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Comparisons of Self-Reported and Measured Height and Weight, BMI, and Obesity Prevalence from National Surveys: 1999–2016

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Abstract

Objective: The aim of this study was to compare national estimates of self-reported and measured height and weight, BMI, and obesity prevalence among adults from US surveys.

Methods: Self-reported height and weight data came from the National Health and Nutrition Examination Survey (NHANES), the National Health Interview Survey, and the Behavioral Risk Factor Surveillance System for the years 1999 to 2016. Measured height and weight data were available from NHANES. BMI was calculated from height and weight; obesity was defined as BMI ≥ 30.

Results: In all three surveys, mean self-reported height was higher than mean measured height in NHANES for both men and women. Mean BMI from self-reported data was lower than mean BMI from measured data across all surveys. For women, mean self-reported weight, BMI, and obesity prevalence in the National Health Interview Survey and Behavioral Risk Factor Surveillance System were lower than self-report in NHANES. The distribution of BMI was narrower for self-reported than for measured data, leading to lower estimates of obesity prevalence.

Conclusions: Self-reported height, weight, BMI, and obesity prevalence were not identical across the three surveys, particularly for women. Patterns of misreporting of height and weight and their effects on BMI and obesity prevalence are complex.

Introduction

Weight and height can be assessed by standardized measurements in a physical examination. For logistical and cost reasons, however, many studies use self-reported weight and height to calculate BMI (weight in kilograms divided by height in meters squared). Several reviews

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Additional Supporting Information may be found in the online version of this article.

have found that participants tend to overreport height and underreport weight, leading to potential bias in estimates of BMI (1,2).

Nationally representative data on weight, height, BMI, and obesity prevalence among adults of all ages in the United States are available from the following three sources: The National Health and Nutrition Examination Survey (NHANES), the National Health Interview Survey (NHIS), and the Behavioral Risk Factor Surveillance System (BRFSS). NHANES and NHIS are programs of the National Center for Health Statistics. BRFSS is a collaborative project of the Centers for Disease Control and Prevention and US states and territories. All three surveys are weighted to be nationally representative of the civilian noninstitutionalized US population. All three surveys include self-reported weight and height data; NHANES additionally provides measured weight and height data. Numerous previous comparisons of self-reported and measured height and weight data within NHANES have identified a variety of factors associated with misreporting of height or weight, including age, sex, measured height or weight, recent physician visits, and health history (3–10).

Because all three surveys are weighted to represent the same national population for the same survey years, the estimates should be comparable across surveys. Several studies have compared estimates from these surveys and shown good agreement for a variety of conditions (11–18). Grabner (19) used data from all three surveys from the 1970s to 2008 for a descriptive investigation of trends in BMI in the United States over time in a subset of white, black, and Hispanic adults aged 20 to 74 years.

Our purpose is to provide a descriptive comparison of weight, height, BMI, and obesity prevalence from these three national surveys in the United States over the period 1999 through 2016 by using both self-reported and measured data from one survey and self-reported data from the two other surveys. We present a detailed examination of how the self-reported and measured data in NHANES compare with self-reported data from other surveys for the same time period and the same target population and across a different set of dimensions, including height, weight, BMI, and obesity prevalence. For example, just because mean BMI is similar does not mean that the prevalence of obesity will be similar. Our paper is a comprehensive look at these issues.

Methods

Survey descriptions

The NHANES program is a series of surveys using in-home interviews and standardized physical examinations conducted in mobile examination centers. In 1999, the survey became continuous without a break between cycles. Data are released in 2-year cycles. In each survey cycle, a nationally representative sample of the US civilian noninstitutionalized population is selected using a complex, stratified, multistage probability cluster sampling design. In the 2015–2016 survey, the interview and examination response rates for NHANES were 61% and 59%. An extensive description of the plan and operation of NHANES has been published (20). Additional information is available at https://www.cdc.gov/nchs/nhanes/index.htm.

NHIS is a survey collecting data on a broad range of health topics through in-person household interviews (21,22). NHIS is a household-based survey in which basic sociodemographic information is collected from a family respondent and then a sample adult and sample child are randomly selected to receive more detailed health questions. Follow-up may be completed by phone if necessary. In 2016, the sample adult component response rate for NHIS was 54.3%. Beginning in 2006, the NHIS data release included a variable to indicate whether part of the interview had been conducted by telephone, although not which part of the interview. We analyzed the data release files and found that between 2006 and 2016, 22.5% of respondents had some part of their interview conducted over the telephone. The content of the survey has been updated every 10 to 15 years. Survey results have been instrumental in providing data to track health status, health care access and utilization, health insurance, health-related risk factors, and progress toward achieving national health objectives. Additional information is available at https://www.cdc.gov/nchs/nhis/index.htm.

BRFSS was established in 1984 with data from 15 states, and it has been a nationwide surveillance system since 1993. This ongoing state-based survey collects data through telephone interviews regarding residents' health-related risk behaviors, chronic health conditions, access to health care, and use of preventive services. In 2011, BRFSS implemented new methods related to the inclusion of cell phones and improved statistical weighting (23). In 2016, the landline and cell phone response rates for BRFSS were 48% and 46%. Extensive information about the design and conduct of the survey is available from http://www.cdc.gov/brfss/.

