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Has Overweight Become the New Normal?
Evidence of a Generational Shift in Body Weight Norms

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Abstract:
We test for differences across the two most recent NHANES survey periods (1988–1994 and 1999–2004) in self-perception of weight status. We find that the probability of self-classifying as overweight is significantly lower on average in the more recent survey, for both men and women, controlling for objective weight status and other factors. Among women, the decline in the tendency to self-classify as overweight is concentrated in the 17–35 age range, and, within this range, is more pronounced among women with normal BMI than among those with overweight BMI. Among men, the shift away from feeling overweight is roughly equal across age groups, except that the oldest group (56–74) exhibits no difference between surveys. In addition, overweight men exhibit a sharper decline in feeling overweight than normal-weight men. Despite the declines in feeling overweight between surveys, weight misperception did not increase significantly for men and decreased by a sizable margin among women. The shifts in self-classification are not explained by differences between surveys in body fatness or waist circumference, nor by shifting demographics. We interpret the findings as evidence of a generational shift in social norms related to body weight, and propose various mechanisms to explain such a shift, including: (1) higher average adult BMI and adult obesity rates in the later survey cohort, (2) higher childhood obesity rates in the later survey cohort, and (3) public education campaigns promoting healthy body image. The welfare implications of the observed trends in self-classification are mixed.

JEL Classifications: I10, J11, Z13

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1. Introduction

A large, multidisciplinary literature has investigated self-perceptions of body size and body shape. The bulk of this analysis has considered the cross-sectional factors influencing the self-perception of weight appropriateness, such as socioeconomic status, race and ethnicity, sex, and age.[1] The considerable variation in self-perceptions across demographic and socioeconomic groups suggests that such perceptions refer, in part, to social norms of appropriate weight or size. However, little is known about the evolution of weight perceptions over time, either within individual lifetimes or across generations. In this paper, we test for differences in self-perception of weight status between two survey cohorts observed 10 years apart on average, using data from the National Health and Nutrition Examination Surveys (NHANES).[2] We find that the probability of self-classifying as overweight is significantly lower on average in the more recent survey, controlling for objective weight status and other factors. We interpret the findings as evidence of a generational shift in social norms related to body weight, and we consider several explanations for such a shift, including (1) higher average adult BMI and adult obesity rates in the later survey cohort, (2) higher childhood obesity rates in the later survey cohort, and (3) public education campaigns promoting healthy body image.[3]

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[1] Among socio-economic factors, race and ethnicity have been found to have sizable effects, with several studies reporting black-white differences in self-perceptions of body size and in body satisfaction. African-American women tend to point to larger images for "ideal" size than do white (non-Hispanic) American women and they are more likely to perceive themselves as normal weight and less likely to be dissatisfied with their body weight and BMI compared with white women. For a survey of this literature, see Flynn and Fitzgibbon (1998); more recent studies include Lovejoy (2001), Fitzgibbon, Blackman, and Avellone (2000), Burke and Heiland (2008), and Dorsey, Eberhardt, and Ogden (2009).

[2] The data are taken from the NHANES III survey, which spans the period 1988–1994, and from pooled NHANES surveys spanning 1999–2004. Data on self-perceptions are also available for NHANES 2005–2006. However, our regression analysis also makes use of body fat percentage data, which are not yet available for 2005–2006. For consistency of comparison, we omit the 2005–2006 data throughout. In models that do not employ body fat percentage, results are not significantly different when the 2005–2006 data are included.

[3] "Healthy body image" refers to positive self-esteem concerning physical size and shape. In the United States, such campaigns have sought to offset cultural emphasis on thinness, celebrate diverse body types, and promote physical and mental health regardless of size. See, for example, www.bodyimagehealth.org.

Several recent articles have reported that significant percentages of individuals who would be classified by the CDC as either overweight or obese (on the basis of their BMI) perceive their weight to be "about right," "appropriate," or "acceptable." (See Rand and Resnick 2000, Chang and Christakis 2003, Neighbors and Sobal 2007, and Howard et al. 2008). Maximova et al. (2008) find that exposure to obese parents and schoolmates raises the risk that overweight elementary school students misperceive their objective weight status. Étilé (2007) documents a direct relationship between social norms of body size (defined using reference-group average BMI) and individual notions of "ideal" BMI among French women. Using cross-sectional data from 15 countries in the EU, Blanchflower et al. (2008) find that people who are heavy relative to their reference group (defined on the basis of nationality, age, and gender) are more likely to classify themselves as overweight, controlling for their absolute weight. Neighbors and Sobal (2007, p.437), looking at a recent cohort of university students, conclude that "overweight females may not be seeking to attain the very thin sociocultural 'ideal' female form," and they speculate that larger sizes have become more acceptable as the population has become heavier. A number of recent papers argue that weight gain exhibits "social contagion" within networks of friends, and suggest that such contagion may occur because normative judgments of body size depend on—and so may change over time with—the size of one's friends.[4]

In a recent theoretical paper, Burke and Heiland (2007) posit that the social norm for body weight—defined as a reference point against which individuals judge the appropriateness of their own weight—varies directly with mean body weight in the population at large. This framework predicts that the (average) social weight norm in the United States would have increased over the past 20–30 years in response to the increase in mean BMI over the same period. As shown in Table 1, between NHANES III (conducted over 1988–1994) and NHANES 1999–2004, mean BMI among women (men) ages 17–74 increased by just under 6.4 (5.3) percent, from 24.6 to 26.2 (24.5 to 25.8), and the obesity rate jumped from 19.3

[4] For details see Christakis and Fowler (2007), Trogdon et al. (2008), Fowler and Christakis (2008), and Renna et al. (2008).

percent to 26.5 percent (15.1 to 22.3).[5] If aggregate weight outcomes govern individuals' perceptions of whether or not they are overweight, then the average individual in the later survey should be less likely to classify herself as overweight than a similar individual (at the same BMI) in the earlier survey.

The NHANES III and NHANES 1999–2004 surveys provide data on the self-classification of body weight for two large, nationally representative samples of individuals, in addition to extensive anthropometric and demographic information.[6] In each survey, people ages 17 to 74 were asked whether they consider themselves (at their current weight) to be either "underweight," "about right," or "overweight."[7] (The choice to self-classify as "obese" was not included.) We describe changes in the self-perception of weight status across these NHANES survey periods, focusing on the dichotomous choice of whether to self-classify as overweight or not. Because "overweight" is contrasted with "about right" in the survey instrument, implying a normative judgment, the responses help locate subjective thresholds for overweight. We compare the responses across different survey cohorts at the same age, separately by sex, controlling for various demographic and anthropometric factors.

Consistent with the prediction that the social norm for appropriate weight increased between the surveys, we find that the probability of self-classifying as overweight is significantly lower on average during the more recent survey period. Among women, the difference is concentrated in the 17–35 age range, and is most pronounced among 17–19 year old women with normal BMI values. Among men, we observe a roughly equal shift away from feeling overweight across all age groups except the oldest group, ages 56–74, which exhibited no significant change in self-classification. In addition, the perception changes are

[5] In Burke and Heiland (2007), weight gains were initiated by an exogenous decline in the full cost (money plus time) of food, and a subsequent increase in the norm triggered social multiplier effects that led to further increases in mean weight.

[6] Footnote 2 above explains why we exclude the 2005–2006 data on weight perceptions. All relevant findings are robust to including these data.

[7] Beginning in 1999, this question was asked of respondents as young as 16 years old. For consistency across surveys, however, we consider only individuals ages 17–74 throughout the analysis.

more marked among men with overweight BMI than those with normal BMI. The results are robust to controls for BMI, squared BMI, body fat percentage, waist circumference, educational attainment, income, marital status, and race/ethnicity.

Looking at simple correlations in the data, there is some suggestion that age-sex subgroups that experienced larger between-survey increases in the adult obesity rate, adult mean BMI, and the childhood obesity rate, also exhibited a sharper decline between surveys in the tendency to self-classify as overweight. Investigating the role of reference-group effects on weight perceptions, we find that members of demographic groups (defined on the basis of sex, race, age, and birth cohort) with higher mean BMI (and higher obesity rates) are less likely to self-classify as overweight, controlling for individual BMI and other factors. We also find that members of groups (by sex, age, and birth cohort) exposed to higher childhood obesity rates are less likely to self-classify as overweight as adults, but the latter effect is only marginally significant.[8] However, none of these apparent reference-group effects fully explains the differences across surveys in self-classification tendencies.

