributions to self-report bias, hierarchical regressions predicted differences between self-reported and measured weight and height. Blocks of variables were entered into the model to allow analysis of their contributions after controlling for previously entered variables. Block 1 included gender and age. Block 2 included BMI derived from measured height and weight. Block 3 included dieting and body perceptions. As shown in Table 3, age and gender did not predict bias in self-reported weight, but after controlling for age and gender BMI was predictive of such bias,

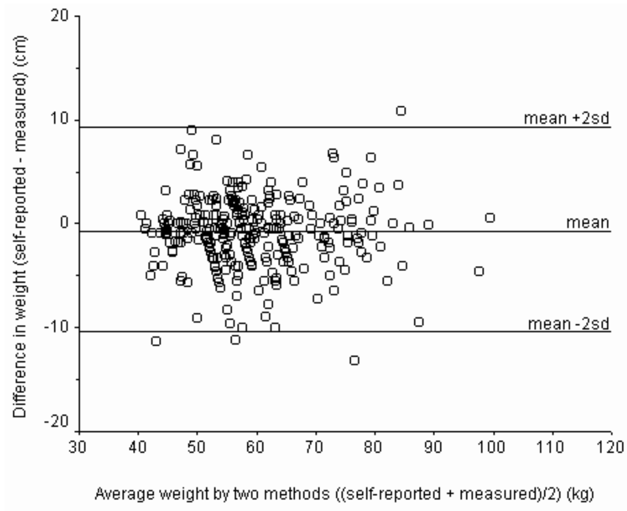
Table 1
Mean weight, height, and BMI based on measured and self-report data (SD)

	Boys, n = 181	Girls, n = 211	Total, n = 395
Measured data			
Weight (kg)	63.52 (11.38)	57.82 (11.81)	60.51 (11.99)
Height (cm)	172.75 (7.68)	162.38 (6.03)	167.15 (8.59)
BMI (kg/m^2)	21.24 (3.29)	21.91 (4.07)	21.61 (3.74)
Self-report data			
Weight (kg)	62.48 (11.34)	56.54 (10.02)	59.27 (11.05)
Height (cm)	173.29 (8.86)	162.93 (7.42)	167.59 (9.61)
BMI (kg/m^2)	20.75 (3.27)	21.36 (3.89)	21.07 (3.62)
Difference between self-report and measured data*			
Weight (kg)	−.43 (3.84)	−.61 (5.76)	−.52 (4.92)
Height (cm)	.58 (4.33)	.31 (5.45)	.43 (4.95)
BMI (kg/m^2)	−.29 (1.61)	−.28 (2.83)	−.29 (2.31)

* Differences do not equal mean measured values minus mean self-reported values owing to missing data.

Table 2
Number of overweight and obese cases based on measured and self-report data using BMI cut-off points (%)

	Boys	Girls	Total
Measured data			
Overweight	36 (19.9)	36 (17.6)	72 (18.7)
Obese	6 (3.3)	11 (5.4)	17 (4.4)
Self-report data			
Overweight	22 (14.8)	22 (13.1)	44 (13.9)
Obese	3 (2.0)	7 (3.6)	9 (2.8)



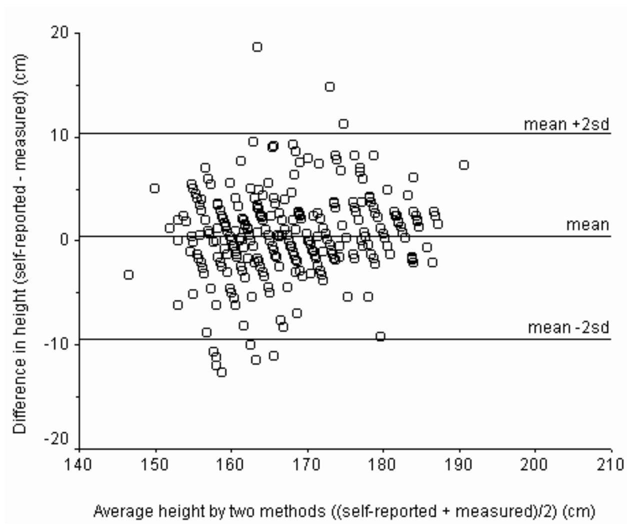


Fig. 1. Bland-Altman plots of differences between measured and self-reported weight (above) and height (below) against the mean of these values (cases that overreported weight by 62.63 kg and underreported height by 36.8 cm and 37.6 cm are not shown).