Here, we used NHANES data from nine 2-year survey cycles from 1999–2000 through 2015–2016 and annual data from NHIS and BRFSS covering the same years. All data used here come from the free and publicly available anonymized data files for each survey, and no additional deletions or changes were made for this analysis. Total sample sizes for these analyses were 43,320 for NHANES, 510,620 for NHIS, and 6,200,791 for BRFSS. Sample sizes by year are shown in Supporting Information Table S1.

Weight and height data

In NHANES, weight and height are queried in an in-person interview in the household. Participants are informed that the interview will be followed several weeks later by a physical examination in a mobile examination center; in that examination, weight and height are measured using standardized procedures (20). In NHIS, weight and height are queried in an in-person interview in the household. In BRFSS, weight and height are queried in a telephone interview. The wording of questions regarding weight and height in each survey are shown in Supporting Information Table S2.

For NHANES, measured and self-reported values of weight and height above the 99th percentile or below the 1st percentile for a particular age or age-gender group are flagged for review as part of the data release processing by National Center for Health Statistics. Values that are considered to be unrealistic (< 10 per survey cycle) are set to missing. None of the original body measure data are changed, and no imputed values are generated. Measured and self-reported height and weight were taken from the public use data files; we calculated BMI values from the measured and self-reported weight and height data.

For NHIS data release, extreme values for the lowest or highest 1.5% of records for either height or weight are reported as “not available” on the public use data files for confidentiality reasons. For 2006–2016, weight or height data were set to “not available” for those with height < 59 inches or ≥ 76 inches or weight < 100 lb or ≥ 299 lb. For 1999–2005, the criteria were based on height < 59 inches or ≥ 76 inches or weight < 99 lb or ≥ 285 lb. For NHIS data release, BMI is calculated for all persons who provide valid values for height and weight, including those for whom specific height and weight values are changed to “not available” on the public use file for reasons of confidentiality. Extremely high and low values of weight (< 50 or > 500 lb) and height (< 24 inches or > 95 inches) are considered invalid.

For BRFSS, extreme values for height and weight are set to missing on public release data files for data quality reasons. For 2011–2016, records were excluded for those with height < 3 feet or ≥ 8 feet and weight < 50 lb or ≥ 650 lb. Before 2011, exclusions were based on height < 3 feet or ≥ 7 feet and weight < 50 lb or ≥ 500 lb. The values set to missing are not used to calculate BMI values on the public use data files.

Respondents report only weight and height. BMI and the prevalence of obesity are secondarily calculated from the reported weight and height values. Obesity is defined as BMI ≥ 30 for all surveys. All presentations are sex specific because of the well-established sexual dimorphisms in height, weight, and adiposity (24) and differences in reporting by sex (1).

Comparisons across surveys

We compared four variables across surveys: weight, height, BMI, and obesity prevalence. Differences are presented graphically. We show sex-specific graphical comparisons across all survey years for measured and self-reported weight, height, BMI, and obesity prevalence in the following four sets of estimates: NHANES measured, NHANES self-reported, NHIS, and BRFSS. Solid lines are used to connect data points, but not all surveys provide data for all years. NHANES data from 1999 onward are plotted as the midpoint of 2-year intervals. Differences by sex in the prevalence of obesity across the surveys were compared using a ratio of age-adjusted obesity prevalence among men to age-adjusted obesity prevalence among women for each year. For comparisons of self-reported data across surveys, statistical testing of differences was not performed.

Statistical methods

Obesity prevalence estimates were age adjusted by the direct method to the 2000 US standard population using the age groups 20 to 39 years, 40 to 59 years, and 60 years and older. Pregnant women were omitted from all analyses. Statistical analyses were carried out using SAS version 9.4 (SAS Institute, Cary, North Carolina) and SUDAAN 11.0.0 (RTI, Research Triangle Park, North Carolina). For all surveys, sampling weights were provided that accounted for unequal probabilities of selection resulting from the sample design and planned oversampling of certain subgroups and adjusted for nonresponse. Although all three surveys are weighted to be nationally representative, there are differences in the precise sample design and weighting procedures (21–23,25,26).

Supplemental NHANES analyses

Differences within NHANES between self-reported and measured weight, height, BMI, and obesity prevalence are tabulated in Supporting Information Tables S3–S6. In order to more fully evaluate differences between self-reported and measured values, and whether the differences are changing over time, regression analyses within NHANES data were conducted. The associations of survey cycle, age group (< 60 years and ≥ 60 years), and measured height with the difference between self-reported and measured height were tested using sex-specific linear regression models. The associations of survey cycle, age group, and measured weight in categories of obesity status (BMI < 30 and BMI ≥ 30) with the differences between self-reported and measured weight or BMI were also tested using sex-specific linear regression. Age group and obesity status were included in the models as predictor variables because previous research has shown that misreporting varies by age (between older and younger/middle aged adults) and obesity status (1,2,4,8). Logistic regression models were used to test the associations of survey cycle and age grouping with differences in obesity prevalence estimates between self-reported and measured values. Results from all models are tabulated in Supporting Information Table S7 and are reported here. All analyses used the sampling weights and took into account differential probabilities of selection and the complex sample design. Standard errors were estimated with SUDAAN using Taylor series linearization. Statistical significance was determined as $P < 0.05$.