Of course, some other, broad-based secular change could have caused both the decreased tendency to feel overweight and (as a consequence, or simultaneously) the increase in mean BMI. In prior research, popular culture and public health messages, separately, have been proposed as contributing factors in the formation of body image and in the determination of weight outcomes. While a full examination of the contribution of these forces is beyond the scope of this paper, we identify public health education programs that may have influenced

[8]For individuals ages 17–42 in either survey, we can estimate the childhood obesity rate (among children ages 6–11 of the same sex) that would have prevailed when the given individual was a child (between ages 6 and 11). Observing the individual's age and the time period during which she was surveyed, we can back out the approximate time frame during which she would have been a child. The relevant childhood obesity rates are published in Ogden et al. 2002 and Ogden et al. 2006, and are based on the NHES 2 survey, conducted in 1963–1965, and on waves I through III of NHANES, covering the periods 1971–1974, 1976–1980, and 1988–1994, respectively. The intermittency of the published childhood obesity rates prevents us from identifying rates for individuals over age 42 in NHANES III and over age 52 in NHANES 1999–2004. More details on the construction of these rates are provided in the Appendix.

the weight perceptions of the current generation of young adults and we briefly discuss the potential role of popular media and culture in promoting a heavier weight norm in recent decades.

2. Descriptive evidence

Table 2 gives cross-tabulations of subjective weight status against CDC-defined ("objective") weight status, separately by survey period and sex, for the full age range, from 17 to 74 years. The value in a given cell indicates the percentage of individuals in a given objective category (the row variable) who reported being in a given subjective category (the column variable). For example, in NHANES III, among women with normal BMI values, 56 percent considered their weight to be "about right" and 39 percent considered themselves to be "overweight." For women in NHANES 1999–2004, the corresponding figures are 64 percent and 32 percent. Among women qualifying as overweight but not obese, 83 percent reported feeling overweight as of NHANES III, and only 78 percent said the same in 1999–2004. (All of the between-survey differences are significant at the 5 percent level or better.) For a given objective weight status and observation period, men are significantly less likely than women to self-classify as overweight and significantly more likely to classify as underweight. However, like women's, men's self-perceptions also shifted significantly between survey periods. For example, among overweight (but not obese) men, the share who self-classified as overweight fell from 58 percent in NHANES III to 53 percent in NHANES 1999–2004. Among obese men the share who considered themselves overweight fell from 89 percent to 87 percent.[9]

Despite the declines in the tendency to self-classify as overweight, the weight misperception rate—the share of all individuals who incorrectly perceive their CDC weight status—actually fell among women between the surveys and did not change significantly for men.

[9]The differences in self-reporting, conditional on weight status, cannot be explained by decreases in average BMI, conditional on the objective weight category, since the conditional means either remained constant or increased between the survey periods.

Among overweight and obese subjects combined, misperception increased significantly between the surveys for women and was unchanged for men. Table 3 shows misperception rates by sex and survey period, with associated standard errors, for the full sample and for the subsample either overweight or obese.[10]

Breaking the data into age groups within each sex, we find significant demographic variation in the between-survey differences in self-perception. Table 4 shows some examples of age-group-specific changes in weight perception and places them alongside age-group-specific changes in weight outcomes between the surveys—specifically, the change in adult mean BMI, the change in the adult obesity rate, and the change in the relevant (prior) childhood obesity rate. Among men, those ages 20–25 experienced the largest decline in the share of individuals who reported feeling overweight conditional on being overweight, and similarly for the share that felt overweight conditional on being obese. This same male age group also exhibited the largest increases between surveys, respectively, in mean BMI, adult obesity rate, and childhood obesity rate.[11] Among women, the 20–25 year-old group exhibited either the largest or second-largest change in each column. These facts are consistent with the hypothesis that the more relaxed attitudes toward overweight held by the recent cohort of young adults reflect their greater social exposure to obesity (whether as children or as adults). However, the recent cohorts (both male and female) in the oldest age bracket (56–74) also had higher mean BMI and adult obesity rates than their predecessor cohorts, yet exhibited either no significant changes in overweight perception (for example, among overweight women, obese women, and obese men) or displayed an *increase* in the share feeling overweight (as in the case of overweight men) compared with the earlier survey cohort.

[10] The misperception rates in Table 3 do not differ significantly when the 2005–2006 data are added to the sample.

[11] The comparison of changes in childhood obesity rates is based on point estimates only. Standard errors on the changes in childhood obesity rates are not available.

3. Evidence from multivariate regression analysis

So far we have described the differences in weight perception between the NHANES III and NHANES 1999–2004 surveys in the absence of controls for individual characteristics. In addition, we have offered suggestive evidence of a link between differences in weight perception between the surveys and differences in group-level outcomes such as mean BMI by age group and sex. Using multivariate regression analysis, we demonstrate the robustness of the between-survey differences in weight perception to numerous controls and test directly for an influence of reference-group outcomes on individual perceptions. The latter tests are merely suggestive, because we cannot strictly identify causal effects.

Empirical setup

We adopt a logit specification that predicts the probability of self-classifying as "overweight," where the base response is "not overweight," a value that collapses the "about right" and "underweight" responses into a single category.[12] Ver Ploeg, Chang, and Lin (2008) suggest omitting individuals who are objectively underweight (BMI<18.5 for adults) from analysis of overweight self-classification. We find that our results are not significantly different depending on whether such individuals are included or omitted, and all results shown here include underweight individuals. To test the significance of differences in responses between the two surveys (NHANES III and NHANES 1999–2004), we pool the data and create a dummy variable that takes the value 1 for observations from NHANES 1999–2004 and the value 0 for observations from NHANES III.[13] This variable is included as an explanatory factor in all model specifications, and its effect is allowed to vary by age group and sex. We divide age into six discrete categories: 17–19, 20–25, 26–35, 36–45,

[12] Most "not overweight" responses refer to the response "about right." Among "not overweight" responses, 9 percent of women and 14 percent of men feel underweight (combining surveys). In the sample at large, just 3 percent of women and 8 percent of men report feeling underweight.

[13] According to Korn and Graubard (1999), it is not necessary to re-weight the data when pooling NHANES surveys, based on the assumption that the samples are independent across the periods. We control for complex survey design within each survey, using the appropriate strata and primary sampling unit (PSU) variables. Using Stata's "svy" commands, the data are weighted correctly and the standard errors are clustered appropriately.

46–55, and 56–74.[14] In an initial set of regressions we estimate the models separately for men and women. When we test for reference-group effects, however, we pool the data but still allow for some gender-specific effects, for reasons discussed below. All results are reported as odds ratios.

In addition to an individual's own BMI, factors such as race/ethnicity, age, and socioeconomic status have been found to influence self-perceptions of weight (Chang and Christakis 2003). To control for the possibility that between-survey differences in such factors might explain observed shifts in weight perceptions, we include the following in all model specifications: individual BMI and its square, age group (defined above, with 36–45 the omitted category), race/ethnicity (African-American, Mexican-American, "other" race/ethnicity, and white, where the last is the omitted category), educational attainment (high school graduate, some college or better, and less than high school, where the last is the omitted category), household income (divided into three discrete categories based on the relationship to poverty-line income, with low income the omitted category), and marital status (currently married, formerly married, and never married, the last being the omitted category). The construction of these variables is discussed in a data appendix. Sample means by sex, pooled across surveys, are shown in Table A.1.

Although we control for individual BMI, self-judgments of weight status may also depend on other aspects of physique, such as body fat percentage and waist circumference. Both of these factors are related to health risks independently of BMI and also influence physical appearance independently of BMI. Individuals with large amounts of lean body mass can achieve BMI values that qualify as overweight or obese, despite having very little body fat. In addition, an individual could have an overweight BMI without having a waist circumference that implies high health risk based on guidelines advanced by the National

[14] If we were to combine the two youngest groups, each group would comprise a roughly equal weighted share of the pooled NHANES data. However, because the criteria for obesity differ between adolescents and adults, and because we might expect adolescents' perceptions to differ *a priori*, we separate out 17–19 year olds.

Heart, Lung, and Blood Institute (NHLBI).[15] Such individuals, possibly with good reason, may disregard CDC standards for overweight based on BMI. If the average person in NHANES 1999–2004 has a lower body fat percentage and/or smaller waist circumference than the average person in NHANES III, conditional on BMI, the former may be less likely to classify as overweight than the latter. Thus, it is important to control for body fat percentage and waist circumference in the regressions.

