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Body size reference norms and subjective weight status: A gender and life course approach

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Abstract

This paper uses data from The National Longitudinal Study of Adolescent to Adult Health (Add Health) to describe county-level variation in norms regarding physical weight among adolescents in the United States. We demonstrate that regardless of one's physical size, those residing in counties with a heavier weight norm are significantly less likely to see themselves as overweight than those residing in counties with a light weight norm. We further show that the local weight norm during adolescence (Wave 1) is associated with individuals' weight perceptions through adolescence and into young adulthood (Wave 4), though these associations attenuate in strength as respondents age. Our results suggest that weight norms have a stronger influence on weight perceptions among women compared to men and that the role of gender is particularly important during adolescence. We encourage life course researchers to consider the normative health environment during adolescence as an important context for understanding disparities in health and health lifestyles as people age.

Keywords

weight norms; reference groups; self-perceived weight status; contextual variation; gender; life course

Obesity prevalence among U.S. adults has nearly tripled in recent decades from roughly 13% in the 1970s to almost 38% in 2014 (Ogden et al. 2015). Obesity is comorbid with functional limitations and disability, is a risk factor for several chronic diseases, and increases mortality risk (Gelber et al. 2008; Masters et al. 2013; Preston, Stokes, and Mehta 2014; Rogers, Hummer, and Krueger 2003). Public health scholars and policy makers are therefore concerned about the consequences of rising obesity for population health and related healthcare costs (Cawley et al. 2009; Wang et al. 2003; Sturm 2002). Although most

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work has focused on objective obesity and physical health concerns, research has also shown that obesity is a stigmatizing social identity with mental health consequences (Terracciano and Sutin 2016).

The social practice which may bring about the stigmatization of obesity depends upon the social processes which define what a “normal weight” is, as well as who is “overweight.” Although the CDC provides objective criteria to classify individuals into discrete weight categories, what denotes an appropriate body size is a context-specific self-perception and subjective identity. The health consequences of objectively classified obesity are well established, but subjective self-perceptions of whether one is “normal weight” or “overweight” may have important social and mental health consequences as well (Wadsworth and Pendergast 2014). Body size norms have changed significantly over time (Andreyeva, Puhl, and Brownell 2008), and in this paper we focus on the extent to which they vary across locations. We add to existing research that links meso- and macro-level social factors to population health (Marmot et al. 2008; Speakman 2004) by examining whether and how county-level “normal weight” reference norms shape adolescents’ and young adults’ perceptions of their bodies above and beyond their objective weight.

Labels operate in relation to reference groups, and meanings attributed to body size are sensitive to social contexts. Therefore, norms about what constitutes a “normal” body size may vary across discrete social contexts (Boardman et al. 2012). Though a limited number of studies have sought to contextualize processes related to body size (Cohen-Cole and Fletcher 2008), most examinations of rising rates of obesity and its physical and mental health consequences have not taken into account reference points for what is considered “normal weight.” Recent work has shown that the adverse effects of obesity on mental health depend on local context (Wadsworth and Pendergast 2014). They specifically show that the association between higher BMI and increased risk of poor mental health is significantly lower for those residing in counties with higher obesity prevalence. They hypothesize that the normative context is the key mechanism through which the prevalence of obesity in an area affects the mental health of overweight individuals, but they do not specifically measure area differences in the shared understandings of what constitutes a “normal body size.” This contribution is critical because culture is purported to play an important role in demographic and sociological processes related to health behaviors and outcomes (England 2015; Bachrach 2014). However, evidence of normative variation and the contribution of this variation to health remains critically understudied.

We use the National Longitudinal Study of Adolescent to Adult Health Study (Add Health) to examine whether self-perception of being “normal weight” or “overweight” varies by social context and how this potential variation impacts self-labeling. Add Health provides a large representative sample of U.S. adolescents and young adults that allows us to build upon recent literature concerning variation in objective body mass index (BMI) at the county level (Kim et al. 2006; Fan, Wen, and Kowaleski-Jones 2016; Myers et al. 2015) and to focus on local norms for what types of bodies are considered “normal weight.” We first consider whether and how weight norms vary by social context, with a focus on whether those who self-label as “normal weight” have different average body sizes from one county to another. We find that weight norms vary considerably across geographical contexts. We

then examine how these varying weight norms link to individuals self-labeling as “overweight” and whether this link varies by gender and over the life course. We find that weight norms are associated with young persons’ likelihood of self-labeling as “overweight” above and beyond objective BMI, that weight norms more strongly affect women than men, and that the influence of weight norms experienced during adolescence persists into young adulthood. These associations attenuate however in strength over time.

1. Theory and Hypotheses

1.1 Context, reference groups, and norms

Health researchers who study social contexts such as neighborhoods and schools describe specific social pathways through which context influences individual health behaviors (Macintyre and Ellaway 2003) and shape individual-level health outcomes (Kawachi and Berkman 2003). Regarding body size, Ruel et al. (2010) found that the demographic and socioeconomic composition of neighborhoods predicts notable geographic variation in BMI levels. Mueller et al. (2010) also highlighted the importance of social environment, showing that school context and peer networks shape girls’ decisions to practice weight control. These neighborhood-level, school-level, and peer group-level patterns indicate the potential importance of contextual norms about idealized weight, which could produce stigma against those whose weight is above what is considered “normal” or acceptable (Boardman et al. 2012; Mustillo, Hendrix, and Shafer 2012; Mustillo, Bud, and Hendrix 2013).

One of the most important sociological understandings of identity is that self-perceptions are always developed in relation to reference groups (Merton 1949). We know obesity prevalence varies substantially by county, state, and region in the United States (Singh, Kogan, and van Dyck 2008; CDC 2010; Ezzati et al. 2006), but we know much less about whether or how the local weight distribution affects individuals’ perceptions of their own weight. We have good reason to believe that norms will vary by local context, and because self-labeling happens in relation to reference groups, that local norms could shape the meaning that individuals place on their body and thus their self-labeling practices. Given the patterns shown in past research (e.g., Wadsworth and Pendergast 2014), there are also strong reasons to believe that counties denote a meaningful ecological unit to evaluate these contextual processes. This is echoed by recent work from the Colorado Department of Public Health which shows notable variation in the prevalence of overweight/obese status across counties in the state. They also show significant variation in the age patterns of overweight/obese status across counties (CDPHE 2015). These patterns provide further support for our belief that counties capture socially relevant processes related to the increased risk of obesity at the individual level. We therefore expect that “normal weight” context at the county level will capture part of a person’s proximal lived experience and thus influence how they view themselves and, more specifically, their bodies. Following Kelley’s (1952) foundational work on the two functions of reference groups, we consider county-level “normal weight” contexts both as (1) the source of an individual’s norms and attitudes about weight and (2) a standard for comparison and self-assessment of one’s body.

Reference group processes can contribute to the development of descriptive and/or injunctive social norms (Cialdini and Trost 1998; Donald and Cooper 2001). Descriptive

norms refer to *what is*, and injunctive norms refer to *what ought to be*. In other words, descriptive norms refer to patterns of behavior in particular places or groups (Cialdini, Reno, and Kallgren 1990). Violating descriptive norms does not necessarily yield negative social sanctions, but descriptive norms can shape individual behavior (Rivis and Sheeran 2003). Although descriptive rather than prescriptive, people can use these norms to determine what is “normal.” Seeing some behaviors or appearances as “normal” and others as “abnormal” can easily produce slippage into injunctive (or prescriptive) norms. Injunctive norms are perceptions of which behaviors are and are not approved by others. Violating these group-level evaluations of how people ought to behave (or look) can yield negative social sanctions.

In this study we measure geographical variation in what adolescents consider to be normal body size, not what ought to be normal, and are therefore dealing in descriptive norms. Nevertheless, descriptive norms could influence and proxy unmeasured injunctive norms (Rimal and Real 2005). We argue that descriptive norms, which may proxy injunctive norms, will influence self-assessments of oneself as “normal” or not in regard to body weight. We expect that people will be more likely to label themselves as overweight in contexts with thinner weight norms than in contexts with heavier weight norms.

HYPOTHESIS 1: *Descriptive weight norms will vary across counties in the United States.*

HYPOTHESIS 2: *When comparing individuals with similar weights, those who live in areas with heavier descriptive weight norms will be less likely than those living in areas with lighter descriptive weight norms to identify as overweight.*

1.2 Gender and body size norms

Cultural processes may operate differently for women and men who face different expectations in numerous areas, including body standards. For example, although there are biological differences in typical body sizes and shapes of women and men, norms of masculinity and femininity encourage women to have smaller bodies (Grogan 2007). Research has shown body weight status to be a more salient identity marker for U.S. women than men (Demarest and Allen 2000; Anderson and Bulik 2004; McKinley 2006; Yuan 2010) and that women are more likely than men to overestimate their body size (Conley and Boardman 2007). Scholars have argued that the female body is understood by many as an object to be scrutinized, sexualized, and assessed (Spitzack 1990; Spencer, Rehman, and Kirk 2015). As women thus internalize this external gaze and scrutiny, they are more likely than men of comparable body shapes and sizes to evaluate their bodies as “overweight” because they are more frequently reminded of the gendered stigma associated with being “overweight” (Major et al. 2014; Schvey, Puhl, and Brownell 2011).

We anticipate that young women will be more sensitive to social cues from descriptive norms when compared to young men, especially in regard to self-perceptions of being “normal weight” or “overweight.” We therefore hypothesize that women will be more likely to report being overweight above and beyond objective BMI than men across the life course regardless of “normal weight” context. Further, we hypothesize that the local “normal

weight” reference norms will matter more for women’s self-perceptions of their bodies than for men’s.