Results

Height

As shown in Figure 1, for every survey year, mean self-reported heights for all three surveys were greater than mean measured heights from NHANES for both men and women. The mean self-reported heights in BRFSS and in NHIS were similar to but slightly higher than the mean self-reported heights in NHANES. For men, the overall mean differences in self-reported height relative to NHANES self-reported height were 0.1 cm in NHIS and 0.4 cm in BRFSS; corresponding values for women were 0.1 cm and 0.3 cm.

Weight

As displayed in Figure 2, the comparisons of self-reported to measured weights across surveys differed somewhat between men and women. For women in every survey cycle, mean self-reported weights for all three surveys were lower than mean measured weights from NHANES. The mean self-reported weights from the other surveys were lower than mean self-reported weights from NHANES. For women, mean self-reported weights in NHIS were 2.8 kg lower and the mean self-reported weights in BRFSS were 1.9 kg lower than the mean self-reported weights in NHANES.

For men, the differences between self-reported and measured weights and in self-reported weights between surveys were less pronounced and less systematic than for women. Overall for men, the mean self-reported weights in NHIS and BRFSS tended to be lower than the mean self-reported weights in NHANES across most survey cycles, as depicted in Figure 2. For men, the mean self-reported weights in NHIS were 1.4 kg lower and the mean self-reported weights in BRFSS were 0.3 kg lower than the mean self-reported weights in NHANES (Figure 2).

BMI

As displayed in Figures 3 and 4, for both men and women and across all survey cycles, mean BMI calculated from self-reported weights and heights for all three surveys was lower than mean BMI calculated from measured values from NHANES. For men, relative to mean BMI values calculated from self-reported weights and heights from NHANES, mean values from BRFSS and NHIS were both 0.2 units lower on average. Corresponding values for women were 0.7 units lower from NHIS and 0.8 units lower from BRFSS.

The distributions of BMI, weight, and height in the three surveys are shown in Table 1. Relative to measured BMI, BMI distributions from self-reported data were narrower, with differences particularly evident at the higher percentiles. Median BMI values were lower for self-reported data than for measured data for both men and women and were lower for the self-reported data from NHIS and BRFSS than for self-reported data from NHANES. The result was that, relative to measured data, the entire BMI distribution was compressed for self-reported data from NHANES and more so for self-reported data from NHIS and BRFSS. The interquartile range for height was similar across different types of data and tended to be slightly higher for self-reported than for measured data. For weight, the distribution was slightly compressed for self-reported data. For women, the highest percentiles of weight were considerably lower for self-reported data than for measured data.

Obesity prevalence

Obesity is calculated as BMI ≥ 30. As displayed in Figures 5 and 6, for both men and women and across all survey cycles, obesity prevalence calculated from self-reported data for all three surveys was lower than obesity prevalence from measured data for NHANES. For men, relative to age-adjusted obesity prevalence using self-reported data from NHANES, age-adjusted obesity prevalence using self-reported data from NHIS was 2.0 percentage points lower, and age-adjusted obesity prevalence using self-reported data from BRFSS was 2.7 percentage points lower. The corresponding figures for women were 4.9 and 5.7 percentage points.

The direction of the difference in obesity prevalence between men and women varied by survey. In both measured data and self-reported data from NHANES, the prevalence of obesity was lower among men than among women overall and in almost every survey cycle, with a single exception (Table 2). To describe this, we reexpressed the data shown in the figures as the ratio of obesity prevalence among men to obesity prevalence among women, as shown in Table 2. The mean ratio of obesity prevalence among men to obesity prevalence among women across all data years was 0.91 for measured data and 0.93 for self-reported data. However, in both the NHIS and the BRFSS data, the prevalence of obesity was higher among men than among women in every survey cycle, with a single exception, with a mean ratio across all data years of 1.03 for NHIS and 1.04 for BRFSS.

Supplemental NHANES analyses

On average in NHANES, both men and women overreported height in every survey cycle (Supporting Information Table S3). The overall mean difference, calculated as self-reported minus measured heights, was 1.36 cm for men and 0.87 cm for women. In linear regression models, age group, measured height, and survey cycle were significant predictors of the difference for both men and women.

On average in NHANES, women underreported weight in every survey cycle (Supporting Information Table S4). In linear regression models, measured BMI category but not age group or survey cycle was a significant predictor of the difference between measured and self-reported weights. The overall mean difference, calculated as self-reported minus measured weights, was −1.37 kg for women. On average, in NHANES, men underreported weight by 0.08 kg. In linear regression models, age group, measured BMI category, and survey cycle were all significant predictors of the difference between self-reported and measured weights. Men with measured BMI ≥ 30 underreported weight on average, and men with measured BMI < 30 overreported weight on average.

On average in NHANES, BMI calculated from self-reported weights and heights was lower than BMI from measured data for both men and women (Supporting Information Table S5). In linear regression models, significant predictors of the difference between self-reported and measured BMI were age group, measured BMI category, and survey cycle for men and age group and measured BMI category for women.

