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The Unequal Burden of Weight Gain: An Intersectional Approach to Understanding Social Disparities in BMI Trajectories from 1986 to 2001/2002

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Abstract

The implications of recent weight gain trends for widening social disparities in body weight in the United States are unclear. Using an intersectional approach to studying inequality, and the longitudinal and nationally representative American's Changing Lives study (1986/2001/2002), we examine social disparities in body mass index trajectories during a time of rapid weight gain in the United States. Results reveal complex interactive effects of gender, race, socioeconomic position and age, and provide evidence for increasing social disparities, particularly among younger adults. Most notably, among individuals who aged from 25–39 to 45–54 during the study interval, low-educated and low-income black women experienced the greatest increase in BMI, while high-educated and high-income white men experienced the least BMI growth. These new findings highlight the importance of investigating changing disparities in weight intersectionally, using multiple dimensions of inequality as well as age, and also presage increasing BMI disparities in the U.S. adult population.

Introduction

The social patterning of overweight and obese persons in the United States is well documented, with higher prevalence rates found among the most socially disadvantaged groups – women, blacks, Hispanics and individuals with less education and income (Wang and Beydoun 2007). It is also well known that the U.S. population recently experienced rapid weight gain. From the 1980s to 2000, the prevalence of obesity in the United States increased from about 23 percent to 30 percent: from 23 percent to 31 percent among white women, from 39 percent to 49 percent among black women, and from 21 percent to 28 percent for both white and black men (Wang and Beydoun 2007). It remains unclear, however, whether recent weight gain trends maintained, narrowed or widened existing social disparities in body weight.

Growing social disparities in weight are cause for concern not only because being overweight and obese are associated with worse physical health (Ferraro and Kelley-Moore 2003; Must et al. 1999), but also because adverse social and psychological consequences are associated with weight-based discrimination. For example, individuals who are overweight or obese have more negative interpersonal relationships (Carr and Friedman 2006), higher

likelihood of experiencing employment discrimination (Larkin and Pines 1979), worse psychological well-being (Carr and Friedman 2005; Ross 1994), and are more likely to receive lower quality medical care (Hebl and Xu 2001). Determining whether social disparities in weight have increased over time is critical because increasing weight disparities would suggest a relative worsening of health and quality of life among already disadvantaged individuals.

Although a handful of studies have examined gender, racial and socioeconomic disparities in weight gain over time (Baltrus et al. 2005; Burke et al. 1996; Clarke et al. 2009; Kahn and Williamson 1991; Mujahid et al. 2005), they are limited by a lack of nationally representative data, an insufficient number of measurement occasions for evaluating change, and most importantly, an incomplete conceptualization of social disparities. These limitations make it difficult to draw conclusions about how social disparities in individual weight gain trajectories have changed. Drawing on intersectionality theory (Crenshaw 1991; Hill Collins 1990; McCall 2005), our analytic approach focuses on the combined impact of gender, race and socioeconomic inequality on disparities in weight gain in the U.S. population.

Using a nationally representative sample of U.S. adults followed for 15 years from 1986 to 2001/2002, and an analytic approach informed by intersectionality theory, this study examines gender, race and socioeconomic disparities in body mass index trajectories, in conjunction with age, to determine whether the most socially disadvantaged experienced the greatest weight gain during a period of rapid increases in population weight.

Previous Research on Social Disparities in Weight Change

Although there are a handful of longitudinal studies that have examined social disparities in weight change, these studies provide inconsistent evidence for whether gender, racial and socioeconomic disparities in weight have increased over time. Prior research generally finds that blacks experienced a greater increase in BMI than whites (Clarke et al. 2009). However, race differences vary significantly by gender. In a study of black-white differences in 10-year weight change in a national sample of adults ages 25–44 years, Kahn and Williamson (1991) found that BMI increased more for black women than it did for white women, but that BMI of black men did not increase significantly more than that of white men, even after adjusting for education and income. Similarly, a community study of race differences in weight trajectories over a 34-year period among adults ages 17–40 years reported significantly higher weight gain among black women compared to white women, but no significant difference among men (Baltrus et al. 2005). In contrast, a multi-city study of young adults, ages 18–30 years, found significantly higher weight gain over a period of five years for both black men and women, compared to their white counterparts (Burke et al. 1996). Thus, prior studies tend to find race differences in weight change among women but report inconsistent results for men.

Studies of socioeconomic disparities in weight change have also reported conflicting results. One study using a national sample of high school seniors found that those with a high school education experienced greater increases in BMI over an 18-year period compared to those with at least some college (Clarke et al. 2009). Similar education differences have been reported in other studies, for both men and women (Burke et al. 1996; Kahn and Williamson 1991). In a multi-community, probability study of middle-aged men and women, Mujahid and colleagues (2005) examined five-year BMI changes in models stratified by race and gender, finding an inverse relationship between education and BMI change among white men and women. Among black men and women, however, they found a *positive* relationship between education and BMI change, although this relationship was not

statistically significant for black men. Prior studies have also examined the effect of income on weight gain, with conflicting results. One study found no significant effect of income for either men or women (Kahn and Williamson 1991), while another study found a significant positive effect of income on BMI change for black and white women, but no significant effect for men (Mujahid et al. 2005).