HYPOTHESIS 3: *The association between objective and subjective weight status will be stronger for women than for men.*

HYPOTHESIS 4: *Contextual weight norms will more strongly affect the association between objective and subjective weight status among women than among men.*

1.3 Body size norms across the life course

Just as we expect gender-based differences in the association between weight norms and perceptions of one’s body, we expect that association to vary across the life course (Nelson et al. 2008; McKinley 1998). Recent research suggests that the effects of weight stigma are stronger at younger ages (Frisco, Houle, and Martin 2010; Van Hook and Baker 2010) and that young people are more likely to face weight discrimination than older people (Puhl, Andreyeva, and Brownell 2008). Young people’s normative reference groups can change as they age and experience new and more diverse social contexts (Moen and Hernandez 2009; Neugarten, Moore, and Lowe 1965; Settersten 2003), but life course research has shown that earlier norms and social contexts continue to shape later behaviors (Wickrama, Conger, Wallace, and Elder 1999; Smith 2015). Little current work has examined these contextual influences on later weight identity.

We expect that early life weight context will continue to influence adolescents’ self-perceptions as they transition into adulthood. However, we also expect that the continuing influence will weaken as people age. First, early life experiences and socialization are central to developing self-perceptions, and it is during this period that people first “learn” what the typical or appropriate body size is. Although early socialization is not deterministic of later outcomes (Maccoby 2015), it does shape later perceptions (Smetana et al. 2015), and early body size norms may continue to shape people’s perspective of what is “normal weight.” Yet, local norms may matter less later in life. As people age, their reference groups’ norms may expand to focus on broader societal levels beyond the county. People may become more informed about objective weight measures rather than relying on cues in their more limited social contexts. Thus, county-level normal weight reference norms may matter less at older ages when individuals have developed a more objective sense of social comparison which includes reference groups and cues from more diverse, broad social contexts (Young and Ferguson 1979; Brake 2013).

HYPOTHESIS 5: *Adolescent’s “normal weight” context will continue to affect their self-perceived weight into young adulthood.*

HYPOTHESIS 6: *The association between adolescent “normal weight” context and self-perception as “overweight” is weaker at older ages compared to younger ages.*

2. Methods

2.1 Data

To test our hypotheses, we use the four available waves of the National Longitudinal Study of Adolescent to Adult Health (Add Health) (Harris et al. 2009). Add Health is a nationally representative U.S. longitudinal data set of adolescents originally sampled in grades 7–12 during the 1994–95 school year. These data provide an excellent opportunity to examine how social environments and behaviors in young people are linked to health outcomes in adulthood. The original cohort was followed into adulthood with three additional in-home interviews that contained detailed information on respondents' social, psychological, and physical well-being, as well as information on respondents' families, neighborhoods, schools, and peer groups.

2.2 Variables and Descriptive Statistics

Perceived Weight Status—Our dependent variable was assessed at all 4 waves in Add Health with the following question: “How do you think of yourself in terms of weight?” Responses to this 5-point Likert scale question included: 1 = “very underweight”; 2 = “slightly underweight”; 3 = “about the right weight”; 4 = “slightly overweight”; and 5 = “very overweight.” In all analyses, our outcome variable of interest is the likelihood of self-assessing one's weight as “overweight.” This variable is a 0/1 binary indicator that codes “very underweight,” “slightly underweight,” and “about the right weight” as a “0” (“not overweight”) and “slightly overweight” and “overweight” as a “1” (“overweight”) [Endnote 1]. As shown in Table 1, the percentages of our analytic sample who self-labeled as “overweight” were 31%, 30%, 40%, and 57% for Waves 1, 2, 3, and 4, respectively.

Objective BMI—We calculated objective body-mass index using measured height and weight taken at Waves 2–4 ($BMI = (\text{weight in pounds} \times 703) / (\text{height in inches})^2$) [Endnote 2]. In Wave 1, only self-reported height and weight were assessed. However, based on the high correlation between objective BMI and self-reported BMI at Wave 2 ($r = 0.93$), we use self-reported BMI as a proxy for objective BMI at Wave 1. Average BMI values amongst our analytic sample were 22.5, 23.1, 26.4, and 29.1 for Waves 1, 2, 3, and 4, respectively.

Wave 1 “Normal Weight” County Reference Norm—Since both weight and height change during growth and development in adolescence, a young person's BMI must be interpreted relative to other adolescents of the same sex and age. Thus for Wave 1 of our dataset we use the Center for Disease Control's recommended growth charts for assessing weight percentiles in adolescents 20 years of age and younger (Ogden 2002). For each of our adolescent respondents, these growth charts provide age- and gender-specific z-scores describing an adolescent's BMI relative to other adolescents in standardized units.

¹While “overweight” is a clinical category for objective BMI values at or above 25, here it is used in a broader sense which indicates whether an individual is above what is perceived to be “normal” weight.

²Because weight is reported in pounds and height in inches in Add Health, “703” is used as a conversion from the standard kilograms/meters² BMI formula.

To estimate Wave 1 (early life course) weight reference norms we take the average CDC percentile among those who assessed their own weight as “about the right weight” for each county with at least 100 observations. This approach follows past research on school-level body size norms (Boardman et al. 2012). The use of CDC growth charts matches our purposes well because they are both age- and gender-normed, and compositional differences in the age and gender of the respondents will not affect our norm. Our study focuses on the 71 counties that included at least 100 respondents, which had an average of 292 respondents each (Min = 103; Max = 1776). Among these counties, the mean “normal” weight reference norm was at the 60th percentile in Wave 1, meaning that what the county-level average teen viewed as “about the right weight” was 10 percentage points higher than the average teen based on CDC growth charts.

Covariates—All models include controls for sex, age, and race/ethnicity for which means and percentages are presented in Table 1. Sex was 50% female in Waves 1 and 2 and 52% female in Waves 3 and 4. Mean ages were 15.7, 16.2, 22, and 28.5 for Waves 1, 2, 3, and 4, respectively. We used a five category race/ethnicity variable pre-constructed and provided in Add Health. Across waves, the average percent of respondents reporting their race as non-Hispanic white was 52%, as non-Hispanic black was 22%, as Native American was 1%, as Asian was 7%, and as Hispanic was 17%. We also control for the standard deviation of the percentile among those who say that they are “about the right weight,” which measures the level of consensus around the weight norm (i.e., how tightly or loosely people who say they are “normal weight” cluster around the average weight norm) [Endnote 3]. Additional analyses also control for mother’s education and county-level sociodemographic characteristics including county income, county race/ethnicity, and county education.

Statistical Analyses

We use a series of logistic regression models for each wave of the four-wave study to predict who self-labels as “overweight.” We exclude pregnant women from our sample. Age, BMI, Wave 1 normal weight reference norm, and variation in Wave 1 county norm are mean centered. We focus on interactions between objective BMI at each wave, gender, and the county “normal weight” reference norm at Wave 1 to consider how early life weight context moderates the gendered association between current BMI and the likelihood of assessing one’s own body as overweight as our respondents age into adulthood. In a series of robustness checks, we assess whether our results change substantively by also controlling for the wave-specific county normal weight reference norm and variation in these county norms in Waves 2, 3, and 4. We also consider whether those who stay in a county are different from those who move to a different county by Wave 4, which could have a different normal weight context. Finally, we examine the impact of county-level controls and whether the patterns vary by how the outcome measure is coded.

³Previous research has shown that county-level consensus regarding normative body size within social contexts is correlated with the level of the norm (Boardman et al. 2012). In other words, the mean weight among those who say “about the right weight” provides an estimate of the county-level normal weight reference norm, and the standard deviation of weight for this group provides an estimate of consensus around the norm. Both approaches to norm measurement have been used in the past, and they may at times provide distinct assessments of the normative context (Mollborn, Domingue, and Boardman 2014). In this paper we focus exclusively on the descriptive norm but control for weight consensus in all multivariate models.

3. Results

3.1 Variation in Normal Weight Context

Figure 1 shows the frequency distribution of county-level descriptive weight norms from 71 counties with at least 100 respondents in Wave 1 of Add Health. As described earlier, the values on the x-axis denote the average BMI among those who say that they are “about the right weight,” expressed as z-scores adjusting for age and gender. That is, a value of 0 to the far left of the distribution shows the three counties in which the “norm” weight is roughly the 50th percentile of the CDC growth chart. The mean of this distribution is 0.25 which translates to the 60th percentile. The one county with a value in excess of 0.5 indicates that the weight norm for this county is in excess of the 70th percentile among comparably aged boys and girls in the U.S. Overall, the distribution of what constitutes a “normal” weight clearly illustrates the importance of our measure of body size reference norms and how these norms vary considerably across counties in the United States.

3.2 County-Level Norms and Individual-Level Self-Perception

Table 2 reports logistic regression coefficients for our wave-specific analyses, first for just the main effects and then for key two-way interactions. In support of our second hypothesis (i.e., county-level norms are associated with self-perceptions of body size), we find a negative and significant main effect for Wave 1 county norms at each wave. Regardless of objective BMI, those who live in areas with heavier weight norms are less likely than those who live in counties with lighter weight norms to consider themselves to be overweight [Endnote 4]. Moreover, we find a significant and negative interaction between Wave 1 county weight norm and wave-specific objective BMI for each wave. This further enhances our understanding because the individual-level interaction suggests that our results are not simply a compositional finding, but rather point to important contextual effects (Subramanian, Lochner, and Kawachi 2003). The link between objective BMI and self-labeling as overweight is furthermore weaker in counties with higher weight norms and stronger in counties with lower weight norms (i.e., where being thin is the norm). Put another way, two groups of people with identical BMI values will have different likelihoods of perceiving themselves as overweight during young adulthood depending on the normal weight context of the county they lived in during adolescence.