In NHANES, obesity prevalence calculated from self-reported weights and heights was lower than obesity prevalence based on measured values for both men and women (Supporting Information Table S6). In logistic regression models, the only significant predictor of the difference between self-reported and measured obesity prevalence was age group for women. Survey cycle was not a significant predictor for either men or women. For men, age-adjusted obesity prevalence using self-reported data from NHANES was 3.11 percentage points lower than age-adjusted obesity prevalence using measured data from NHANES. For women, age-adjusted obesity prevalence using NHANES self-reported data was 4.2 percentage points lower than age-adjusted obesity prevalence using measured data from NHANES.

Discussion

We compared weight, height, and the derived variables of BMI and obesity prevalence from three national surveys. For height and weight, findings were similar to those that have been described from other studies (1,2). Across all NHANES surveys between 1999 and 2016, both men and women showed a tendency to overreport height relative to measured height; self-reported heights were similar across NHANES, NHIS, and BRFSS. For weight, underreporting of weight for women was larger than that for men, and self-reported weights were lower in NHIS and BRFSS than in NHANES.

The relation of errors in self-reported weight and height to errors in BMI and obesity is indirect. BMI reflects the combined effects of errors in weight reporting and in height reporting. It is possible for those errors to enhance or reduce the total error in BMI. For example, overreporting of height will tend to reduce BMI calculated from self-reported data, but overreporting of weight will tend to increase BMI calculated from self-reported data. Because height is in the denominator of BMI, overreporting of height leads to lower values of BMI. The net effects on BMI will depend on the magnitude and direction of reporting errors for weight and height. Some examples are shown in Supporting Information Table S8.

Underreporting of obesity prevalence was more pronounced for women than for men. In NHANES, obesity prevalence estimates from both measured and self-reported data were lower for men than for women, but in NHIS and BRFSS, obesity prevalence estimates were higher for men than for women. Similar findings of differences across gender, race, age, and education subgroups were reported by Yun et al. (27) who compared obesity prevalence in NHANES with BRFSS by demographic and social categories. Thus, the extent to which self-reported data can be used appropriately to compare findings across subgroups may be limited.

Secondary analysis of NHANES data showed that overreporting of height increased over time in both men and women, while underreporting of weight increased in men but not women. The under-reporting of weight among men increased only among those with BMI above 30. Thus, these changes did not result in changes in the difference between self-reported and measured obesity prevalence over time (survey cycle) in either men or women.

Studies of reporting accuracy that use only mean values of weight, height, and BMI to compare self-reported and measured values may not adequately address issues such as obesity prevalence that are related not only to mean values but also to the distribution of reported versus measured values. For example, although the mean values from NHANES data suggest better agreement between measured and reported BMI on average for men compared with women, obesity prevalence is nonetheless quite different between measured and reported values. The systematic errors characteristic of self-reported weight and height data can lead to a compression of the distribution of BMI. Thus, despite small mean differences, using BMI from self-reported data can lead to considerable misclassification into BMI categories, which in turn can bias hazard ratios in epidemiologic studies (28). BMI calculated from self-reported data also tends to have a narrower distribution than does measured BMI, which also can bias hazard ratios upward, making associations appear stronger than they really are (29).

Several studies have attempted to use NHANES self-reported and measured weight data to generate corrections for BRFSS self-reported weight and height data (11,12,15) or for NHIS data (12,17,18,30), as well as for other data sets (31,32). However, the differences between the self-reported data in NHANES and the self-reported data in NHIS and BRFSS suggest that such corrections may not be completely accurate. For example, as indicated by the male-female ratios of age-adjusted obesity prevalence, the prevalence of obesity among men was lower than among women based on measured and self-reported data from NHANES but higher than among women in NHIS and BRFSS. In addition, because weight and height data are characterized by systematic errors, it is difficult to correct the errors using prediction equations (33). As the data presented here show, conclusions about the properties of BRFSS and NHIS self-reported data cannot necessarily be drawn from the comparisons of measured and self-reported data from NHANES.

Several studies have compared self-reported weights and heights or derived versions among NHANES, NHIS, and BRFFS. Li et al. (15) found similar obesity prevalence estimates among NHANES, NHIS, and BRFSS based on self-reported weights and heights for all but did not consider obesity prevalence based on measured weights and heights from NHANES. Fahimi et al. (13) compared 2004 self-reported data for all three surveys and found no significant height differences overall, but the authors did find significant differences for men and not for women. In contrast, for weight, there were significant differences overall and significant differences for women but not for men.

All three surveys are weighted to be nationally representative (21–23,25,26); however, comparisons may be affected by differences in survey design, question wording, or data editing. Another potential source of differences between surveys is mode of administration. In NHANES, participants reported weight and height during a household interview and were also informed that a subsequent physical examination would include weight and height measurements. Some data suggest that self-reported weight and height data may be more accurate when participants know that they will be followed by measurement (12,34–36), as in NHANES, and more accurate when collected via face-to-face interview, as in NHANES and NHIS, than when collected by telephone, as in BRFSS (12,35,37,38). However, the results presented here suggest that this may not necessarily always be the case.