To investigate the role of reference-group effects on weight perceptions, as suggested by the theories of endogenous weight norms discussed above, we estimate models that include, in turn: (1) the contemporaneous mean BMI in a reference group, (2) the contemporaneous obesity rate in a reference group, and (3) the childhood obesity rate for a reference group. In these models, data for males and females are pooled and reference groups are defined as follows: for adult mean BMI and the adult obesity rate, the reference group is defined by sex, age group, survey period, and race/ethnicity; for the childhood obesity rate, the reference group is defined by sex, age group, and survey period, because race-specific childhood obesity rates are not available. Combining the data for males and females reduces the risk of collinearity between the reference-group variables and the survey-by-age fixed effects. In the model that includes the childhood obesity rate, the age range must be restricted to individuals 42 and under, based on data availability. The construction of the childhood obesity rate is discussed in footnote 7 above and in the appendix.

Main results

Table 5 shows the results of three different models in which respondents' ages ranged from 17 to 74. We estimate the models separately for women and men to allow for gender differences in the effects of the covariates. The baseline model ("Model 1"), includes BMI, BMI squared, and the demographic and socioeconomic variables. Model 2 includes the baseline variables plus body fat percentage. Model 3 includes all the previous variables plus

[15] The waist circumference thresholds for elevated risk are 35 inches for women and 40 inches for men. See, for example, http://www.nhlbi.nih.gov/guidelines/obesity/e_txtbk/txgd/4142.htm

waist circumference. In the baseline specification for women, the estimated odds ratio on the NHANES 1999–2004 dummy is 0.73, suggesting that, all else equal, 36–45 year old women from NHANES 1999–2004 are significantly less likely to consider themselves overweight than women of the same age from NHANES III.[16] In the corresponding model for men, the analogous odds ratio is 0.52, indicating that 36–45 year old men experienced an even larger decline in the probability of feeling overweight between the surveys than women of the same age.

Among women, we observe significant age differences in the survey-period effects on weight perception. Women in each of the three youngest age groups (17–19, 20–25, and 26–35), exhibited significantly sharper declines in the tendency to feel overweight than those in the omitted (36–45) age group. No significant differences in the survey effect were observed for the two oldest female age groups (46–55 and 56–74) compared with the omitted age group, however. For men, the only significant age difference in the survey effect pertains to the oldest group, among whom the tendency to feel overweight was roughly unchanged between surveys in the baseline model.[17]

Model 2 indicates that, all else constant, a higher body fat percentage is associated with a greater risk of feeling overweight. For both men and women, the main survey effect becomes stronger when body fat is included. This suggests that the tendency to feel overweight would have declined by an even greater margin if it were not for the fact that body fat percentage increased on average between the surveys, controlling for BMI. Model 3 shows that a higher waist circumference is also associated with a higher risk of feeling

[16] Given the interaction terms between the survey and the age groups, the survey effect refers to the effect for the omitted age group only. Survey effects for other age groups are obtained by multiplying the main survey effect by the coefficient on the appropriate age-survey interaction term.

[17] This result is obtained by multiplying the odds ratio on the main survey effect and the odds ratio on the age-survey interaction for 56–74 year olds, both taken from the baseline model, to yield a value of 1.04. Doing the same for models 2 and 3 yields net survey effects for 56–74 year olds of 0.76 and 0.78, respectively.

overweight. Based on these results, we conclude that the changes in weight perception are not explained by changes in adiposity or waist circumference between the surveys.

The remaining effects in the baseline model are largely in line with expectations. The higher is BMI, the greater the risk that an individual classifies as overweight, but the magnitude of this additional risk is smaller beginning from a higher BMI. High school graduates and college attendees are each more likely to self-classify as overweight than those who did not complete high school, and those with middle and high incomes are more likely to feel overweight than those with the lowest incomes. Married people are more likely to feel overweight than never-married people, and members of minority groups are significantly less likely than whites to consider themselves overweight. All of these results apply to both men and women.

One noteworthy difference between the sexes is found in the age differences in self-perception as of NHANES III. For women, the main age effects reveal a strong inverse age gradient in feeling overweight in NHANES III, with the youngest group having the highest risk of this perception and the oldest group having the lowest risk (based on comparisons with the omitted, 36–45 year old group). Among men, however, all age groups have a roughly equal probability of feeling overweight except for the oldest group, which has a significantly lower risk. Interactions between the survey effect and age, described above, imply that the female age gradient flattens out in the NHANES 1999–2004 survey, especially between young and middle-aged women, and sex differences in age effects become less pronounced as a result.

Table 6 shows estimates from models in which data on males and females are pooled in order to facilitate estimation of models with reference-group effects, as explained above. The specifications in the first three columns are the same as in Models 1–3 in Table 5, with the addition of a female dummy variable and an interaction term between the female dummy and the NHANES 1999–2004 dummy. Model 4 includes all the variables from

Model 3, plus the estimated childhood obesity rate for the reference group (based on age, sex, and survey period). In this model, the sample is restricted to individuals ages 17–42, for which childhood obesity rates are available for both surveys, and the omitted age category is 36–42 rather than 36–45. Model 5 includes the same variables as Model 3, plus the contemporaneous mean BMI for the reference group (now defined by age, sex, survey period, and race/ethnicity). Model 6 includes the same variables as Model 3, plus the contemporaneous obesity rate for the individual's reference group (also defined by age, sex, survey period, and race/ethnicity). The results in Models 1 through 3 are largely consistent with the estimates from Table 5.[18]

In Model 4, the coefficient associated with the childhood obesity rate in the reference group is less than one (0.53) and significant at the 10 percent level. This result suggests that individuals exposed to a higher childhood obesity rate (as children) have a lower relative risk of self-classifying as overweight as adults, all else equal. Also note that the main survey effect increases to 0.70 (Model 4) from 0.60 (Model 3). A Wald test of the hypothesis that these latter two coefficient estimates are equal can be rejected at the 10 percent level, a result that offers some (albeit weak) evidence that exposure to higher childhood obesity among the more recent survey cohort (of 36–45 year olds) may partly account for their lower risk of feeling overweight. We conduct similar tests comparing the estimated survey effects—between Model 3 and Model 4—for other age groups, each of which rejects the equality hypothesis at the 10 percent level. However, we cannot reject the hypothesis that equality holds simultaneously for each of these six pairs of coefficients.[19]

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[18] In the non-sex-specific models, the interaction term between "female" and "NHANES 1999–2004" refers to the difference in the survey effect between men and women, averaged across all age groups.. While the sex-specific regressions indicate that the survey difference in perceptions is larger for 36–45 year old men than for 36–45 year old women, the combined regressions indicate that the survey difference is larger on average for women.

[19] These tests are conducted using the Stata "suest" command on the two different regressions. The test is roughly equivalent to stacking the data from the two models, clustering standard errors by observation ID, and employing the associated variance-covariance matrix in an F test of equality of the relevant coefficient estimates.

In Model 5 we observe that individuals in reference groups with higher mean BMI are less likely to self-classify as overweight, and Model 6 indicates that a similar effect holds for individuals in reference groups with higher adult obesity rates. For each of Models 5 and 6, again we test for whether the survey effects (within each age group) differ significantly from those in Model 3, in order to determine whether the reference group effects help to explain the differences in perception between the surveys. The tests indicate that the introduction of reference-group mean BMI results in a significant mitigation of the survey effect for the 36–45 year old group. That is, we reject equality of the main survey effect between models 3 and 5 at the 1 percent level. We also reject equality (at the 1 percent level) between survey effects for all but the 17–19 year old group, and the simultaneous test implies that at least one pair of coefficients differs significantly between the models. (The testing method is described in footnote 18.) We have less statistical confidence that the adult obesity rate in the reference group helps to account for differences in weight perception between surveys. Testing individually, we can reject equality between any (age-specific) pair of coefficients at the 5 percent level or better, but we cannot reject the simultaneous hypothesis that all pairs are equal.[20]

The results from Models 5 and 6 are broadly consistent with the prediction that the social weight norm—in this case the subjective threshold for overweight—will shift to the right following a rightward shift in the empirical weight distribution in the relevant reference group. However, the results do not establish causality definitively. The changes in perceptions between surveys may have preceded the changes in the contemporaneous outcomes (mean BMI and adult obesity) or both developments may have occurred in response to a change in some other factor. Concerning the influence of childhood obesity exposure on weight perceptions in adulthood, simultaneity and reverse causality are not viable explanations, given the timing of the events, but the data are limited and the significance of the results is weaker.

[20]Note the exception that the test yields a p-value of 0.058 for the 56–74 year old group.