The models with interactions in Table 2 present the individual-level interaction between BMI and sex as well as cross-level interactions between county weight norms and both sex and BMI. The BMI and sex interaction demonstrates that, in confirmation of Hypothesis 3, the association between objective and subjective weight status is stronger for women than for men in Wave 1 and Wave 2. In other words, BMI has a larger impact on women’s

⁴Here it is important to note that we present unstandardized logit coefficients in Tables 2 and 3. As such, it is not appropriate to compare the values of the effects and infer anything about the relative magnitude of individual BMI vs. county-level norm. Because they are not measured comparably and because it is not our goal to make these comparisons, we emphasize the unstandardized estimates that make the presentation of fitted values in Figure 2 more direct. Nevertheless, in ancillary analyses we calculated standardized logit coefficients using the *spost13* package for Stata (Long and Freese 2014). As with most contextual analyses, the relative magnitude of individual-level BMI was roughly 10 to 20 times larger than the effect of the contextual variable. While individual-level BMI only affects a given individual, the small effect of the contextual norm theoretically affects all residents of the county. As such the statistical effect size may be small, but the substantive significance with respect to public health is quite large.

propensity to identify as overweight than that of men. In order to consider Hypothesis 4—that contextual weight norms will more strongly affect the association between objective and subjective weight status among women than among men—we need a three-way interaction between sex, weight norms, and BMI. This interaction, presented in Table 3 for each of the waves, is significant in Wave 1 and Wave 3. Contextual weight norms therefore have a stronger impact on the association between objective and subjective weight status among women than among men.

Moving to the questions of whether “normal weight” context remains associated with self-perceptions as overweight into young adulthood (Hypothesis 5) and whether this continued association weakens (Hypothesis 6), we can turn back to Table 2. As displayed in the main effects in the models without interactions, the association between the county norm and the likelihood of labeling oneself as overweight remains significant through all four waves. Yet as expected, the size of the effect decreases over time. Overall, we have found consistent empirical support for each of our hypotheses.

To better illustrate the way in which the relationship between objective and subjective weight status varies by contextual weight norms we plot the effect of a one-unit increase in BMI on the increased probability of reporting oneself as “overweight” [Endnote 5]. The estimates and 95% confidence intervals shown in Figure 2 are derived from the models in Table 3 using the *margins* command in Stata 13 and summarize both the gender and developmental life course perspectives [Endnote 6]. This figure first makes it particularly clear that the patterns vary substantially by gender. Young women specifically are more likely than young men to self-label as overweight at the same BMI in Waves 1 through 3, but not in Wave 4. These patterns further illustrate that local weight norms are more strongly associated with women’s body perceptions than men’s but that the gender-based differences in overestimating one’s weight decline over the life course.

3.3 Sensitivity Analyses

In ancillary analyses, we considered weight norms at each wave instead of just at Wave 1 in order to determine whether the norms of each wave, rather than adolescent norms alone, drive the life course patterns we observe above. Table A1, which presents models that include the “normal weight” reference norm in each wave [Endnote 7], demonstrates that

⁵We calculate margins from each of our wave-specific models in Table 3 at fixed values (–5 and 5 percentage points relative to the sample mean) of our mean-centered Wave 1 county normal weight reference norm. These fixed values capture counties where the Wave 1 normal weight reference norm was low (5 percentile points lower than the mean) and high (5 percentile points above the mean), without drawing too heavily from the outliers of our distribution.

⁶Open circles reflect outcomes in counties with a relatively low “normal weight” reference norm, and closed circles reflect outcomes in counties with relatively high “normal weight” reference norms. Each circle can be interpreted as the increased probability of evaluating one’s body as “overweight” as a function of a one-unit increase in the respondent’s BMI. The effect of county weight reference norm is understood as the difference between the wave- and gender-specific estimates. For example, the two entries to the far right of the figure suggest that for young men in Wave 1, a one-unit increase in BMI increases the probability of reporting overweight by roughly 0.05 for those in counties with a relatively low normal weight reference norm value, and by roughly 0.04 for those residing in counties with a relatively high normal weight reference norm. We provide these estimates at each wave by gender, and further by low and high Wave 1 county reference norms. For instance, in Wave 3 women who lived in a county with a low normal weight reference norm in Wave 1 have about a 0.06 increased probability of describing themselves as overweight for each one-unit increase in BMI.

⁷In Wave 2, we calculated this norm with the CDC z-scores as we did in Wave 1, since most respondents are age 20 or younger. In Waves 3 and 4, we used the same method to calculate the normal weight reference norm, but here we used measured BMI rather than percentile, since most respondents in these waves are age 21 or older.

wave-specific norms do influence self-perceptions. The earlier influence of norms experienced at Wave 1 nevertheless continue to influence self-perceptions. This pattern indicates that although new reference norms develop over the life course, early life experiences still have a lasting influence. Perhaps even more importantly, in the case of Wave 3, while the Wave 1 county norm remains comparable to the earlier results, Wave 3 norm does not independently affect weight assessment, providing very strong support for the idea that area of residence during adolescence may set the stage for later life understandings of healthy lifestyles. This same understanding is further bolstered when one considers the analyses shown in Table A2. Here, we considered how moving between Wave 1 and Wave 4 affected the relationship between adolescent norms and self-perceptions of body size in young adulthood. To protect confidentiality, our dataset does not allow researchers to trace the counties to which particular individuals move to and from. However, we are provided with an estimate of the distance moved between waves. In Table A2 we therefore re-estimate our Wave 4 models using this information as a proxy for moving to different counties [Endnote 8]. We first control for the distance moved between Waves 1–4 for all individuals in Wave 4. Second, we stratify by those who moved between Waves 1–4 and those who did not. The patterns are consistent across estimation strategies. Although our measures are in some ways limited, this robustness check suggests that norms experienced during adolescence have an effect across the life course, both for people who move and those who do not move. Again, even among those who moved, the effect of Wave 1 county norm and the interaction between BMI and county norm remain statistically significant. This change reduced the magnitude of the three-way interaction to a value that was no longer statistically significant, and we encourage future researchers to consider this association more thoroughly.

There are several limitations that are important to consider. First, our data are observational, and we cannot be sure omitted variables are not biasing our results. We have however considered and confirmed that the results are robust to a number of different specification strategies and the inclusion of additional individual-level and county-level controls. In Table A3, we re-estimate the final models presented in Table 3 with additional controls for mother's education, county-level median household income, county-level percent black, county-level percent Hispanic, and county-level percent of adults 25 or older who had completed college. As shown in the table, the main effects of normative weight context and our "Wave 1 County Norm x BMI" interaction term remain significant, despite the additional statistical controls [Endnote 9].

We finally focus on those who consider themselves to be overweight, because we believe that this designation has more meaning for individuals than a one-point increase on a 5 point

⁸We focus on Wave 4 because it is the furthest from Wave 1. Robustness analyses for movement were conducted in Waves 2 and 3 as well. These analyses showed similar results as the Wave 4 analyses. These results are available upon request.

⁹Because we add additional controls to the models in Table A3, our sample size decreases from the results reported in our main models in Table 3. Accordingly, our coefficients for the main effect of county normative weight context and the "Wave 1 County Norm x BMI" interaction appear to increase in magnitude. To therefore make a fair comparison, in Table A4 we re-run the main analyses from Table 3, this time limiting to the samples used in the models in Table A3. Moving from the models in Table A4 to the models in Table A3, which include county-level controls, we see slight or no attenuation in the main effect of county normative weight context or the "Wave 1 County Norm x BMI" interaction. These comparisons provide further evidence that our county-level SES controls do not alter the effect of county normative weight context in one's subjective assessment of their own weight.

Likert scale. Yet it is also important to consider comparable models using the full range of response options from the survey. Accordingly, Table A5 presents results for an alternative specification of our outcome measure as an ordinal outcome (ranging from very underweight=1 to very overweight=5) instead of the binary presented in the main results (overweight=1). The overall patterns again remain robust. While we must therefore remain circumscribed in the causal claims we can make with the data we use, the patterns are very consistent across modeling strategies. In an accompanying online supplement to this paper we provide more additional analyses for the interested reader, including multilevel models which focus in more detail on processes related to age and gender.

4. Discussion

In this study we provide evidence suggesting that the likelihood of labeling oneself as “overweight” varies considerably across geographic areas. Of equal importance, we show that the geographic area in which U.S. young adults experienced adolescence continues to shape how they perceive their bodies, and that this association is different for men and women at different stages of the life course. Consistent with past research on obesity-related stigma, “normal weight” contexts have more of an influence for women than for men and for adolescents than for young adults. Women face more weight discrimination than men (Andreyeva et al. 2008; Mason 2012), and likewise “normal weight” norms have more of an influence on women than men—especially so among young people. Moreover, weight discrimination is highest among adolescents (Frisco, Houle, and Martin 2010; Van Hook and Baker 2010) and declines over the life course (Puhl, Andreyeva, and Brownell 2008), and “normal weight” norms have more of an influence on adolescents and declines as people age.

Previous work has evaluated contextual influences on physical weight (Burdette and Whitaker 2005; Boardman et al. 2005) and demonstrated important biological underpinnings of physical weight as a function of the normal weight environment (Boardman et al. 2012). Past research has also examined contextual variation in body size as an important factor related to mental well-being (Wadsworth and Pendergast 2014). We too examine contextual effects, but instead of focusing on just physical weight, we consider the interaction between contextual weight norms and physical weight in shaping individual’s propensity to self-label as overweight. We leveraged variation in geographical differences in body size that exist across the United States (CDC 2010), and norms related to what is considered a “normal” body, and found disparate understandings of a healthy or “normal” body size. We demonstrated that groups with similar bodies will be more or less likely to consider themselves overweight depending on where they live and who they are.