accounting for 15.9% of the variance. After controlling for age, gender, and BMI, body perception still was predictive of underreporting weight but dieting was not. Analogous regressions of bias in self-reported height showed no significant prediction by age, gender, body size, dieting, or body perceptions.

Discussion

Self-reported height and weight can be used to calculate BMI and provide a categorical measure of overweight and obesity using cut-off points in BMI. The goal of this study was to assess the validity of these categoric data as a screen for overweight and obesity and to explore predictors of self-report bias. Despite highly correlated self-reports and body measurements, the screen missed nearly half of all cases of overweight and obesity. The high specificity and low sensitivity of the screen were similar to previous studies [6–8].

Clearly, highly correlated data from a self-report screen and a valid measure is insufficient to establish validity of the screen. Not all studies on self-report screens for weight problems have scrutinized such data adequately. For example, a validation study of self-reported height and weight was performed with adults [10]. Based on correlations between self-reported and measured height and weight, it was concluded that "some systematic bias was observed. . .although these biases were small and, for most purposes, of little consequence" and that self-reported weight was "extremely accurate" (p. 222) [10]. One could easily infer from these conclusions that self-reports provide accurate rates of weight problems. However, the criterion validity of a screen is poor when it fails to detect a substantial proportion of morbid cases (similar confusion about reliability and validity of self-reported body measurements also was evident in recent correspondence published in this journal [18]). In surveys requesting self-report data on body size, it may be advisable to take measured data from at least a random subsample to examine the size and trajectory of any bias.

The study also showed that self-perceptions of body size

Table 3
Summary of regression of self-report bias in body weight

Variable	Model 1			Model 2			Model 3		
	B	SE B	β	B	SE B	β	B	SE B	β
Gender (female)	.20	.61	.02	.27	.56	.03	−.10	.62	−.01
Age	.12	.45	.02	.21	.42	.03	−.09	.41	−.01
BMI				−.58	.08	−.40*	−.97	.11	−.67*
Dieting							.41	.51	.06
Body perception							.61	.48	.26*
Silhouette choice							1.33	.47	.11
R^2		.001			.159			.237	
F for R^2 change		.089			51.13*			9.12*	

NOTE. N = 310.
* $p < .01$.

predicted bias in self-reported weight (after controlling for measured body size), but that dieting did not predict bias. This result is inconsistent with adult studies that found that dieting contributes to underestimation of body weight [13]. Failure to replicate this finding may be attributed to collinearity of dieting behavior and perceptions of overweight and to the crude measures of dieting and body perception in the HBSC questionnaire. Future studies may test these associations again by using thorough measurements of dietary intake and perceptions of physical appearance, as well as potential contributions by smoking, exercise behavior, or socioeconomic status. Another caveat is that the small size and age range of our sample limited the generalizability of our findings. Further research involving other age groups may elucidate developmental trends in biases in self-reported body size.

Accurate screening of weight problems in young people is essential to epidemiological and clinical research. As rates of overweight and obesity continue to increase, so too will co-existing medical and psychosocial problems. The high prevalence rates of overweight and obesity shown in this study highlight the need for community- and school-based programs that improve nutritional awareness, eating habits, and active lifestyles in young people. More importantly, this study showed that exclusive reliance on adolescents' self-reports can lead to erroneous prevalence estimates of weight problems.

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