Graphical illustration

Figures 1 and 2 illustrate the controlled differences in overweight self-classification between the surveys, based on the coefficient estimates of our gender-specific, baseline regressions (Model 1 in Table 5). Each figure shows the predicted probabilities of feeling overweight (for women in Figure 1 and men in Figure 2) by age group and survey cohort, at the BMI values 23 and 28. These BMI values represent the approximate midpoints, respectively, of the BMI ranges defined as "normal" and "overweight" by the CDC.[21] All variables other than BMI are held at the sex-specific means of the combined sample (NHANES III and NHANES 1999–2004), reported in Table A.1. Predicted probabilities reflect coefficient estimates regardless of significance. The statistical significance of the between-survey differences is indicated with asterisks, as noted in the figure. Because individual characteristics are held constant, the between-survey differences are driven solely by the (age-specific) effect of the NHANES 1999–2004 dummy variable.

Figure 1 confirms that the decline between surveys in the predicted probability of feeling overweight is more pronounced among women ages 35 and under than among women over 35. No significant difference between surveys is observed for women in the 46–55 year old group. Ignoring the latter group, we find that the percentage-point declines in feeling overweight are larger for women with BMI equal to 23 than for BMI equal to 28. For example, among 17–19 year old women, the predicted probability of self-classifying as overweight falls between surveys by 32 percentage points assuming a BMI of 23, and by just 8 percentage points assuming a BMI of 28.

Figure 2 shows that there are no significant differences in the predicted responses among men between the survey periods for either the youngest group (17–19) or the oldest group (56–74). The differences are sizable, and similar, for each of the 20–25, 26–35, and 36–45 year old groups. In contrast to declines among women, declines among men in the predicted

[21]Body fat percentage and waist circumference are not controlled for in the regression that produces the predictions in Figures 1 and 2. Observations with missing body fat and waist values are excluded as are observations with BMI >= 50

probability of feeling overweight are greater at a BMI of 28 than at a BMI of 23. Put differently, changes in self-assessment were more pronounced among overweight men than among normal-weight men and among normal-weight women than among overweight women. Although assessments of overweight by both men and women became more forgiving between the surveys, men's assessments tended to move away from CDC classifications while women's assessments tended to moved toward them, at least based on these predictions for these BMI values.

4. Discussion

We document a significant decline, on average, in the probability of self-classifying as overweight between the NHANES III and 1999–2004 survey periods. The declines were particularly pronounced among younger (ages 17–35), normal-weight women and among young-to-middle aged (20–45), overweight men. These findings cannot be explained by changes in individuals' own BMI, race/ethnicity, age, and socioeconomic characteristics between the survey periods. Changes in body fat percentage and/or waist circumference do not account for the changes in weight classification between surveys, as both of these factors increased on average between the surveys, conditional on BMI, and would have increased the tendency to feel overweight all else equal.[22] In the uncontrolled analysis, we observe a decline in misperception relative to CDC standards among women and no net change in misperception among men.

Our novel findings suggest that the subjective threshold for overweight increased between the earlier and later surveys, consistent with theories of endogenous weight norms. Burke and Heiland (2007) argue that mean BMI in the population determines the social norm for body weight, and assume that individuals assess their own weight in relation to the social

[22] This statement is based on our regression analysis, which shows that: (1) higher body fat and higher waist circumference each raise the probability of feeling overweight, and (2) estimated declines in the probability of classifying as overweight (among 36–45 year olds, both male and female) between surveys are at least as great, or greater when body fat percentage and waist circumference are included in the regression compared to when they are omitted.

norm. The observed decline between the NHANES surveys in the tendency to self-classify as overweight, which occurred during a period that also saw an increase in aggregate mean BMI, agrees with the central prediction of this framework. In addition, we find that members of groups (defined by age, sex, race/ethnicity, and birth cohort) with higher average BMI (or higher obesity prevalence) are less likely to classify as overweight than members of groups with lower mean BMI (or lower obesity rate), controlling for own BMI and other factors, where this relationship helps to account for the between-survey decline in the tendency to feel overweight. We also find that exposure to a higher childhood obesity rate may reduce the tendency to feel overweight in adulthood and that this relationship, too, may explain some of the reduced tendency to feel overweight in the more recent survey period. We do not, however, claim to identify causality between the rightward shift of the weight distribution and the increase in the subjective threshold for overweight.

Of course, a variety of social forces may influence self-perceptions of body weight, such as imagery in the popular media, public health messages, and scholastic content. Any of these factors may have changed between the survey periods, contributing to a more relaxed standard of overweight. Concerning public health messages, the official CDC standard for overweight actually became *stricter* between the survey periods, such that individuals with BMI values between 25 and 27 should have been more likely to classify as overweight in the later survey.[23] Concerning media imagery, evidence from *Playboy* magazine suggests that the ideal female body became progressively thinner between 1950 and 1980 and then leveled off (Garner et al. 1980, Wiseman et al. 1992, and Katzmarzyk and Davis 2006). The fact that women's weight assessments became more forgiving in recent decades despite the apparent persistence of the thin female ideal suggests that media images do not dictate women's attitudes towards their weight, or at least that such images have become less influential in

[23] In 1998, on the recommendation of the World Health Organization, the CDC reduced the BMI thresholds for overweight, from 27.8 for men and 27.3 for women, down to 25 for both sexes. This new standard is applied retroactively when we measure rates of overweight and obesity in surveys conducted prior to 1998.

recent years.[24] Trends among *Playgirl* magazine centerfolds indicate that the ideal male figure became more muscular between 1973 and 1997 Leit, Pope, and Gray 2001 and a similar trend has been noted among action figures (Pope et al. 1999). How these trends would have influenced men's self-assessments of weight is not clear: a more muscular physique is likely to entail a higher BMI, but an emphasis on musculature could make being fat less acceptable. Without a clear prediction, it is difficult to determine whether trends in media portrayals of male physique played any role in the trends we have documented in men's tendency to feel overweight.

In the past decade numerous government programs have emerged that promote the development of a "healthy" body image and healthy eating behavior, for young women in particular. For example, the National Eating Disorders Association offers the educational program "GO GIRLS!" and the U.S. Department of Health offers a "Healthy Body Image" book for use in public schools.[25] While we cannot identify a causal link, such programs may have contributed to our finding that younger, normal-weight females experienced some of the greatest reductions of any demographic group in the probability of self-classifying as overweight. At the same time, in recent years, several states have come to require that children and adolescents in public schools be weighed and measured.[26] Parents and children are informed of the child's official weight status and, in the case of overweight and obese children, advised to adopt healthier habits and target a healthier weight. Overweight students may therefore be receiving mixed messages: on the one hand, to lose weight, and

[24] While there is anecdotal evidence that the relative number of "plus-sized" female models in popular media has increased in recent years, we can find no rigorous documentation of such a trend. Furthermore, any increase in the media's representation of overweight women (or overweight men) has likely emerged as a reaction to, rather than a precursor of, the increases in mean BMI and obesity prevalence in the population.

[25] The "GO GIRLS!" program "engages high school girls (and boys too!) to advocate for positive body images of youth in advertising, the media and major retailers." See http://www.nationaleatingdisorders.org/programs-events/educational-programs.php#go-girls. The "Healthy Body Image" book is part of the "BodyWise" information kit distributed by The U.S. Department of Health, Office of Women's Health.

[26] See http://www.cdc.gov/HealthyYouth/obesity/BMI/pdf/BMI_execsumm.pdf

on the other hand, to have a healthy self-image. The net impact of such messages on self-assessments among children and adolescents remains unclear.

Mirroring the observed shifts in weight perceptions, women's dress sizes have also been recalibrated in recent decades. According to one estimate, a size 12 dress from the 1960s would be a size 6 by contemporary standards (Simmons 2002).[27] While some part of this change may reflect increases in women's height and overall skeletal dimensions, resizing has largely been construed as an attempt to flatter increasingly heavy customers, hence the term "vanity sizing" (Bold 1997, Helser 2004, Gebhart 2005). Even if women are not fooled by vanity sizing, the strategy suggests that women care about their nominal size more than their absolute size, in line with the notion that people define overweight in relative terms. Furthermore, because clothing sizes send signals as to what constitutes "small," "medium," and "large," the recalibration of clothing sizes may have contributed to changes in perceptions of overweight.