Our findings suggest that individuals exposed to different environments in early life will develop different reference points for what particular body size is “normal,” and these reference points will continue to impact their self-perceptions as they enter adulthood. Our results indicate that county-level “normal weight” context early in life operates as a reference point that young Americans compare against when determining the types of bodies that constitute “normal” weight. In particular, those who were socialized about “normal” body sizes in places with thinner normal weight reference norms were more likely to assess

their own bodies as “overweight” across waves. In contrast, those socialized in places with heavier normal weight reference norms were less likely to assess their own bodies as “overweight.” The consequences of these norms are particularly salient in the earlier parts of the life course and have less of an impact as individuals age. At older ages, reference norms likely expand beyond the local context, and self-perceptions about body size could be more informed by technical knowledge and larger-scale comparisons across larger social contexts (Moen and Hernandez 1999; Setterson 2003). As expected, we observed that early life course descriptive normal weight reference norms mattered less at older ages when individuals may be drawing from broader and more diverse reference groups.

Contextual “normal weight” reference norms appear to play a larger role in the self-perceptions of women than men. Women were consistently more likely than men to report being overweight, and the differential likelihood of self-assessing as overweight by low and high “normal weight” contexts was on average greater than the differential for men. Although not surprising, this pattern demonstrates a socially important consequence: the self-perception costs of weight increases are greater for women than for men, especially among young people.

The social contexts in which people are first exposed to the idea of a “normal” body size could be an important bridge to understanding the mental health outcomes associated with different body types (Andreyeva, Puhl, and Brownell 2008; Terracciano and Sutin 2016). Indeed, the health literature on perceived weight status shows highly robust evidence that weight perception is associated with mental health problems like depression, especially for adolescents and young adults, and that the association is stronger for young women than for young men (Goldfield et al. 2010; Bigdeli et al. 2017). Even more importantly, past research has shown that weight perception, but not measured weight, is associated with these mental health problems for young adults (Al Mamun et al. 2007). Adding to this robust evidence from the literature, our study indicates that perceptions of weight vary by normative weight context. The important implication then is that the social norms that are associated with health outcomes like depression may depend upon the normative health context in which one finds oneself. This context could affect how and when individuals manage their own health and might help explain some of the differential patterns in health and health behavior we observe at the county and state levels in the United States (CDC 2010; Robert Wood Johnson Foundation 2017).

Because a person’s perception of her or his body size has implications for mental health and well-being (Mustillo, Bud, and Hendrix 2013; Wadsworth and Pendergast 2014), these disparities in vulnerability to early social contextual influences could have lifelong impacts which both reflect and reinforce social inequalities. Future research should continue to trace culturally influenced perceptions at the collective and individual levels and across the life course. More specifically, future research could focus on more macro- or micro-level normal weight contexts (i.e., neighborhoods, states) to compare effects across these different spatial levels. Researchers could also consider whether and how these patterns operate further into the life course and, should new data come available, break down norms by subpopulations. For example, we might expect that weight norms in a county would operate differently across racial and ethnic groups, and future data that provides sufficient numbers of people in

different groups to calculate separate group-specific local norms could be leveraged to great benefit. This is particularly important when one considers the well-established link between obesity and type 2 diabetes (Mokdad et al. 2003), and the subsequent disparities that exist in both obesity status and diabetes across racial and ethnic groups in the United States. Among adults 20 years and older, 7.6% of non-Hispanic whites and 13.2% of non-Hispanic blacks have been diagnosed with diabetes (CDC 2014). In ancillary analyses, we re-evaluated our models, but this time examined two different dependent variables. The first was a diagnostic criterion for diabetes based on blood draws at Wave 4 (Whitsel et al. 2012), and the second was a respondent self-report of ever having been diagnosed with diabetes. Our results suggest that a one-unit increase in BMI is consistently associated with an increased risk for diabetes based on the objective criteria from blood samples, regardless of the body size norms of the county. However, in considering self-reported diabetes, a one-unit increase in BMI led to a greater likelihood of reported diabetes for those in counties with a relatively light body size norm, compared to those with comparable BMI in counties with a relatively heavy body size norm. The fact that physiological pathways are identical regardless of where one lives, but knowledge regarding the morbidity depends on the local body size norms, may point to county-level differences in communication between physicians and patients, access to health care, or other institutional level factors that demand attention. We encourage future work to evaluate how contextual weight and health norms might inform physical health outcomes and knowledge of these outcomes.

In sum, our study shows that whether someone self-labels as overweight depends on where they live, their age, and their gender. These findings have important implications for stigma processes, and social norms should be further examined as Americans' BMIs continue to rise and greater numbers of people experience not only physical health complications but also social stigma and mental health disadvantages that could in part be related to contextual variation in what constitutes "normal weight."

Additional Considerations

While not the central focus of this paper, there are two important substantive issues that readers should consider when interpreting our results. First, research on social disparities in health has increasingly been turning to the early life course to explain later health and health behavior (Hayward and Gorman 2004; Haas 2007; Willson, Shuey, and Elder 2007). Social and cultural understandings shape individual attitudes which are clearly shaped by experiences and exposures earlier in life. This study provides support for the argument that early socialization in contexts with relatively higher levels of physical weight could contribute to cumulative advantage/disadvantage throughout the life course beyond material circumstances and physical health (DiPrete and Eirich 2006; Willson, Shuey, and Elder 2007). Exposure to different understandings of "normal" body size in one's social contexts influences people's later perceptions of their own bodies in ways that are gendered and aged, which may in turn create differential vulnerabilities for different subpopulations. This is particularly important when one considers the large disparities in obesity prevalence across socially defined racial and ethnic groups. According to recent CDC estimates, 48.1% of non-Hispanic black and 42.5% of Hispanic adults are obese compared to 34.5% of non-Hispanic white adults. These differences are less pronounced among men and very large among

women, with obesity prevalence estimates of 35.5%, 56.9%, and 45.7 % for white, black, and Latina women, respectively. As described above, we examined comparable models controlling for the racial and ethnic composition of counties, but these controls did not eliminate the association. In fact, these controls enhanced the magnitude of our parameter estimates. However, if members of racial and ethnic minorities are more concentrated in counties with higher weight norms, then a generally shared understanding of appropriate body size among all residents of the county will contribute to racial and ethnic disparities in obesity, simply because of the non-random geographic distributions of adults as a function of racial identity. We encourage future researchers to evaluate comparable questions, but to also consider racialized norms and see how these associations differ when considering the norm of one's racial group compared to the norm of other racial and ethnic groups in the local community. While sample sizes limit our ability to evaluate this question in our analyses, it is nonetheless important to consider.

Second, we find that women are more likely than men to respond to social cues regarding the appropriate body size and that this gender association is particularly pronounced at younger ages. This finding is very much in line with work using these same data (Wedow et al. 2016), which shows that physical weight, subjective weight, and weight identity (self-reported weight above and beyond objective weight) are all influenced by genetics; roughly 35–50% of the variation in weight identity is due to additive genetic variation in the population. Most importantly, this estimate is roughly 35–39% in adolescence, but increases to 50% by Wave 4 of the study. As social influences wane, the relative contribution of genetic factors becomes increasingly important. We encourage future researchers to consider evaluating comparable hypotheses regarding sensitivity to local body size norms, but also to evaluate the way in which genetic polymorphisms linked to environmental sensitivity are different for men and women.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

- Andreyeva, Tatiana, Puhl, Rebecca M., Brownell, Kelly D. Changes in Perceived Weight Discrimination among Americans, 1995–1996 through 2004–2006. *Obesity*. 2008; 16:1129–1134. [PubMed: 18356847]
- Anderson, Charles B., Bulik, Cynthia M. Gender Differences in Compensatory Behaviors, Weight and Shape Salience, and Drive for Thinness. *Eating Behaviors*. 2004; 5(1):1–11. [PubMed: 15000949]
- Archer, Edward, et al. Validation of a Novel Protocol for Calculating Estimated Energy Requirements and Average Daily Physical Activity Ratio for the US Population: 2005–2006. *Mayo Clinic Proceedings*. 2013; 88(12)
- Bachrach, Christine A. Culture and Demography: From Reluctant Bedfellows to Committed Partners. *Demography*. 2014; 51(1):3–25. [PubMed: 24338643]
- Bigdeli TB, et al. Genetic Effects Influencing Risk for Major Depressive Disorder in China and Europe. *Translational Psychiatry*. 2017; 7(3):e1074. [PubMed: 28350396]
- Boardman, Jason D., Saint, Onge JM., Rogers, RG., Denney, JT. Race Differentials in Obesity: The Impact of Place. *Journal of Health and Social Behavior*. 2005; 46(3):229–243. [PubMed: 16259146]
- Boardman, Jason D., et al. Gene-environment interactions related to body mass: School policies and social context as environmental moderators. *Journal of Theoretical Politics*. 2012; 24(3):370–388. [PubMed: 23236222]