Conclusion

Here, we present a detailed examination of how the self-reported and measured anthropometric data in NHANES compare with self-reported anthropometric data from other national surveys (NHIS and BRFSS) for the same time period and the same target population across a different set of dimensions, including height, weight, BMI, and obesity prevalence. Patterns of reporting of height and weight vary by age, sex, weight or height, and survey type. The net impact of misreporting on mean BMI depends on the magnitude and direction of the misreporting, which may be different for height than for weight. Secondary measures such as BMI and obesity prevalence calculated from self-reported weight and height may exhibit unpredictable types of bias. For example, just because mean BMI is similar does not mean that the prevalence of obesity will be similar. Thus, the net effect of misreporting on obesity prevalence may vary depending on the age and sex composition of the population and other characteristics related to misreporting. Patterns of misreporting of height and weight and their effects on BMI and obesity prevalence are complex.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

References

1. Connor Gorber S, Tremblay M, Moher D, Gorber B. A comparison of direct vs. self-report measures for assessing height, weight and body mass index: a systematic review. Obes Rev 2007;8:307–326. [PubMed: 17578381]
2. Maukonen M, Mannisto S, Tolonen H. A comparison of measured versus self-reported anthropometrics for assessing obesity in adults: a literature review. Scand J Public Health 2018;46:565–579. [PubMed: 29528773]
3. Gillum RF, Sempos CT. Ethnic variation in validity of classification of overweight and obesity using self-reported weight and height in American women and men: the Third National Health and Nutrition Examination Survey. Nutr J 2005;4:27. doi:10.1186/1475-2891-4-27 [PubMed: 16209706]
4. Kuczmarski MF, Kuczmarski RJ, Najjar M. Effects of age on validity of self-reported height, weight, and body mass index: findings from the Third National Health and Nutrition Examination Survey, 1988–1994. J Am Diet Assoc 2001;101:28–34. [PubMed: 11209581]
5. Merrill RM, Richardson JS. Validity of self-reported height, weight, and body mass index: findings from the National Health and Nutrition Examination Survey, 2001–2006. Prev Chronic Dis 2009;6:A121 http://www.cdc.gov/pcd/issues/2009/oct/08_0229.htm [PubMed: 19754997]
6. Rowland ML. Self-reported weight and height. Am J Clin Nutr 1990;52:1125–1133. [PubMed: 2239790]
7. Sahyoun NR, Maynard LM, Zhang XL, Serdula MK. Factors associated with errors in self-reported height and weight in older adults. J Nutr Health Aging 2008;12:108–115. [PubMed: 18264637]
8. Villanueva EV. The validity of self-reported weight in US adults: a population based cross-sectional study. BMC Public Health 2001;1:11. doi:10.1186/1471-2458-1-11 [PubMed: 11716792]
9. Craig BM, Adams AK. Accuracy of body mass index categories based on self-reported height and weight among women in the United States. Matern Child Health J 2009;13:489–496. [PubMed: 18607705]
10. Wen M, Kowaleski-Jones L. Sex and ethnic differences in validity of self-reported adult height, weight and body mass index. Ethn Dis 2012;22:72–78. [PubMed: 22774312]
11. Chou SY, Grossman M, Saffer H. An economic analysis of adult obesity: results from the Behavioral Risk Factor Surveillance System. J Health Econ 2004;23:565–587. [PubMed: 15120471]
12. Ezzati M, Martin H, Skjold S, Vander HS, Murray CJ. Trends in national and state-level obesity in the USA after correction for self-report bias: analysis of health surveys. J R Soc Med 2006;99:250–257. [PubMed: 16672759]
13. Fahimi M, Link M, Mokdad A, Schwartz DA, Levy P. Tracking chronic disease and risk behavior prevalence as survey participation declines: statistics from the behavioral risk factor surveillance system and other national surveys. Prev Chronic Dis 2008;5:A80 http://www.cdc.gov/pcd/issues/2008/jul/07_0097.htm [PubMed: 18558030]
14. Le A, Judd SE, Allison DB, et al. The geographic distribution of obesity in the US and the potential regional differences in misreporting of obesity. Obesity (Silver Spring) 2014;22:300–306. [PubMed: 23512879]
15. Li C, Balluz LS, Ford ES, Okoro CA, Zhao G, Pierannunzi C. A comparison of prevalence estimates for selected health indicators and chronic diseases or conditions from the Behavioral Risk Factor Surveillance System, the National Health Interview Survey, and the National Health and Nutrition Examination Survey, 2007–2008. Prev Med 2012;54:381–387. [PubMed: 22521996]
16. Nelson DE, Powell-Griner E, Town M, Kovar MG. A comparison of national estimates from the National Health Interview Survey and the Behavioral Risk Factor Surveillance System. Am J Public Health 2003;93:1335–1341. [PubMed: 12893624]
17. Schenker N, Raghunathan TE, Bondarenko I. Improving on analyses of self-reported data in a large-scale health survey by using information from an examination-based survey. Stat Med 2010;29:533–545. [PubMed: 20029804]
18. Stommel M, Schoenborn CA. Accuracy and usefulness of BMI measures based on self-reported weight and height: findings from the NHANES & NHIS 2001–2006. BMC Public Health 2009;9:421. doi:10.1186/1471-2458-9-421 [PubMed: 19922675]