The welfare implications of a change in the weight standard are ambiguous. Our results indicate that women's notion of overweight in the later survey shows stronger agreement with CDC standards than before, as the share of normal-weight women who considered themselves overweight declined significantly. However, a larger share of overweight and obese men and women now classify themselves as "about right," an indication that such individuals feel that they do not need to lose weight. While departing from official classifications, such judgments may not have a negative net impact on health, especially for those individuals who are merely overweight and not obese. Recent research (Flegal et al. 2005 and 2007) has shown that overweight (but not obese) individuals enjoy lower mortality rates than people in any of the other weight classes. Fat-acceptance advocates have pointed out, further, that negative self-image results in significant mental health costs and that dieting is costly in numerous ways. More fundamentally, recent research has highlighted

[27] It is harder to resize men's clothing because most items are sized according to actual dimensions such as waist circumference and inseam length. Men's items marked "small," "medium," and "large" may also have been resized, but there is no rigorous study that shows this.

the limitations of using a one-dimensional index to define appropriate body size, resulting in increased calls for the use of alternative measures such as waist circumference and body fat percentage.[28] Regardless of where one stands in these debates, there is likely to be broad agreement that public policy has, to date, focused too narrowly on promoting "healthy weight" rather than promoting a more comprehensive definition of health that includes good nutrition, cardiovascular fitness, and sound mental health.

[28] See, for example, Visscher et al. (2001), Janssen, Katzmarzyk, and Ross (2002), and Bosy-Westphal et al. (2005).

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Table 1. Mean BMI and Obesity Rate by Survey and Sex

	Mean BMI NHANES III			Obesity Rate NHANES III	
Age	Men	Women	Age	Men	Women
17–19	23.254	23.400	17–25	12.467	9.953
	(0.291)	(0.315)		(2.184)	(1.914)
20–25	24.691	24.274	20–25	11.943	14.272
	(0.172)	(0.263)		(1.433)	(1.674)
26–35	26.134	25.473	26–35	14.871	21.338
	(0.151)	(0.198)		(1.298)	(1.274)
36–45	27.203	26.767	36–45	22.552	25.953
	(0.248)	(0.354)		(1.346)	(2.154)
46–55	27.438	28.012	46–55	23.702	32.985
	(0.223)	(0.279)		(1.817)	(2.028)
56–74	27.356	27.621	56–74	25.378	29.800
	(0.143)	(0.177)		(1.718)	(1.251)
Total	24.484	24.632	Total	15.051	19.344
	(0.096)	(0.130)		(0.547)	(0.713)
	NHANES 1999–2004			**NHANES 1999–2004**	
Age	Men	Women	Age	Men	Women
17–19	24.639	24.702	17–25	16.808	16.774
	(0.193)	(0.251)		(1.547)	(1.436)
20–25	26.484	26.387	20–25	21.941	24.631
	(0.215)	(0.255)		(2.035)	(1.790)
26–35	27.394	27.815	26–35	23.726	31.545
	(0.221)	(0.304)		(1.887)	(1.917)
36–45	28.204	28.509	36–45	31.292	34.454
	(0.195)	(0.266)		(1.439)	(1.626)
46–55	28.637	28.944	46–55	31.077	36.507
	(0.220)	(0.319)		(1.574)	(1.920)
56–74	28.648	29.237	56–74	32.825	39.563
	(0.159)	(0.195)		(1.237)	(1.488)
Total	25.774	26.204	Total	22.302	26.475
	(0.084)	(0.130)		(0.534)	(0.783)
	Change			**Change**	
Age	Men	Women	Age	Men	Women
17–19	1.385	1.302	17–25	4.341	6.821
	5.95%	5.56%		34.82%	68.54%
20–25	1.794	2.112	20–25	9.998	10.359
	7.26%	8.70%		83.71%	72.58%
26–35	1.260	2.342	26–35	8.855	10.207
	4.82%	9.19%		59.54%	47.84%
36–45	1.001	1.742	36–45	8.741	8.501
	3.68%	6.51%		38.76%	32.76%
46–55	1.199	0.931	46–55	7.376	3.522
	4.37%	3.33%		31.12%	10.68%
56–74	1.292	1.616	56–74	7.447	9.763
	4.72%	5.85%		29.34%	32.76%
Total	1.290	1.572	Total	7.250	7.131
	5.27%	6.38%		48.17%	36.86%

Table 2. Weight Perception, Age 17–74

	Women 17–74, NHANES III					Men 17–74, NHANES III			
	Underweight	About Right	Overweight	Total		Underweight	About Right	Overweight	Total
BMI Category					**BMI Category**				
Underweight	43.04	56.96	0.00	100.00	Underweight	73.67	26.33	0.00	100.00
	(5.00)	(5.00)	0.00			(5.01)	(5.01)	0.00	
Normal	4.59	56.11	39.30	100.00	Normal	15.76	73.82	10.42	100.00
	(0.37)	(1.38)	(1.35)			(1.14)	(1.20)	(0.86)	
Overweight	0.45	16.24	83.30	100.00	Overweight	0.70	40.92	58.38	100.00
	(0.10)	(1.20)	(1.17)			(0.23)	(1.32)	(1.33)	
Obese	0.21	3.55	96.24	100.00	Obese	0.55	10.73	88.72	100.00
	(0.13)	(0.42)	(0.44)			(0.36)	(1.47)	(1.60)	
Total	3.93	33.51	62.56	100.00	Total	7.91	48.47	43.62	100.00
	(0.25)	(0.96)	(1.00)			(0.56)	(0.80)	(0.87)	
Actual Rates	3.72	47.26	49.02	100.00	*Actual Rates*	1.40	41.24	57.36	100.00
	(0.36)	(1.10)	(1.12)			(0.22)	(1.11)	(1.06)	

	Women 17–74, NHANES 1999–2004					Men 17–74, NHANES 1999–2004			
	Underweight	About Right	Overweight	Total		Underweight	About Right	Overweight	Total
BMI Category					**BMI Category**				
Underweight	48.97	49.93	1.10	100.00	Underweight	71.87	28.13	0.00	100.00
	(5.25)	(5.38)	(1.08)			(5.73)	(5.73)	0.00	
Normal	3.76	63.91	32.33	100.00	Normal	18.94	73.64	7.41	100.00
	(0.32)	(1.17)	(1.15)			(1.05)	(1.18)	(0.76)	
Overweight	0.37	22.12	77.51	100.00	Overweight	1.29	46.12	52.60	100.00
	(0.12)	(1.14)	(1.17)			(0.29)	(1.50)	(1.52)	
Obese	0.21	4.53	95.26	100.00	Obese	0.39	12.32	87.28	100.00
	(0.12)	(0.44)	(0.48)			(0.19)	(0.97)	(0.99)	
Total	2.82	32.56	64.62	100.00	Total	7.61	45.10	47.29	100.00
	(0.20)	(0.82)	(0.79)			(0.40)	(0.81)	(0.77)	
Actual Rates	2.55	37.30	60.15	100.00	*Actual Rates*	1.41	31.68	66.92	100.00
	(0.25)	(0.94)	(0.94)			(0.17)	(0.72)	(0.74)	

Notes: Coefficients represent the share of individuals who perceive themselves as "Underweight," "About Right," or "Overweight" by BMI categories. Standard errors are in parentheses.

Table 3. Misperception of Weight, Age 17–74

	All BMI values		BMI >= 25†	
	NHANES III	**NHANES 1999–2004**	**NHANES III**	**NHANES 1999–2004**
Men	29.18	30.74	31.41	32.87
	(0.84)	(0.63)	(1.19)	(0.83)
N	7391	6949	4335	4361
Women	27.90	22.39***	10.29	12.70**
	(0.89)	(0.65)	(0.67)	(0.63)
N	8338	7536	4889	4724

Notes: † For ages 17–19, age-specific BMI thresholds for adolescent overweight are employed. Standard errors in parentheses. ***difference between NHANES III and 1999–2004 is significant at the 1% level. ** difference is significant at the 5% level. † For ages 17–19, age-specific BMI thresholds for adolescent overweight are employed.