- Brake, Mike. Comparative Youth Culture: The Sociology of Youth Cultures and Youth Subcultures in America, Britain and Canada. New York: Routledge; 2013.
- Burdette, Hillary L., Whitaker, Robert C. A National Study of Neighborhood Safety, Outdoor Play, Television Viewing, and Obesity in Preschool Children. *Pediatrics*. 2005; 116(3):657–662. [PubMed: 16140705]
- Cawley, John. Obesity, Business and Public Policy. 2009. The Labor Market Impact of Obesity; p. 76
- Centers for Disease Control and Prevention. Vital Signs: State-Specific Obesity Prevalence Among Adults-United States. *MMWR. Morbidity and Mortality Weekly Report*. 2010; 59(30):951. [PubMed: 20689500]
- Centers for Disease Control and Prevention. National Diabetes Statistics Report, 2014. 2014. <https://www.cdc.gov/diabetes/pubs/statsreport14/national-diabetes-report-web.pdf>
- Church, Timothy S., et al. Trends Over 5 Decades in US Occupation-Related Physical Activity and Their Associations with Obesity. *PloS one*. 2011; 6(5):e19657. [PubMed: 21647427]
- Cialdini, Robert B., Reno, Raymond R., Kallgren, Carl A. A Focus Theory of Normative Conduct: Recycling the Concept of Norms to Reduce Littering in Public Places. *Journal of Personality and Social Psychology*. 1990; 58(6):1015–1026.
- Cialdini, Robert B., Trost, Melanie R. Social Influence: Social Norms, Conformity and Compliance. In: Gilbert, Daniel T., Fiske, Susan T., Lindzey, Gardner, editors. *The Handbook of Social Psychology*. New York: McGraw-Hill; 1998. p. 151-192.
- Cohen-Cole E, Fletcher Jason M. Is Obesity Contagious? Social Networks vs. Environmental Factors in the Obesity Epidemic. *Journal of Health Economics*. 2008; 27(5):1382–1387. [PubMed: 18571258]
- Colorado Department of Public Health and Environment. “Process Steps Using a Multilevel Regression Model for Small Area BMI BRFSS eEstimates. 2015. http://www.cohealthmaps.dph.state.co.us/cdphe_community_level_estimates/assets/presentations_methods/CDPHE_BRFSS_SAE_Process%20Diagram_2015.pdf
- Conley A, J Boardman. Weight Overestimation as an Indicator of Disordered Eating Behaviors Among Young Women in the United States. *International Journal of Eating Disorders*. 2007; 40(5):441–445. [PubMed: 17497706]
- Demarest, Jack, Allen, Rita. Body Image: Gender, Ethnic, and Age Differences. *Journal of Social Psychology*. 2000; 140:465–472. [PubMed: 10981375]
- DiPrete, Thomas A., Eirich, Gregory M. Cumulative Advantage as a Mechanism for Inequality: A Review of Theoretical and Empirical Developments. *Annual Review of Sociology*. 2006; 32:271–297.
- Donald, Ian, Cooper, Simon R. A Facet Approach to Extending the Normative Component of the Theory of Reasoned Action. *British Journal of Social Psychology*. 2001; 40(4):599–621. [PubMed: 11795070]
- England P. Sometimes the Social Becomes Personal: Gender, Class, and Sexualities. *American Sociological Review*. 2015; 81(1):4–28.
- Ezzati, Majid, et al. Trends in National and State-Level Obesity in the USA after Correction for Self-Report Bias: Analysis of Health Surveys. *Journal of the Royal Society of Medicine*. 2006; 99(5): 250–257. [PubMed: 16672759]
- Fan, Jessie X., Wen, Ming, Kowaleski-Jones, Lori. Tract-and County-Level Income Inequality and Individual Risk of Obesity in the United States. *Social Science Research*. 2016; 55:75–82. [PubMed: 26680289]
- Frayling, Timothy M., et al. A Common Variant in the FTO Gene is Associated with Body Mass Index and Predisposes to Childhood and Adult Obesity. *Science*. 2007; 316:89–894. [PubMed: 17412954]
- Frisco, Michelle L., Houle, Jason N., Martin, Molly A. The Image in the Mirror and the Number on the Scale weight, Weight Perceptions, and Adolescent Depressive Symptoms. *Journal of health and social behavior*. 2010; 51(2):215–228. [PubMed: 20617760]
- Gelber, Rebecca P., et al. Measures of Obesity and Cardiovascular Risk Among Men and Women. *Journal of the American College of Cardiology*. 2008; 52(8):605–615. [PubMed: 18702962]

- Goldfield, Gary S., et al. Body Dissatisfaction, Dietary Restraint, Depression, and Weight Status in Adolescents. *Journal of School Health*. 2010; 80(4):186–192. [PubMed: 20433644]
- Grogan, Sarah. *Body image: Understanding body dissatisfaction in men, women and children*. Routledge; 2007.
- Haas SA. The Long-Term Effects of Poor Childhood Health: An Assessment and Application of Retrospective Reports. *Demography*. 2007; 44(1):113–135. [PubMed: 17461339]
- Harris, Kathleen M., et al. The National Longitudinal Study of Adolescent Health: Research Design. 2009. Available at <http://www.cpc.unc.edu/projects/addhealth/design>
- Hayward, Mark D., Gorman, Bridget K. The Long Arm of Childhood: The Influence of Early Life Social Conditions on Men's Mortality. *Demography*. 2004; 41(1):87–107. [PubMed: 15074126]
- Herbert, Alan, et al. A Common Genetic Variant is Associated with Adult and Childhood Obesity. *Science*. 2006; 312(5771):279–283. [PubMed: 16614226]
- Kawachi, Ichiro, Berkman, Lisa F., editors. *Neighborhoods and Health*. New York: Oxford University Press; 2003.
- Kim, Daniel, et al. US State-and County-Level Social Capital in Relation to Obesity and Physical Inactivity: A Multilevel, Multivariable Analysis. *Social Science & Medicine*. 2006; 63(4):1045–1059. [PubMed: 16644081]
- Kelley, Harold H. Two Functions of Reference Groups. In: Swanson, GuyNewcomb, Theodore, Hartley, Eugene, editors. *Society for the Psychological Study of Social Issues, Readings in Social Psychology*. New York: Holt; 1952. p. 410-414. Reprint in: *Readings in Reference Group Theory and Research*, by Herbert Hyman & Eleanor Singer. New York: Free Press, London: Collier-Macmillan Limited. pp. 77–83. (Page citations are to the reprint edition)
- Long, J Scott, Freese, Jeremy. *Regression models for categorical dependent variables in Stata*. 3. College Station, TX: Stata Press; 2014.
- Maccoby, Eleanor. Historical Overview of Socialization Research and Theory. In: Grusec, Joan, Hastings, Paul, editors. *Handbook of Socialization: Theory and Research*. New York, NY: The Guilford Press; 2015. p. 3-34.
- Macintyre, Sally, Anne, Ellaway. *Neighborhoods and Health: An Overview*. *Neighborhoods and Health*. 2003:20–42.
- Maddock, Jay. The Relationship Between Obesity and the Prevalence of Fast Food Restaurants: State-Level Analysis. *American Journal of Health Promotion*. 2004; 19(2):137–143. [PubMed: 15559714]
- Mamun, Abdullah, et al. Adolescents' Perceived Weight Associated with Depression in Young Adulthood: A Longitudinal Study. *Obesity*. 2007; 15(12):3097–3105. [PubMed: 18198320]
- Major, Brenda, et al. The Ironic Effects of Weight Stigma. *Journal of Experimental Social Psychology*. 2014; 51:74–80.
- Marmot, Michael, et al. Closing the Gap in a Generation: Health Equity through Action on the Social Determinants of Health. *The Lancet*. 2008; 372(9650):1661–1669.
- Mason, Katherine. The Unequal Weight of Discrimination: Gender, Body Size, and Income Inequality. *Social Problems*. 2012; 59(3):411–435.
- Masters, Ryan K., et al. The Impact of Obesity on US Mortality Levels: The Importance of Age and Cohort Factors in Population Estimates. *American Journal of Public Health*. 2013; 103(10):1895–1901. [PubMed: 23948004]
- McKinley, Nita Mary. Gender Differences in Undergraduates' Body Esteem: The Mediating Effect of Objectified Body Consciousness and Actual/Ideal Weight Discrepancy. *Sex Roles*. 1998; 39(1):113–123.
- McKinley, Nita Mary. Longitudinal Gender Differences in Objectified Body Consciousness and Weight-Related Attitudes and Behaviors: Cultural and Developmental Contexts in the Transition from College. *Sex Roles*. 2006; 54(3–4):159–173.
- Miech, Richard Allen, et al. The Sequencing of a College Degree During the Transition to Adulthood: Implications for Obesity. *Journal of Health and Social Behavior*. 2015; 56(2):281–295. [PubMed: 26022787]
- Merton, Robert King. *Social Theory and Social Structure*. Simon and Schuster; 1949.