19. Grabner M BMI trends, socioeconomic status, and the choice of dataset. Obes Facts 2012;5:112–126. [PubMed: 22433623]
20. Zipf G, Chiappa M, Porter KS, Ostchega Y, Lewis BG, Dostal J. National Health and Nutrition Examination Survey: plan and operations, 1999–2010 Vital and Health Statistics, series 1, no. 56 Hyattsville, MD: National Center for Health Statistics; 2013.
21. Botman SL, Moriarity CL; NCHS Office of Research and Methodology. Design and estimation for the National Health Interview Survey, 1995–2004 Vital and Health Statistics, series 2, no. 130 Hyattsville, MD: National Center for Health Statistics; 2000.
22. Parsons VL, Moriarity C, Jonas K, Moore TF, Davis KE, Tompkins L. Design and estimation for the National Health Interview Survey, 2006–2015 Vital and Health Statistics, series 2, no. 165 Hyattsville, MD: National Center for Health Statistics; 2014.
23. Centers for Disease Control and Prevention. Methodologic changes in the Behavioral Risk Factor Surveillance System in 2011 and potential effects on prevalence estimates. MMWR Morb Mortal Wkly Rep 2012;61:410–413. [PubMed: 22672976]
24. Wells JC. Sexual dimorphism in body composition across human populations: associations with climate and proxies for short- and long-term energy supply. Am J Hum Biol 2012;24:411–419. [PubMed: 22345077]
25. Chen TC, Parker JD, Clark J, Shin HC, Rammon JR, Burt VL. National Health and Nutrition Examination Survey: estimation procedures, 2011–2014 Vital and Health Statistics, series 2, no. 177 Hyattsville, MD: National Center for Health Statistics; 2018.
26. Mirel LB, Mohadjer LK, Dohrmann SM, et al. National Health and Nutrition Examination Survey: estimation procedures, 2007–2010 Vital and Health Statistics, series 2, no. 159 Hyattsville, MD: National Center for Health Statistics; 2013.
27. Yun S, Zhu BP, Black W, Brownson RC. A comparison of national estimates of obesity prevalence from the Behavioral Risk Factor Surveillance System and the National Health and Nutrition Examination Survey. Int J Obes (Lond) 2006;30:164–170. [PubMed: 16231026]
28. Flegal KM, Kit BK, Graubard B. Bias in hazard ratios arising from misclassification by self-reported weight and height in observational studies of body mass index and mortality. Am J Epidemiol 2018;187:125–134. [PubMed: 29309516]
29. Ni Mhurchu C, Parag V, Nakamura M, Patel A, Rodgers A, Lam TH. Body mass index and risk of diabetes mellitus in the Asia-Pacific region. Asia Pac J Clin Nutr 2006;15:127–133. [PubMed: 16672195]
30. Stommel M, Osier N. Temporal changes in bias of body mass index scores based on self-reported height and weight. Int J Obes (Lond) 2013;37:461–467. [PubMed: 22546777]
31. Berrington de Gonzalez A, Hartge P, Cerhan JR, et al. Body-mass index and mortality among 1.46 million white adults. N Engl J Med 2010;363:2211–2219. [PubMed: 21121834]
32. Yu D, Zheng W, Johansson M, et al. Overall and central obesity and risk of lung cancer: a pooled analysis. J Natl Cancer Inst 2018;110:831–842. [PubMed: 29518203]
33. Plankey MW, Stevens J, Flegal KM, Rust PF. Prediction equations do not eliminate systematic error in self-reported body mass index. Obes Res 1997;5:308–314. [PubMed: 9285836]
34. Cash TF, Counts B, Hangen J, Huffine CE. How much do you weigh?: Determinants of validity of self-reported body weight. Percept Mot Skills 1989;69:248–250.
35. Scribani M, Shelton J, Chapel D, Krupa N, Wyckoff L, Jenkins P. Comparison of bias resulting from two methods of self-reporting height and weight: a validation study. JRSM Open 2014;5:2042533313514048. doi:10.1177/2042533313514048 [PubMed: 25057397]
36. Black DR, Taylor AM, Coster DC. Accuracy of self-reported body weight: Stepped Approach Model component assessment. Health Educ Res 1998;13:301–307. [PubMed: 10181028]
37. Béland Y, St-Pierre M. Mode effects in the Canadian Community Health Survey: a comparison of CAPI and CATI In: Lepkowski JM, Tucker C, Brick JM, et al., eds. Advances in Telephone Survey Methodology. Hoboken, NJ: John Wiley & Sons; 2008:297–314.
38. Taylor AW, Dal Grande E, Gill TK, et al. How valid are self-reported height and weight? A comparison between CATI self-report and clinic measurements using a large cohort study. Aust N Z J Public Health 2006;30:238–246. [PubMed: 16800200]

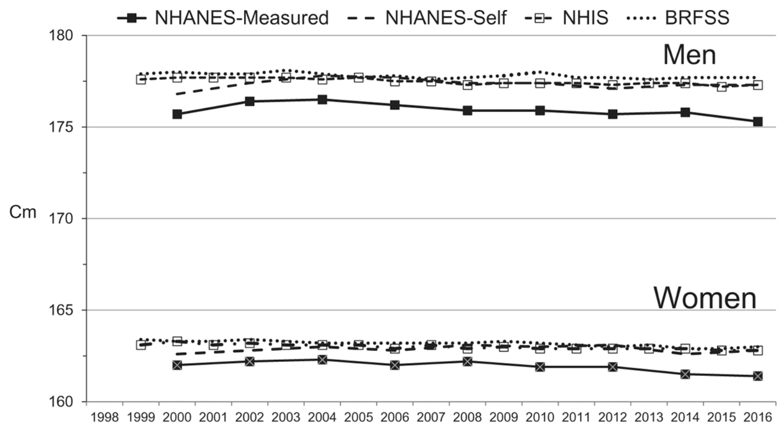

Figure 1.