Table 4. Differences in Means and Probabilities, NHANES1999–2004 minus NHANESIII

Age Range	**BMI**	**Obesity Rate**	**Childhood Obesity Rate**	**Feel Overweight (cond: Overweight)**	**Feel Overweight (cond: Obese)**
Women 17–74					
17–19	1.302***	6.821***	4.600	-12.370***	-6.075
	(0.403)	(2.393)		(4.320)	(5.249)
20–25	2.112***	10.358***	5.485	-7.098**	-5.910*
	(0.367)	(2.451)		(3.522)	(3.526)
26–35	2.342***	10.207***	1.905	-6.325**	-3.466**
	(0.363)	(2.301)		(2.406)	(1.380)
36–45†	1.742***	8.501***	-0.390	-3.666**	-0.724
	(0.442)	(2.699)		(1.730)	(1.077)
46–55	0.931**	3.522		-0.543	0.689
	(0.424)	(2.793)		(1.475)	(0.991)
56–74	1.616***	9.763***		1.765	1.597
	(0.263)	(1.944)		(1.598)	(1.082)
Men 17–74					
17–19	1.385***	4.341	5.000	-7.222	-11.532*
	(0.349)	(2.676)		(8.181)	(6.418)
20–25	1.794***	9.998***	5.662	-8.484*	-14.320***
	(0.275)	(2.489)		(4.909)	(4.606)
26–35	1.260***	8.855***	2.155	-6.743**	-6.389*
	(0.268)	(2.290)		(3.061)	(3.786)
36–45†	1.001***	8.741***	0.558	-2.736	3.219
	(0.315)	(1.970)		(3.820)	(3.809)
46–55	1.199***	7.376***		1.154	-1.193
	(0.313)	(2.404)		(3.475)	(3.923)
56–74	1.292***	7.447***		5.299**	2.894
	(0.214)	(2.116)		(2.649)	(2.702)

Notes: Standard errors in parentheses. *** indicates difference is significant at the 1% level. ** indicates difference is significant at the 5% level. * indicates difference is significant at the 10% level.
†Childhood obesity rates are calculated for ages 36–42.

Table 5. Logit Estimates of Self-Classifying as Overweight, Women (N=12,016) vs. Men (N=12,161).

	Women			Men		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
NHANES 1999–2004	**0.73***	**0.60*****	**0.60*****	**0.52*****	**0.44*****	**0.45*****
	(0.13)	(0.11)	(0.11)	(0.10)	(0.08)	(0.09)
BMI	4.29***	3.44***	3.36***	5.15***	4.53***	4.30***
	(0.20)	(0.20)	(0.20)	(0.37)	(0.32)	(0.32)
BMI Squared	0.98***	0.98***	0.98***	0.98***	0.98***	0.98***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age 17–19	2.22***	2.12**	2.20**	0.94	1.01	1.19
	(0.67)	(0.68)	(0.71)	(0.30)	(0.33)	(0.39)
Age 20–25	1.59**	1.62**	1.68**	0.92	0.97	1.07
	(0.37)	(0.37)	(0.39)	(0.22)	(0.23)	(0.25)
Age 26–35	1.63***	1.74***	1.77***	1.03	1.04	1.10
	(0.30)	(0.31)	(0.32)	(0.21)	(0.22)	(0.23)
Age 46–55	0.77	0.72*	0.71*	0.87	0.89	0.85
	(0.15)	(0.14)	(0.14)	(0.18)	(0.17)	(0.17)
Age 56–74	0.45***	0.40***	0.39***	0.62**	0.58***	0.53***
	(0.07)	(0.06)	(0.06)	(0.12)	(0.11)	(0.10)
NHANES 1999–2004 x Age 17–19	0.35***	0.37***	0.36***	1.24	1.18	1.11
	(0.11)	(0.12)	(0.12)	(0.42)	(0.42)	(0.40)
NHANES 1999–2004 x Age 20–25	0.54**	0.56*	0.55*	0.95	0.92	0.89
	(0.17)	(0.17)	(0.17)	(0.27)	(0.27)	(0.26)
NHANES 1999–2004 x Age 26–35	0.49***	0.46***	0.46***	1.02	1.03	1.00
	(0.13)	(0.12)	(0.12)	(0.26)	(0.27)	(0.26)
NHANES 1999–2004 x Age 46–55	1.28	1.22	1.22	1.45	1.31	1.31
	(0.36)	(0.34)	(0.34)	(0.39)	(0.35)	(0.35)
NHANES 1999–2004 x Age 56–74	1.03	0.93	0.94	2.00***	1.72**	1.73**
	(0.23)	(0.20)	(0.20)	(0.47)	(0.42)	(0.42)
High School Graduate	2.14***	2.12***	2.13***	1.32**	1.34**	1.34**
	(0.21)	(0.21)	(0.21)	(0.16)	(0.17)	(0.17)
Some College or College Graduate	2.06***	2.05***	2.07***	1.72***	1.76***	1.77***
	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
Middle Income Group	1.42***	1.43***	1.44***	1.37***	1.42***	1.43***
	(0.13)	(0.13)	(0.13)	(0.10)	(0.11)	(0.11)
High Income Group	1.54***	1.58***	1.61***	1.45***	1.53***	1.55***
	(0.14)	(0.14)	(0.15)	(0.13)	(0.14)	(0.14)
Married	1.43***	1.39**	1.39**	1.33**	1.30**	1.29**
	(0.18)	(0.18)	(0.18)	(0.16)	(0.15)	(0.15)
Formerly Married	1.23*	1.23	1.23	1.31*	1.29	1.28
	(0.15)	(0.15)	(0.15)	(0.21)	(0.21)	(0.21)
African American non-Hispanic	0.31***	0.35***	0.35***	0.38***	0.46***	0.50***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)
Mexican American	0.61***	0.58***	0.58***	0.79***	0.76***	0.81**
	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.08)
Other Race/Ethnicity	0.58***	0.56***	0.56***	0.72**	0.69***	0.75**
	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)	(0.10)
Body Fat		1.08***	1.08***		1.10***	1.08***
		(0.01)	(0.01)		(0.01)	(0.01)
Waist Circumference			1.01*			1.03***
			(0.01)			(0.01)

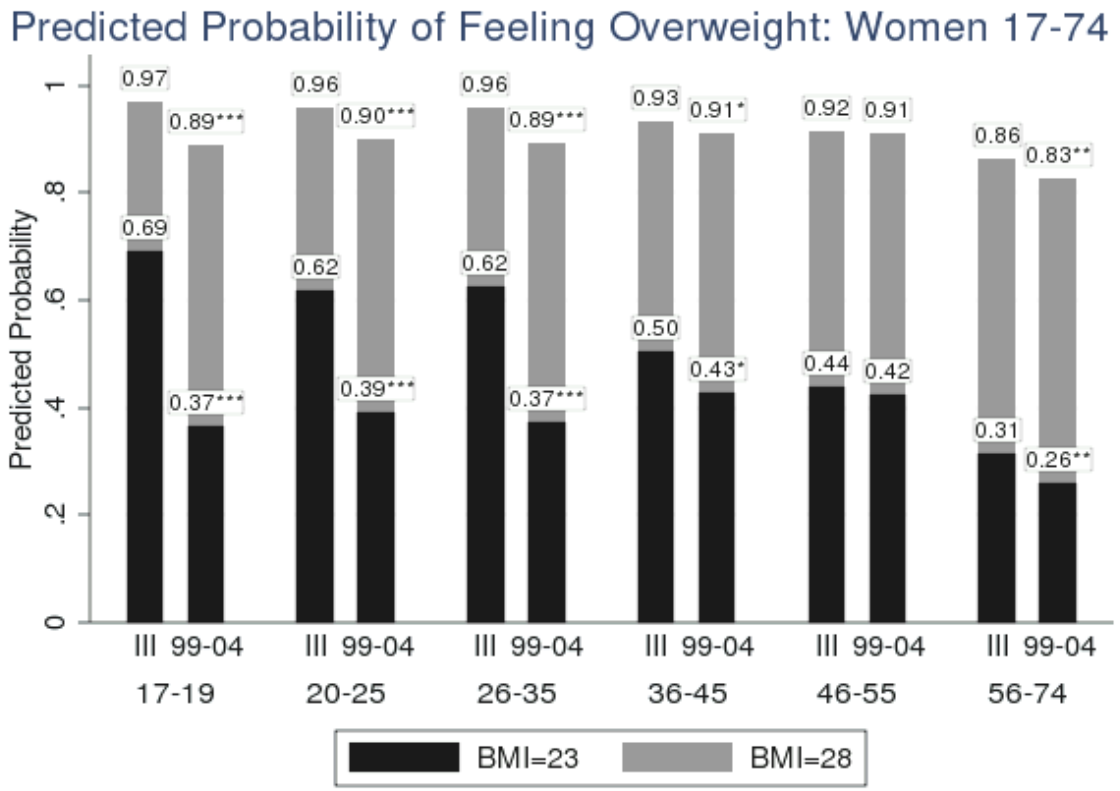
Notes: Coefficients represent odds ratios. Standard errors are in parentheses. *** indicates coefficient is significantly different from 1 at the 1% level or better, ** indicates coefficient is significantly different from 1 at the 5% level, * indicates coefficient is significantly different from 1 at the 10% level or better.

Table 6. Logit Estimates of Self-Classifying as Overweight, Pooled Sample.