- Moen, Phyllis, Hernandez, Elaine. Social Convoys: Studying Linked Lives in Time, Context, and Motion. *The Craft of Life Course Research*. 2009:258–279.
- Mokdad, Ali H., et al. Prevalence of Obesity, Diabetes, and Obesity-Related Health Risk Factors. *Jama*. 2003; 289(1):76–79. [PubMed: 12503980]
- Mueller, Anna S., et al. Sizing Up Peers Adolescent Girls' Weight Control and Social Comparison in the School Context. *Journal of Health and Social Behavior*. 2010; 51(1):64–78. [PubMed: 20420295]
- Mustillo, Sarah A., Hendrix, Kimber L., Schafer, Markus H. Trajectories of Body Mass and Self-Concept in Black and White Girls: The Lingering Effects of Stigma. *Journal of Health and Social Behavior*. 2012; 53(1):2–16. [PubMed: 22382717]
- Mustillo, Sarah A., Budd, Kristen, Hendrix, Kimber. Obesity, Labeling, and Psychological Distress in Late-Childhood and Adolescent Black and White Girls: The Distal Effects of Stigma. *Social Psychology Quarterly*. 2013; 76(3):268–289.
- Myers, Candice A., et al. Regional Disparities in Obesity Prevalence in the United States: A Spatial Regime Analysis. *Obesity*. 2015; 23(2):481–487. [PubMed: 25521074]
- Nelson, Melissa C., et al. Emerging Adulthood and College-Aged Youth: An Overlooked Age for Weight-Related Behavior Change. *Obesity*. 2008; 16(10):2205–2211. [PubMed: 18719665]
- Neugarten, Bernice L., Moore, Joan W., Lowe, John C. Age Norms, Age Constraints, and Adult Socialization. *American Journal of Sociology*. 1965:710–717.
- Mollborn, Stephanie, Domingue, Benjamin W., Boardman, Jason D. Norms as Group-Level Constructs: Investigating School-Level Teen Pregnancy Norms and Behaviors. *Social Forces*. 2014; 93(1):241–267.
- Ogden, Cynthia L., et al. Centers for Disease Control and Prevention 2000 Growth Charts for the United States: Improvements to the 1977 National Center for Health Statistics Version. *Pediatrics*. 2002; 109(1):45–60. [PubMed: 11773541]
- Ogden, Cynthia L., et al. Prevalence of Childhood and Adult Obesity in the United States, 2011–2012. *Jama*. 2015; 311(8):806–814.
- Preston, Samuel H., et al. Projecting the Effect of Changes in Smoking and Obesity on Future Life Expectancy in the United States. *Demography*. 2014; 51(1):27–49. [PubMed: 24272710]
- Pudrovska, Tetyana, Logan, Ellis Scott, Richman, Aliza. Early Life Social Origins of Later-Life Body Weight: The Role of Socioeconomic Status and Health Behaviors Over the Life Course. *Social Science Research*. 2014; 46:59–71. [PubMed: 24767590]
- Puhl, Rebecca M., Latner, Janet D. Stigma, Obesity, and the Health of the Nation's Children. *Psychological Bulletin*. 2007; 133(4):557. [PubMed: 17592956]
- Puhl, Rebecca M., Andreyeva, Tatiana, Brownell, Kelly D. Perceptions of Weight Discrimination: Prevalence and Comparison to Race and Gender Discrimination in America. *International Journal of Obesity*. 2008; 32(6):992–1000. [PubMed: 18317471]
- Reither, Eric N., Hauser, Robert M., Yang, Yang. Do Birth Cohorts Matter? Age-Period-Cohort Analyses of the Obesity Epidemic in the United States. *Social Science & Medicine*. 2009; 69(10):1439–1448. [PubMed: 19773107]
- Rimal, Rajiv N., Real, Kevin. How Behaviors Are Influenced by Perceived Norms: A Test of the Theory of Normative Social Behavior. *Communication Research*. 2005; 32(3):389–414.
- Rivis, Amanda, Sheeran, Paschal. Descriptive Norms as an Additional Predictor in the Theory of Planned Behavior: A meta-Analysis. *Current Psychology*. 2003; 22(3):218–233.
- Robert Wood Johnson Foundation. The State of Obesity: Diabetes in the United States. 2017. <http://stateofobesity.org/diabetes>
- Rogers, Richard G., Hummer, Robert A., Krueger, Patrick M. The Effect of Obesity. *Journal of Biosocial Science*. 2003; 35(01):107–129. [PubMed: 12537160]
- Ruel, Erin, et al. Neighborhood Effects of BMI Trends: Examining BMI Trajectories for Black and White Women. *Health & Place*. 2010; 16(2):191–198. [PubMed: 19879795]
- Schvey, Natasha A., Puhl, Rebecca M., Brownell, Kelly D. The Impact of Weight Stigma on Caloric Consumption. *Obesity*. 2011; 19(10):1957–1962. [PubMed: 21760636]

- Seidell, Jacob C., Flegal, Katherine M. Assessing Obesity: Classification and Epidemiology. *British Medical Bulletin*. 1997; 53(2):238–252. [PubMed: 9246834]
- Settersten, Richard A, Jr. *Age Structuring and the Rhythm of the Life Course*. US: Springer; 2003.
- Singh, Gopal K., Kogan, Michael D., van Dyck, Peter C. A Multilevel Analysis of State and Regional Disparities in Childhood and Adolescent Obesity in the United States. *Journal of Community Health*. 2008; 33(2):90–102. [PubMed: 18049885]
- Smetana, Judith, Robinson, John, Rote, Wendy. Socialization in Adolescence. In: Grusec, Joan, Hastings, Paul, editors. *Handbook of Socialization: Theory and Research*. New York, NY: The Guilford Press; 2015. p. 60-84.
- Smith, James P. Economic Shocks, Early Life Circumstances and Later Life Outcomes: Introduction. *The Economic Journal*. 2015; 125(588):F306–F310.
- Speakman, John R. Obesity: The Integrated Roles of Environment and Genetics. *The Journal of Nutrition*. 2004; 134(8):2090S–2105S. [PubMed: 15284410]
- Spencer, Rebecca A., Rehman, Laurene, Kirk, Sara FL. Understanding Gender Norms, Nutrition, and Physical Activity in Adolescent Girls: A Scoping. *International Journal of Behavioral Nutrition and Physical Activity*. 2015; 12(6)
- Spitzack, Carol. *Confessing Excess: Women and The Politics of Body Reduction*. Albany, NY: State University of New York Press; 1990.
- StataCorp. *Stata Statistical Software: Release 13*. College Station, TX: StataCorp LP; 2013.
- Sturm R. The Effects of Obesity, Smoking, and Drinking on Medical Problems and Costs. *Health Affairs*. 2002; 21(2):245–253. [PubMed: 11900166]
- Subramanian, Arvind S., et al. Neighborhood Differences in Social Capital: A Compositional Artifact or a Contextual Construct? *Health & Place*. 2003; 9(1):33–44. [PubMed: 12609471]
- Swinburn, Boyd, Sacks, Gary, Ravussin, Eric. Increased Food Energy Supply is More than Sufficient to Explain the US Epidemic of Obesity. *The American Journal of Clinical Nutrition*. 2009; 90(6): 1453–1456. [PubMed: 19828708]
- Taber, Daniel R., et al. Deconstructing Race and Gender Differences in Adolescent Obesity: Oaxaca-Blinder Decomposition. *Obesity*. 2016; 24(3):719–726. [PubMed: 26841122]
- Terracciano, Antonio, Sutin, Angelina. Perceived Weight Discrimination and Obesity. *PLoS One*. 2016; 8(7)
- Van Hook, Jennifer, Baker, Elizabeth. Big Boys and Little Girls: Gender, Acculturation, and Weight Among Young Children of Immigrants. *Journal of Health and Social Behavior*. 2010; 51(2):200–214. [PubMed: 20617759]
- Wadsworth, Tim, Pendergast, Philip M. Obesity (Sometimes) Matters: The Importance of Context in the Relationship Between Obesity and Life Satisfaction. *Journal of Health and Social Behavior*. 2014; 55(2):196–214. [PubMed: 24872467]
- Wang, Samuel J., et al. A Cost-Benefit Analysis of Electronic Medical Records in Primary Care. *The American Journal of Medicine*. 2004; 114(5):397–403.
- Wedow, Robbee, et al. Gender and Genetic Contributions to Weight Identity Among Adolescents and Young Adults in the US. *Social Science & Medicine*. 2016; 165:99–107. [PubMed: 27500942]
- Whitsel, Eric A., et al. Measures of Glucose Homeostasis: Add Health Wave IV Documentation. Carolina Population Center, University of North Carolina at Chapel Hill; 2012.
- Wickrama KAS, et al. The Intergenerational Transmission of Health-Risk Behaviors: Adolescent Lifestyles and Gender Moderating Effects. *Journal of Health and Social Behavior*. 40(3):258–272.
- Willson, Andrea E., Shuey, Kim M., Elder, Glen H, Jr. Cumulative Advantage Processes as Mechanisms of Inequality in Life Course Health. *American Journal of Sociology*. 2007; 112(6): 1886–1924.
- Young, James W., Ferguson, Lucy Rau. Developmental Changes Through Adolescence in the Spontaneous Nomination of Reference Groups as a Function of Decision Content. *Journal of Youth and Adolescence*. 1979; 8(2):239–252. [PubMed: 24317721]
- Young, Lisa R., Nestle, Marion. The Contribution of Expanding Portion Sizes to the US Obesity Epidemic. *American Journal of Public Health*. 2002; 92(2):246–249. [PubMed: 11818300]

Yuan, Anastasia S Vogt. Body Perceptions, Weight Control Behavior, and Changes in Adolescents' Psychological Well-Being Over Time: A Longitudinal Examination of Gender. *Journal of Youth and Adolescence*. 2010; 39(8):927–939. [PubMed: 20596819]

Appendix

Table A1

Coefficients from cross-sectional logistic regression models predicting likelihood of reporting overweight controlling for wave-specific norms, Add Health Waves 2–4

	Wave 2	Wave 3	Wave 4
<i>Individual-Level Main Effects</i>			
BMI	0.39 *** (0.01)	0.41 *** (0.01)	0.38 *** (0.01)
Female	1.45 *** (0.06)	1.66 *** (0.06)	1.55 *** (0.07)
Race (non-Hispanic White reference)			
Black	−0.67 *** (0.07)	−0.65 *** (0.08)	−0.84 *** (0.07)
Native American	−0.64 (0.36)	−0.40 (0.32)	0.25 (0.36)
Asian	0.14 (0.10)	0.14 (0.10)	0.24 * (0.10)
Hispanic	−0.02 (0.07)	0.17 * (0.08)	−0.08 (0.08)
Age (in years)	−0.08 *** (0.02)	0.02 (0.02)	0.02 (0.01)
Age ²	0.02 * (0.01)	0.00 (0.01)	−0.01 (0.01)
<i>County-Level Main Effects</i>			
Wave-Specific County Norm	−1.21 *** (0.26)	−0.17 (0.09)	−0.13 * (0.06)
Wave-Specific County Norm Variance	0.07 (0.32)	0.01 (0.09)	0.00 (0.05)
Wave 1 County Norm	−0.30 * (0.40)	−0.37 * (0.43)	−0.98 ** (0.38)
Wave 1 County Norm Variance	−0.61 (0.36)	0.16 (0.34)	−0.07 (0.32)
<i>Individual-Level Interaction</i>			
BMI x Female	0.04 ** (0.02)	−0.01 (0.02)	0.01 (0.02)
<i>Cross-Level Interactions</i>			
Wave 1 County Norm x Female	−0.23 (0.54)	−1.45 ** (0.54)	−1.08 * (0.59)
Wave 1 County Norm x BMI	−0.42 *** (0.10)	−0.20 * (0.10)	−0.35 *** (0.09)