Mean height by survey, 1999 through 2016.

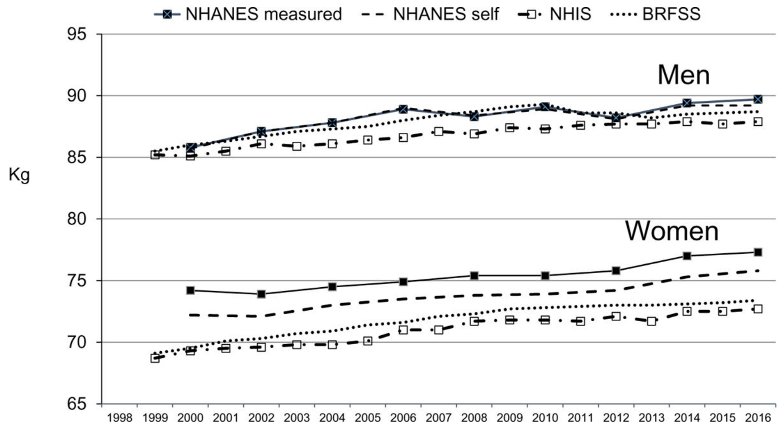

Figure 2.
Mean weight by survey, 1999 through 2016.

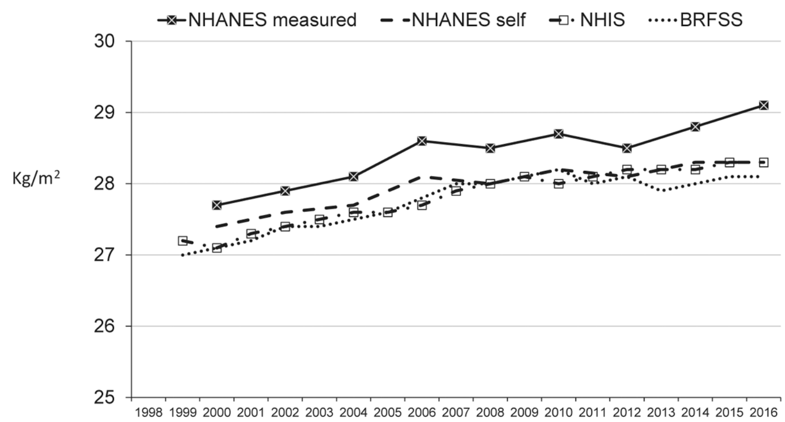

Figure 3.

Mean BMI by survey for men, 1999 through 2016.

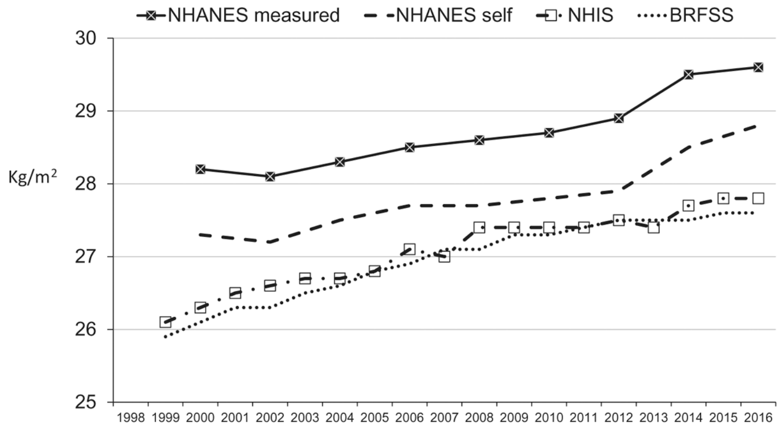

Figure 4.

Mean BMI by survey for women, 1999 through 2016.

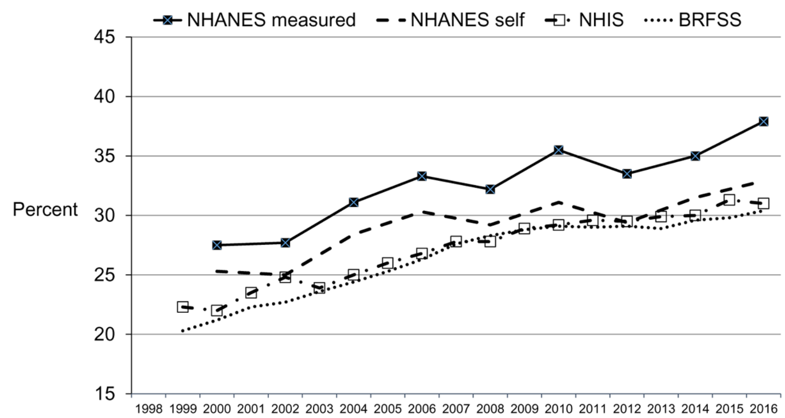

Figure 5.
Age-adjusted obesity prevalence by survey for men, 1999 through 2016.