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
NHANES 1999–2004	**0.71****	**0.60*****	**0.60*****	**0.70****	**0.71****	**0.73****
	(0.10)	(0.08)	(0.08)	(0.13)	(0.11)	(0.12)
Female	7.04***	3.21***	4.00***	4.93***	3.85***	4.46***
	(0.56)	(0.33)	(0.48)	(0.82)	(0.46)	(0.54)
NHANES 1999–2004 x Female	0.80**	0.74***	0.74***	0.52***	0.81**	0.75***
	(0.08)	(0.07)	(0.07)	(0.11)	(0.08)	(0.07)
BMI	4.06***	3.56***	3.43***	3.64***	3.50***	3.47***
	(0.15)	(0.16)	(0.15)	(0.19)	(0.15)	(0.15)
BMI Squared	0.98***	0.98***	0.98***	0.98***	0.98***	0.98***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age 17–19	1.38	1.55*	1.69**	5.41*	0.89	1.23
	(0.29)	(0.36)	(0.40)	(5.05)	(0.25)	(0.33)
Age 20–25	1.08	1.25	1.35**	2.61*	0.86	1.03
	(0.15)	(0.18)	(0.20)	(1.32)	(0.14)	(0.17)
Age 26–35	1.15	1.30**	1.36**	1.32*	1.11	1.17
	(0.14)	(0.16)	(0.16)	(0.19)	(0.13)	(0.14)
Age 46–55	0.87	0.82	0.80*		0.90	0.88
	(0.11)	(0.11)	(0.11)		(0.13)	(0.13)
Age 56–74	0.56***	0.50***	0.47***		0.51***	0.51***
	(0.06)	(0.06)	(0.06)		(0.06)	(0.07)
NHANES 1999–2004 x Age 17–19	0.63**	0.64*	0.61**	13.33	0.61**	0.57**
	(0.14)	(0.16)	(0.15)	(23.40)	(0.15)	(0.15)
NHANES 1999–2004 x Age 20–25	0.73*	0.74	0.71	24.44	0.79	0.73
	(0.14)	(0.15)	(0.15)	(50.90)	(0.16)	(0.15)
NHANES 1999–2004 x Age 26–35	0.72**	0.71**	0.70**	2.56	0.74*	0.70**
	(0.11)	(0.11)	(0.11)	(2.02)	(0.12)	(0.11)
NHANES 1999–2004 x Age 46–55	1.29	1.24	1.24		1.20	1.16
	(0.24)	(0.24)	(0.24)		(0.24)	(0.23)
NHANES 1999–2004 x Age 56–74	1.43**	1.27	1.28		1.32*	1.29
	(0.22)	(0.20)	(0.20)		(0.21)	(0.20)
High School Graduate	1.62***	1.64***	1.65***	1.75***	1.66***	1.65***
	(0.13)	(0.14)	(0.14)	(0.20)	(0.14)	(0.14)
Some College or College Graduate	1.81***	1.88***	1.90***	1.70***	1.91***	1.90***
	(0.12)	(0.13)	(0.13)	(0.17)	(0.13)	(0.13)
Middle Income Group	1.41***	1.44***	1.45***	1.53***	1.45***	1.45***
	(0.08)	(0.09)	(0.09)	(0.13)	(0.09)	(0.09)
High Income Group	1.46***	1.55***	1.58***	1.61***	1.58***	1.58***
	(0.09)	(0.10)	(0.10)	(0.14)	(0.10)	(0.10)
Married	1.32***	1.40***	1.39***	1.26**	1.36***	1.37***
	(0.11)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Formerly Married	1.13	1.20*	1.19*	1.22	1.19*	1.19*
	(0.11)	(0.12)	(0.12)	(0.18)	(0.12)	(0.12)
African American non-Hispanic	0.35***	0.40***	0.41***	0.40***	0.54***	0.51***
	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)
Mexican American	0.70***	0.68***	0.71***	0.74***	0.84**	0.79***
	(0.05)	(0.05)	(0.05)	(0.07)	(0.06)	(0.06)
Other Race/Ethnicity	0.66***	0.61***	0.63***	0.73**	0.57***	0.57***
	(0.07)	(0.06)	(0.06)	(0.10)	(0.06)	(0.06)
Body Fat		1.08***	1.08***	1.08***	1.08***	1.08***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Waist Circumference			1.02***	1.02***	1.02***	1.02***
			(0.00)	(0.01)	(0.00)	(0.00)
Childhood Obesity Rate				0.53*		
				(0.20)		
Mean BMI					0.84***	
					(0.03)	
Obesity Rate						0.98***
						(0.01)

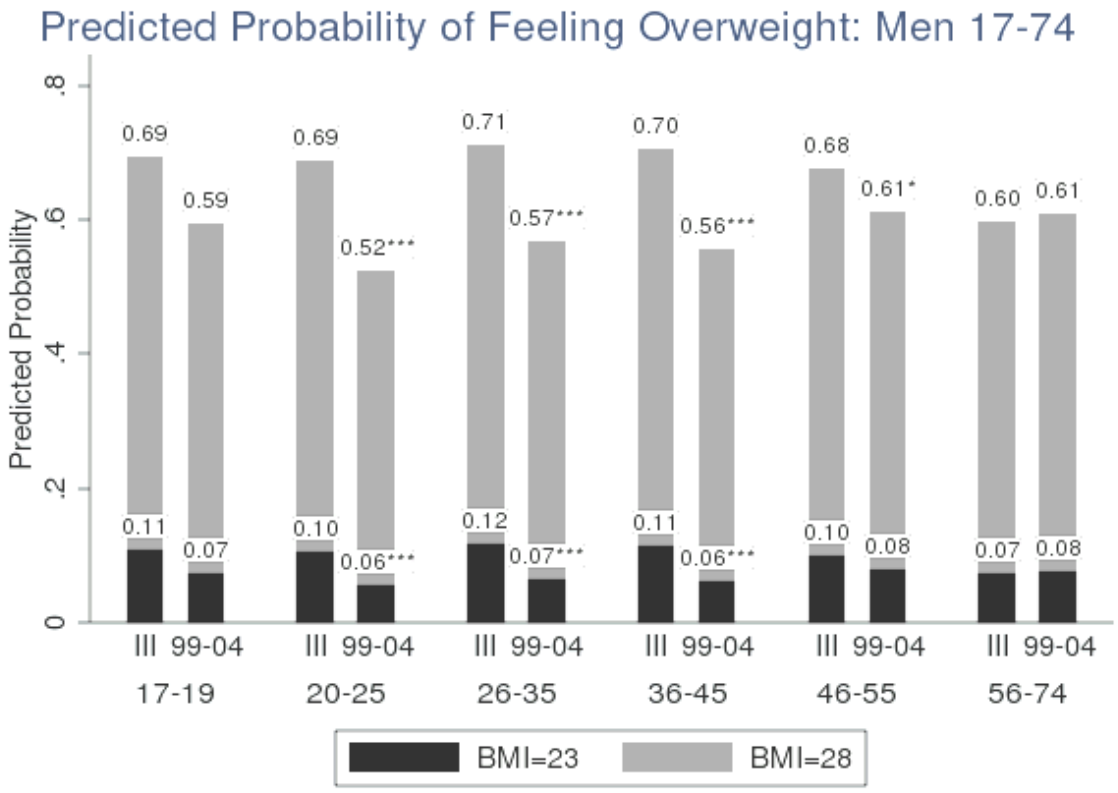
Notes: Coefficients represent odds ratios. Standard errors are in parentheses. *** indicates coefficient is significantly different from 1 at the 1% level or better, ** indicates coefficient is significantly different from 1 at the 5% level, * indicates coefficient is significantly different from 1 at the 10% level or better.

Figure 1. Predicted Probability of Feeling Overweight for Women by Age at BMI = 23, 28.



Notes: Observations with BMI >= 50 and observations with missing body fat and waist values excluded. *** indicates NHANES 1999–2004 average is significantly different from NHANES III at the 1% level or better, ** indicates NHANES 1999–2004 average is significantly different from NHANES III at the 5% level or better, * indicates NHANES 1999–2004 average is significantly different from NHANES III at the 10% level or better.

Figure 2. Predicted Probability of Feeling Overweight for Men by Age at BMI = 23, 28.



Notes: Observations with BMI >= 50 and observations with missing body fat and waist values excluded. *** indicates NHANES 1999–2004 average is significantly different from NHANES III at the 1% level or better, ** indicates NHANES 1999–2004 average is significantly different from NHANES III at the 5% level or better, * indicates NHANES 1999–2004 average is significantly different from NHANES III at the 10% level or better.