	Wave 2	Wave 3	Wave 4
Wave 1 County Norm x BMI x Female	-0.11 (0.14)	-0.24* (0.13)	-0.04 (0.13)
<i>Intercept</i>	-1.72	-1.16	0.38
N	11,919	10,786	11,254

Standard errors in parentheses

* $p < .05$;

** $p < .01$;

*** $p < .001$

Table A2

Coefficients from logistic regression models predicting likelihood of reporting overweight in Wave 4 controlling for and stratifying by Wave 1–4 movers, Add Health Wave 4

	Wave 4: All	Wave 4: Stayers	Wave 4: Movers
<i>Individual-Level Main Effects</i>			
BMI	0.38*** (0.01)	0.34*** (0.02)	0.40*** (0.01)
Female	1.55*** (0.07)	1.51*** (0.16)	1.56*** (0.08)
Race (non-Hispanic White reference)			
Black	-0.84*** (0.07)	-0.71*** (0.18)	-0.87*** (0.08)
Native American	0.25 (0.36)	0.50 (0.92)	0.20 (0.40)
Asian	0.24* (0.10)	0.13 (0.23)	0.28* (0.11)
Hispanic	-0.07 (0.08)	0.19 (0.18)	-0.13 (0.09)
Age (in years)	0.02 (0.01)	0.01 (0.04)	0.03 (0.02)
Age ²	-0.01 (0.01)	-0.01 (0.02)	-0.00 (0.01)
Move Distance: Waves 1–4	-0.00 (0.00)	— —	— —
<i>County-Level Main Effects</i>			
Wave 1 County Norm	-0.99** (0.38)	-0.75* (0.35)	-1.09** (0.43)
Wave 1 County Norm Variance	-0.11 (0.32)	1.10 (0.79)	-0.30 (0.35)
Wave 4 County Norm	-0.13* (0.05)	-0.45** (0.15)	-0.08 (0.06)
Wave 4 County Norm Variance	0.00	0.25	-0.04

	Wave 4: All	Wave 4: Stayers	Wave 4: Movers
	(0.05)	(0.14)	(0.06)
<i>Individual-Level Interaction</i>			
BMI x Female	0.01	0.03	0.00
	(0.02)	(0.03)	(0.02)
<i>Cross-Level Interactions</i>			
Wave 1 County Norm x Female	-1.09	-2.99 [*]	-0.66
	(0.59)	(1.34)	(0.67)
Wave 1 County Norm x BMI	-0.35 ^{***}	-0.63 ^{***}	-0.24 [*]
	(0.09)	(0.18)	(0.11)
Wave 1 County Norm x BMI x Sex	-0.04	0.07	-0.09
	(0.13)	(0.26)	(0.15)
<i>Intercept</i>	0.38	0.14	0.43
N	11,234	1,873	9,361

Standard errors in parentheses

^{*}

$p < .05$;

^{**}

$p < .01$;

^{***}

$p < .001$

Table A3

Coefficients from logistic regression models with country-level controls, Waves 1–3

	Wave 1	Wave 2	Wave 3
<i>Individual-Level Main Effects</i>			
BMI	0.46 ^{***}	0.40 ^{***}	0.41 ^{***}
	(0.01)	(0.01)	(0.01)
Female	1.62 ^{***}	1.48 ^{***}	1.66 ^{***}
	(0.05)	(0.06)	(0.06)
Race (non-Hispanic white reference)			
Black	-0.84 ^{***}	-0.62 ^{***}	-0.60 ^{***}
	(0.07)	(0.09)	(0.09)
Native American	-0.37	-0.38	-0.06
	(0.27)	(0.32)	(0.34)
Asian	0.20 [*]	0.18	0.17
	(0.10)	(0.12)	(0.11)
Hispanic	0.01	0.02	0.21 [*]
	(0.08)	(0.10)	(0.09)
Age (in years)	-0.16 ^{***}	-0.08 ^{***}	0.01
	(0.01)	(0.02)	(0.02)
Age ²	0.02 [*]	0.03 ^{**}	0.01
	(0.01)	(0.01)	(0.01)
Mother's Education	0.03	0.01	0.17
	(0.01)	(0.11)	(0.01)

	Wave 1	Wave 2	Wave 3
<i>County-Level Main Effects</i>			
Wave 1 County Norm	-1.02 *	-1.27 **	-0.95 *
	(0.40)	(0.48)	(0.44)
Wave 1 County Norm Variance	-0.38	-0.16	0.36
	(0.30)	(0.35)	(0.34)
<i>Individual-Level Interaction</i>			
BMI x Female	0.04 *	0.04 *	-0.00
	(0.02)	(0.02)	(0.02)
<i>Cross-Level Interactions</i>			
Wave 1 County Norm x Female	-0.36	-0.13	-0.87
	(0.47)	(0.57)	(0.55)
Wave 1 County Norm x BMI	-0.40 ***	-0.44 ***	-0.22 *
	(0.10)	(0.10)	(0.11)
Wave 1 County Norm x BMI x Female	-0.24	-0.05	-0.16
	(0.13)	(0.14)	(0.14)
<i>County-Level Demographic Controls</i>			
County Income	0.00	0.00	-0.00
	(0.00)	(0.00)	(0.00)
County % Black	-0.84	-0.01	-0.63 *
	(0.23)	(0.28)	(0.26)
County % Hispanic	-0.06	0.22	-0.07
	(0.20)	(0.24)	(0.20)
County % College Completion	-0.35	-0.44	0.63
	(0.44)	(0.52)	(0.45)
<i>Intercept</i>	-1.74	-1.76	-1.18
N	15,636	11,232	10,805

Standard errors in parentheses

*

$p < .05$;

**

$p < .01$;

$p < .001$

Table A4

Coefficients from cross-sectional logistic regression models predicting likelihood of reporting overweight with three-way interaction, limiting samples from models in Table A3, Add Health Waves 1–3

	Wave 1	Wave 2	Wave 3
<i>Individual-Level Main Effects</i>			
BMI	0.46 ***	0.40 ***	0.41 ***
	(0.01)	(0.01)	(0.01)
Female	1.62 ***	1.48 ***	1.66 ***
	(0.05)	(0.06)	(0.06)

	Wave 1	Wave 2	Wave 3
Race (non-Hispanic white reference)			
Black	-0.84 *** (0.06)	-0.62 *** (0.08)	-0.66 *** (0.08)
Native American	-0.38 (0.27)	-0.34 (0.32)	-0.07 (0.33)
Asian	0.20 (0.09)	0.23 * (0.11)	0.19 (0.10)
Hispanic	-0.06 (0.06)	0.05 (0.07)	0.16 * (0.07)
Age (in years)	-0.16 *** (0.01)	-0.08 *** (0.02)	0.01 (0.02)
Age ²	0.02 ** (0.01)	0.03 ** (0.01)	0.01 (0.01)
<i>County-Level Main Effects</i>			
Wave 1 County Norm	-1.00 ** (0.39)	-1.24 ** (0.46)	-0.75 * (0.32)
Wave 1 County Norm Variance	-0.53 (0.27)	-0.28 (0.33)	-0.12 (0.33)
<i>Individual-Level Interaction</i>			
BMI x Female	0.04 * (0.02)	0.04 * (0.02)	-0.01 (0.02)
<i>Cross-Level Interactions</i>			
Wave 1 County Norm x Female	-0.39 (0.47)	-0.04 (0.55)	-0.97 (0.54)
Wave 1 County Norm x BMI	-0.39 * (0.10)	-0.43 *** (0.10)	-0.22 * (0.11)
Wave 1 County Norm x BMI x Female	-0.25 (0.13)	-0.06 (0.14)	-0.19 (0.14)
<i>Intercept</i>	-1.73	-1.76	-1.16
N	15,636	11,232	10,805

Standard errors in parentheses

*
 $p < .05$;

**
 $p < .01$;

 $p < .001$

Table A5

Coefficients from cross-sectional ordered logistic regression models predicting likelihood of reporting overweight with three-way interaction, Add Health Waves 1–4

	Wave 1	Wave 2	Wave 3	Wave 4
<i>Individual-Level Main Effects</i>				
BMI	0.41 ***	0.37 ***	0.37 ***	0.33 ***