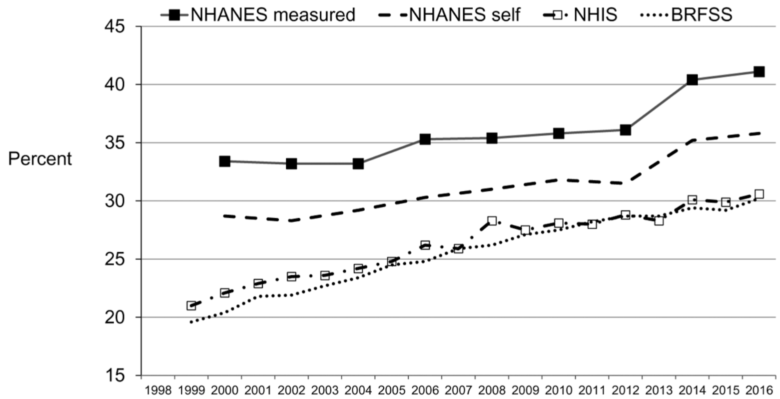

Figure 6.
Age-adjusted obesity prevalence by survey for women, 1999 through 2016.

TABLE 1

Selected percentiles and IQR of BMI, weight, and height by sex and survey: NHANES, NHIS, and BRFSS, 1999–2016

	5th	10th	25th	50th	75th	90th	95th	IQR
BMI								
Male								
NHANES measured	20.6	22.0	24.5	27.6	31.3	35.6	39.1	6.8
NHANES self-report	20.8	22.1	24.3	27.1	30.7	34.6	37.8	6.4
NHIS	20.9	22.2	24.3	27.0	30.4	34.5	37.6	6.1
BRFSS	20.9	22.2	24.3	27.0	30.2	34.2	37.2	5.9
Female								
NHANES measured	19.5	20.8	23.3	27.3	32.6	38.5	42.5	9.3
NHANES self-report	19.4	20.4	22.8	26.5	31.5	37.1	41.0	8.7
NHIS	19.2	20.2	22.4	25.7	30.3	35.7	39.8	7.9
BRFSS	19.3	20.3	22.4	25.7	30.0	35.2	39.1	7.6
Weight (kg)								
Male								
NHANES measured	61.6	66.2	74.8	85.3	98.6	112.9	124.0	23.8
NHANES self-report	63.1	67.6	74.8	85.0	98.1	112.1	122.3	23.3
NHIS	64.3	67.9	75.4	83.9	95.2	108.6	115.5	19.8
BRFSS	63.5	68.0	75.0	84.9	97.4	111.2	122.3	22.4
Female								
NHANES measured	50.2	53.8	61.0	71.4	85.7	102.5	114.4	24.7
NHANES self-report	49.8	53.4	59.9	69.9	82.8	99.6	111.0	22.9
NHIS	50.1	54.0	58.9	67.8	79.5	91.9	101.8	20.6
BRFSS	49.9	53.6	59.1	68.1	81.3	93.6	104.5	22.2
Height (cm)								
Male								
NHANES measured	163.3	166.2	170.8	176.0	181.0	185.5	188.2	10.2
NHANES self-report	162.9	165.9	170.7	176.4	181.6	186.2	188.8	10.9
NHIS	164.1	166.5	171.1	176.5	181.4	185.6	187.8	10.3
BRFSS	163.3	166.2	171.2	176.8	181.9	186.5	189.3	10.7

	5th	10th	25th	50th	75th	90th	95th	IQR
Female								
NHANES measured	150.4	153.0	157.2	162.0	166.6	170.7	173.3	9.4
NHANES self-report	150.2	152.4	156.6	161.5	166.5	170.8	173.6	9.9
NHIS	151.0	153.1	156.9	161.5	166.4	170.3	172.6	9.5
BRFSS	150.6	152.7	156.9	161.7	166.7	171.1	174.0	9.8

IQR calculated as difference between 75th percentile and 25th percentile.

IQR, interquartile range.

TABLE 2

Ratio of age-adjusted obesity prevalence among men to age-adjusted obesity prevalence among women by year and survey: NHANES, NHIS, and BRFSS, 1999–2016

Survey year	NHANES measured	NHANES self-report	NHIS	BRFSS
1999			1.06	1.04
2000	0.82	0.88	1.00	1.04
2001			1.03	1.02
2002	0.83	0.88	1.06	1.04
2003			1.01	1.04
2004	0.94	0.97	1.03	1.04
2005			1.05	1.03
2006	0.94	1.00	1.02	1.06
2007			1.07	1.07
2008	0.91	0.94	0.98	1.08
2009			1.05	1.06
2010	0.99	0.98	1.04	1.06
2011			1.06	1.03
2012	0.93	0.93	1.02	1.01
2013			1.06	1.01
2014	0.87	0.89	1.00	1.01
2015			1.05	1.02
2016	0.92	0.92	1.01	1.01
Total	0.91	0.93	1.03	1.04