Data Appendix

Data Sets

The empirical analysis is conducted using data from the National Health and Nutrition Examination Survey (NHANES), a nationally-representative series of cross-sectional studies conducted by the Centers for Disease Control. The NHANES data include observations of weight, height, and weight perception, as well as information about demographic and socioeconomic characteristics collected via in-person interviews. We examine data from NHANES III (1988–1994) and NHANES 1999–2004.[29] We restrict the samples to individuals 16 to 74 years of age. In NHANES III respondents are interviewed starting at age 17. We calculate individual BMI values as weight in kilograms divided by the square of height in meters, using weight and height data measured by NHANES surveyors at mobile examination centers around the country.[30]

Measures

Education

Educational attainment is measured through self-reports of years of education, top-coded at 17+ years in the first three waves, where 16 years is an (imperfect) threshold indicating college completion. The 1999–2004 data are top-coded at 13, however, such that those with just some college cannot be distinguished from those with a college degree or better. In order to compare education effects across NHANES III and 1999–2004, we create consistent education categories, defined as 0–11 years or "less than high school," 12 years exactly or "high school," and 13 or more years or "some college (or above)."

[29] Since 1999, the survey has been conducted annually, with statistics reported in two-year increments. Reported figures for NHANES 1999–2004 refer to the combined data, but figures can be broken out for 1999–2000, 2001–2002 and 2003–2004. Data are available from NHANES 2005–2006, but we limit our analysis to the 1999–2004 data in order to enable the most comprehensive set of control variables.

[30] Individuals were also asked (in an interview session conducted separately from and prior to the examination) to report their own weight and height. For some individuals, the data contain only these self-reports and not also direct measurements, but we exclude the latter from our analysis. This exclusion minimizes measurement error and does not affect representativeness, since survey weights are provided that pertain to use of the examination-only sample.

Income

NHANES collects self-reported data on household income, rather than individual income, as a categorical variable. NHANES also includes a related variable based on household income, the "poverty income ratio," which is recommended for comparing income effects across different surveys.[31] As recommended in the NHANES analytical guidelines, we collapse the poverty income ratio into three categories, "low," "middle," and "high," representing, respectively, individuals with household income up to 1.3 times the poverty threshold, between 1.3 and 3.5 times the threshold, and more than 3.5 times the threshold.[32]

Marital Status

We observe information pertaining to marital status and living situation, including whether individuals are cohabiting with a partner and whether individuals are separated in addition to the standard legal categories. Using this information we create three categories, "married," which includes married people living with a spouse as well as unmarried individuals cohabiting with a partner, "formerly married," which includes divorced individuals as well as separated (or married but estranged) individuals no longer living with a spouse, and "never married," which includes those who have never been married and are not currently cohabiting.

Race and Ethnicity

NHANES III uses four race categories: white (non-Hispanic), black or African-American (non-Hispanic), Mexican-American, and "other." In NHANES 1999–2004, an additional category, "other Hispanic," was added, to capture non-Mexican Hispanics. To make the

[31] The poverty income ratio is roughly standardized for inflation and takes into account household size, whereas the raw income categories are not easy to align consistently in real terms across surveys.

[32] Individuals with incomes up to 1.3 times the poverty line are eligible for food assistance programs, and thus we might expect categorical differences in outcomes across this divide.

categories comparable across surveys, we merge "other Hispanic" with "other." In the analysis, we include dummy variables for each race category, letting whites be the omitted category.

Childhood Obesity Rates

We define overweight and obesity for those under age 20 using the CDC's official BMI-for-age-and-gender reference distributions. We classify children and adolescents with BMI values between the 85th and 95th percentile thresholds in the reference distribution as "overweight," and those above the 95th percentile as "obese." Underweight children and adolescents are those below the 5th percentile, and the normal range is between the 5th and 85th percentile values. It is important to note that some sources classify children and adolescents between the 85th and 95th percentile BMI values as "at risk of overweight," rather than "overweight," and those above the 95th percentile as "overweight" rather than "obese."

For individuals ages 17–42 in NHANES III, and those ages 17–52 in NHANES 1999–2004, we estimate the childhood obesity rate (among children ages 6–11 of the same sex) that would have prevailed when they were between the ages of 6 and 11. Observing the individual's age and the time period during which the individual was surveyed, we can back out the approximate time frame during which she or he would have been a child. Then we look up the previously published childhood obesity rates (gender-specific) observed in the NHES 2 survey, conducted in 1963–1965, and in waves I through III of NHANES, covering the periods 1971–1974, 1976–1980, and 1988–1994, respectively, (Ogden et al. 2006; Ogden et al. 2002), and we assign the rate from the appropriate time period. However, the year when a given individual was surveyed is observed only up to a 3-year window for NHANES III subjects, and up to a 2-year window for the 1999–2004 subjects. Therefore, in some cases, we cannot determine with certainty the appropriate survey from which to draw the childhood obesity rate, and in some cases subjects would have been children during a time frame for which no survey was conducted. When either

of two surveys may have been correct, we assign the average of the rates from those two surveys. In some cases, we could not map backward to an appropriate obesity rate. For example, we would need childhood obesity rates predating 1963 in order to assign childhood obesity rates to individuals ages 43 and older in NHANES III and those 53 and older in the 1999–2004 survey. Also, 23 year olds observed in NHANES 1999–2000, 26 year olds observed in NHANES 2001–2002, and 28 year olds observed in NHANES 2003–2004 could not be assigned childhood obesity rates, and instead they were assigned, respectively, the rates of 24, 27, and 29 year olds observed during the same survey periods.

Appendix Tables

Table A.1. Measures and Basic Descriptives

Men

Variable	Obs.	Mean	Std. Dev.	Min	Max
NHANES 1999–2004	14545	0.530	0.499	0	1
BMI	14359	27.144	5.328	13.8	70.2
AGE 17–25	14545	0.186	0.389	0	1
AGE 26–35	14545	0.223	0.416	0	1
AGE 46–55	14545	0.169	0.375	0	1
AGE 56–74	14545	0.198	0.399	0	1
NHANES 1999–2004 x AGE 17–25	14545	0.095	0.294	0	1
NHANES 1999–2004 x AGE 26–35	14545	0.106	0.308	0	1
NHANES 1999–2004 x AGE 46–55	14545	0.105	0.306	0	1
NHANES 1999–2004 x AGE 56–74	14545	0.103	0.304	0	1
High School Graduate	14481	0.286	0.452	0	1
Some College or Better	14481	0.473	0.499	0	1
Middle Income Group	13298	0.297	0.457	0	1
High Income Group	13298	0.417	0.493	0	1
Previously Married	14332	0.653	0.476	0	1
Never Married	14332	0.098	0.297	0	1

Women

Variable	Obs.	Mean	Std. Dev.	Min	Max
NHANES 1999–2004	16123	0.528	0.499	0	1
BMI	15893	27.266	6.842	11.7	79.6
AGE 17–25	16123	0.180	0.384	0	1
AGE 26–35	16123	0.214	0.410	0	1
AGE 46–55	16123	0.169	0.375	0	1
AGE 56–74	16123	0.217	0.412	0	1
NHANES 1999–2004 x AGE 17–25	16123	0.094	0.291	0	1
NHANES 1999–2004 x AGE 26–35	16123	0.103	0.304	0	1
NHANES 1999–2004 x AGE 46–55	16123	0.105	0.306	0	1
NHANES 1999–2004 x AGE 56–74	16123	0.113	0.316	0	1
High School Graduate	16071	0.310	0.463	0	1
Some College or Better	16071	0.464	0.499	0	1
Middle Income Group	14633	0.286	0.452	0	1
High Income Group	14633	0.375	0.484	0	1
Previously Married	15860	0.604	0.489	0	1
Never Married	15860	0.198	0.399	0	1

Table A.2. BMI Cutoffs for Adolescents (17–19) and Adults (20–74)

	Young Women			Young Men		
	Under (<)	**Over (>=)**	**Obese (>=)**	**Under (<)**	**Over (>=)**	**Obese (>=)**
17	17.2	25.2	29.6	17.8	25.0	28.2
18	17.6	25.6	30.4	18.4	25.6	29.0
19	17.8	26.2	31.0	18.8	26.4	29.8
Adult	18.5	25.0	30.0	18.5	25.0	30.0

Notes: From CDC's reference distributions. At a given gender and age, underweight is defined as below the 5^{th} percentile of the relevant BMI distribution, between 5^{th} and 85^{th} is defined as normal, 85^{th} to 95^{th} is considered overweight but not obese, and 95^{th} and above is obese.