	Wave 1	Wave 2	Wave 3	Wave 4
	(0.01)	(0.01)	(0.01)	(0.01)
Female	1.32 ***	1.19 ***	1.41 ***	1.42 ***
	(0.03)	(0.04)	(0.04)	(0.04)
Race (non-Hispanic white reference)				
Black	-0.57 ***	-0.45 ***	-0.48 ***	-0.71 ***
	(0.04)	(0.05)	(0.05)	(0.05)
Native American	-0.33	-0.36	-0.14	-0.27
	(0.17)	(0.21)	(0.23)	(0.23)
Asian	-0.04	-0.02	0.10	0.18 *
	(0.06)	(0.07)	(0.07)	(0.07)
Hispanic	-0.11 *	-0.08	0.16 **	-0.06
	(0.04)	(0.05)	(0.05)	(0.05)
Age (in years)	-0.17 ***	-0.13 ***	0.00	0.02
	(0.01)	(0.01)	(0.01)	(0.01)
Age ²	0.02 ***	0.02 **	0.00	-0.01
	(0.00)	(0.01)	(0.01)	(0.01)
<i>County-Level Main Effects</i>				
Wave 1 County Norm	-0.67 ***	-0.59 *	0.49 *	-0.58 *
	(0.20)	(0.24)	(0.25)	(0.25)
Wave 1 County Norm Variance	-0.18	-0.24	-0.12	-0.36
	(0.18)	(0.22)	(0.23)	(0.21)
<i>Individual-Level Interaction</i>				
BMI x Female	0.04 ***	0.02	-0.28 ***	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
<i>Cross-Level Interactions</i>				
Wave 1 County Norm x Female	-0.89 **	-0.72 *	-1.54 ***	-0.51
	(0.28)	(0.34)	(0.34)	(0.33)
Wave 1 County Norm x BMI	-0.30 ***	-0.34 ***	-0.22 ***	-0.10 **
	(0.05)	(0.05)	(0.05)	(0.04)
Wave 1 County Norm x BMI x Female	-0.05	-0.06	-0.07	-0.08
	(0.07)	(0.07)	(0.06)	(0.05)
<i>Cut Points</i>				
Cut Point 1	-4.40	-4.85	-5.27	-6.01
	(0.60)	(0.08)	(0.09)	(0.11)
Cut Point 2	-1.83	-2.00	-2.47	-3.38
	(0.03)	(0.41)	(0.05)	(0.05)
Cut Point 3	1.59	1.60	1.07	-0.25
	(0.03)	(0.42)	(0.04)	(0.38)
Cut Point 4	5.81	6.00	5.49	3.78
	(0.74)	0.93	(0.08)	(0.06)
N	17,521	12,510	12,233	13,147

Standard errors in parentheses

*
 $p < .05$;
**
 $p < .01$;

 $p < .001$

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Figure 1.
Distribution of county-level CDC weight z-scores in Add Health, Wave 1.

Figure 2.

Variance in the relationship between objective and subjective weight status by county normal weight reference norm at Wave 1 across the life course and by gender, Add Health Waves 1–4.

Table 1

Variable Means and Percentages, Add Health Waves 1–4

Measures	Wave 1	Wave 2	Wave 3	Wave 4
<i>Dependent Variable</i>				
Perceive Self as Overweight	31.3%	30.4%	40.1%	56.9%
<i>Individual-Level Covariates</i>				
BMI	22.5 (4.5)	23.1 (5.1)	26.4 (6.2)	29.1 (7.6)
Female	49.6%	49.9%	51.8%	52.3%
<i>Race/Ethnicity</i>				
Non-Hispanic White	52.5%	52.1%	52.2%	52.0%
Black	22.4%	22.5%	22.3%	22.7%
Native American	0.9%	1.0%	1.1%	1.0%
Asian	7.0%	7.3%	7.4%	7.1%
Hispanic	17.2%	17.1%	17.0%	17.2%
Age	15.6 (1.7)	16.2 (1.6)	21.9 (1.8)	28.5 (1.8)
<i>County-Level Covariates</i>				
County Norm Z-Score	0.24 (0.1)	0.29 (0.1)	— —	— —
County Norm Z-Score Variance	0.76 (0.1)	0.90 (0.2)	— —	— —
County Norm BMI	— —	— —	23.8 (0.5)	24.6 (0.7)
County Norm BMI Variance	— —	— —	3.4 (0.6)	3.9 (0.8)
N	17,521	12,510	12,233	13,147

Standard deviations in parentheses for relevant variables

Table 2

Coefficients from cross-sectional logistic regression models predicting likelihood of reporting overweight, Add Health Waves 1–4

	Wave 1		Wave 2		Wave 3		Wave 4	
	Without Interactions	With Interactions	Without Interactions	With Interactions	Without Interactions	With Interactions	Without Interactions	With Interactions
<i>Individual-Level Main Effects</i>								
BMI	0.47*** (0.01)	0.46*** (0.01)	0.41*** (0.01)	0.40*** (0.01)	0.41*** (0.01)	0.42*** (0.01)	0.40*** (0.01)	0.40*** (0.01)
Female	1.60*** (0.05)	1.60*** (0.05)	1.45*** (0.06)	1.44*** (0.06)	1.60*** (0.06)	1.62*** (0.06)	1.52*** (0.06)	1.56*** (0.06)
Race (non-Hispanic white reference)								
Black	-0.87*** (0.06)	-0.87*** (0.06)	-0.69*** (0.07)	-0.69*** (0.07)	-0.69*** (0.07)	-0.67*** (0.07)	-0.89*** (0.07)	-0.88*** (0.07)
Native American	-0.67** (0.26)	-0.58* (0.25)	-0.35 (0.29)	-0.30 (0.29)	-0.34 (0.31)	-0.30 (0.31)	-0.13 (0.32)	-0.12 (0.32)
Asian	0.18* (0.08)	0.18* (0.08)	0.17 (0.10)	0.18 (0.10)	0.15 (0.10)	0.15 (0.10)	0.22* (0.09)	0.22* (0.10)
Hispanic	-0.06 (0.06)	-0.09 (0.06)	-0.01 (0.07)	-0.02 (0.07)	0.16* (0.07)	0.15* (0.07)	-0.17* (0.07)	-0.18** (0.07)
Age (in years)	-0.16*** (0.01)	-0.16*** (0.01)	-0.07*** (0.02)	-0.08*** (0.02)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)
Age ²	0.01 (0.01)	0.01* (0.01)	0.02* (0.01)	0.02* (0.01)	0.01 (0.01)	0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
<i>County-Level Main Effects</i>								
Wave 1 County Norm	-1.44*** (0.21)	-0.68* (0.34)	-1.44*** (0.25)	-1.01* (0.41)	-1.16*** (0.25)	-0.54* (0.28)	-0.79*** (0.24)	-1.28*** (0.33)
Wave 1 County Norm Variance	-0.74** (0.26)	-0.72** (0.26)	-0.54 (0.30)	-0.50 (0.31)	-0.08 (0.31)	-0.05 (0.31)	-0.16 (0.29)	-0.14 (0.29)
<i>Individual-Level Interaction</i>								
BMI x Female		0.03* (0.01)		0.03* (0.01)		-0.01 (0.01)		0.01 (0.01)

	Wave 1		Wave 2		Wave 3		Wave 4	
	Without Interactions	With Interactions	Without Interactions	With Interactions	Without Interactions	With Interactions	Without Interactions	With Interactions
<i>Cross-Level Interactions</i>								
Wave 1 County Norm x Female		(0.01)		(0.02)		(0.02)		(0.01)
		-0.66		-0.25		-1.18*		-0.44
		(0.43)		(0.51)		(0.50)		(0.47)
Wave 1 County Norm x BMI		-0.54***		-0.44***		-0.34***		-0.30***
		(0.06)		(0.07)		(0.06)		(0.06)
<i>Intercept</i>	-3.35	-3.31	-3.19	-3.15	-2.72	-2.74	-1.10	-1.12
<i>N</i>	17,521	17,521	12,510	12,510	12,233	12,233	13,147	13,147

Standard errors in parentheses

* $p < .05$;** $p < .01$;*** $p < .001$

Table 3

Coefficients from cross-sectional logistic regression models predicting likelihood of reporting overweight with three-way interaction, Add Health Waves 1–4

	Wave 1	Wave 2	Wave 3	Wave 4
<i>Individual-Level Main Effects</i>				
BMI	0.46 *** (0.01)	0.40 *** (0.01)	0.41 *** (0.01)	0.39 *** (0.01)
Female	1.61 *** (0.05)	1.46 *** (0.06)	1.63 *** (0.06)	1.56 *** (0.07)
Race (non-Hispanic white reference)				
Black	−0.87 *** (0.06)	−0.69 *** (0.07)	−0.67 *** (0.07)	−0.88 *** (0.07)
Native American	−0.34 * (0.29)	−0.61 (0.25)	−0.32 (0.31)	−0.12 (0.32)
Asian	0.17 * (0.08)	0.16 (0.10)	0.15 (0.10)	0.22 * (0.09)
Hispanic	−0.10 (0.06)	−0.04 (0.07)	0.15 * (0.07)	−0.18 ** (0.07)
Age (in years)	−0.16 *** (0.01)	−0.08 *** (0.02)	0.02 (0.01)	0.02 (0.01)
Age ²	0.01 * (0.01)	0.02 * (0.01)	0.01 (0.01)	−0.01 (0.01)
<i>County-Level Main Effects</i>				
Wave 1 County Norm	−0.88 * (0.34)	−1.13 ** (0.43)	−0.74 * (0.31)	−1.27 *** (0.34)
Wave 1 County Norm Variance	−0.71 ** (0.26)	−0.50 (0.31)	−0.05 (0.31)	−0.15 (0.29)
<i>Individual-Level Interaction</i>				
BMI x Female	0.04 * (0.02)	0.04 * (0.02)	−0.01 (0.02)	0.01 (0.01)
<i>Cross-Level Interactions</i>				
Wave 1 County Norm x Female	−0.46 (0.44)	−0.13 (0.52)	−1.10 * (0.51)	−0.45 (0.54)
Wave 1 County Norm x BMI	−0.44 *** (0.09)	−0.38 *** (0.10)	−0.19 * (0.09)	−0.29 *** (0.09)
Wave 1 County Norm x BMI x Female	−0.19 (0.12)	−0.11 (0.13)	−0.25 * (0.12)	−0.01 (0.12)
<i>Intercept</i>	−1.71	−1.70	−1.13	0.44
N	17,521	12,510	12,233	13,147

Standard errors in parentheses

*
 $p < .05$;

**
 $p < .01$;

 $p < .001$