Inconsistencies in findings from prior longitudinal research on social disparities in weight change may result from differences in study design. For example, most of the prior research consists of studies that are based on select populations of adults from a limited number of geographic areas or with a specific level of educational attainment (Baltrus et al. 2005; Burke et al. 1996; Clarke et al. 2009; Mujahid et al. 2005). Patterns of social disparities in weight change may differ between selected populations. Moreover, because previous research on social disparities in weight change is not based on nationally representative data, their findings are not necessarily generalizable to the U.S. population. Prior research on weight-gain disparities that utilized nationally representative data is limited by the use of only two measurement points to study change (Kahn and Williamson 1991), which increases the possibility of measurement error (Singer and Willett 2003) and may introduce selection bias because individuals who dropped out after baseline, and thus do not have a measurement for both occasions, are not included in the analysis. Both measurement error and selection bias can be reduced by including more measurement occasions and analyzing the *trajectory* of change (Rogosa, Brandt and Zimowski 1982). Finally, a major shortcoming of existing studies of weight disparities is that they primarily use an additive approach to studying disparities, which does not provide a full or accurate picture of how gender, race and socioeconomic position interact to shape disparities in weight change.

Conceptual Framework

This study examines interactions among race, gender and socioeconomic position, by age, to estimate and understand the full extent and nature of social disparities in weight change. The idea of multiple, interacting dimensions of inequality is articulated most clearly by the theory of intersectionality, which emphasizes the fundamental interconnections and interdependence between categories of gender, race and class (Crenshaw 1991; Hill Collins 1990). Intersectional analysis aims to evaluate differences both *between* and *within* social groups, thereby recognizing the existence of within-group diversity. The intersectional approach, therefore, addresses an issue of fundamental importance to sociologists, pervasive social inequality, but does so in a novel way that acknowledges how individual experiences differ depending on the unique social space each individual occupies, with social locations determined by intersecting identities.

Drawing on intersectionality theory, we argue that health inequalities are embedded in social relationships defined by intersections of race, gender and socioeconomic position, and that important differences exist not just between but also within social groups. Traditional approaches to studying health inequality, however, tend to treat social categories as additive in their effects, rather than interactive. Recognizing that race differences may be more pronounced within specific socioeconomic strata, and that socioeconomic differences may vary by race, some previous studies of health disparities have investigated the interactive effects of race and SEP, finding that treating race and SEP independently is often an inadequate analytic strategy for revealing the full extent of racial and socioeconomic disparities in health (Farmer and Ferraro 2005; Hayward, Crimmins, Miles and Yang 2000; Kessler and Neighbors 1986; Waitzman and Smith 1994). Importantly, gender is often not considered as an additional dimension through which to better understand health disparities, even though the implications of race and SEP for health may differ for men and women.

Dimensions of inequality form specific social identities that reflect unique historical experiences and produce different levels of exposure and vulnerability to health risks (House 2002; Krieger et al. 1993; Krieger, Williams and Moss 1997; LaVeist 1994; Williams and Collins 1995). Individuals do not experience weight gain, or the forces contributing to it, in terms of either gender or race or SEP, but rather as individuals whose identity is jointly composed of these attributes. Prior studies of social disparities in weight change are limited by an incomplete conceptualization of disparities that mainly treats categories of inequality as separate and additive in their association with body weight. Those studies that have examined differences between groups rarely do so for more than two dimensions of social inequality. For example, while most prior studies of weight gain disparities recognize the intersection between gender and race, finding that black women gained more weight over time compared to white women (Baltrus et al. 2005; Burke et al. 1996; Kahn and Williamson 1991), they do not further consider how socioeconomic position shapes race/gender differences in weight change. Thus, none of the existing studies have examined gender, racial and socioeconomic disparities *simultaneously and interactively*.

Conceptualizing disparities using an intersectional framework enables us to form expectations about which individuals gained the most weight over time based on their differential susceptibility to the underlying causes of population weight gain. Although the causes of recent weight gain in the U.S. population are still debated, socio-environmental factors that limited opportunities for physical activity and provided an abundance of high-calorie foods are thought to be among the primary contributors (Hill and Peters 1998). Gender, race and SEP interact to determine one's social and economic resources, which may in turn determine one's susceptibility to recent trends toward inactivity and high-calorie diets. Differential susceptibility to the causes of weight gain, and resources for buffering against these forces, can produce social variation in BMI trajectories. Low-SEP black women, for example, may have been particularly vulnerable to the socio-environmental shifts that led to weight gain.

With the shift to more sedentary lifestyles, it has become increasingly important, and yet more difficult, to find opportunities for physical activity (Brownson, Boehmer and Luke 2005). Although trends toward reduced physical activity were experienced across the population, some individuals may have been particularly disadvantaged in this arena. Disadvantaged socioeconomic and racial/ethnic groups are more likely to live in neighborhoods that lack safe and attractive places to exercise (Lovasi et al. 2009), and low-SEP black women living in these neighborhoods may have been especially disadvantaged with regard to physical activity because, unlike their male counterparts, they have safety and victimization concerns that are more likely to prevent them from walking and exercising in public spaces in their neighborhoods (Eyler et al. 1998; Ferraro 1996). In addition to environmental barriers, individuals have had increasingly less time to devote to physical activity. Black women in particular may be more likely to experience a time bind that limits their opportunities for physical activity. Women tend to have less leisure time, compared to men (Mattingly and Bianchi 2003), but black women in particular may have less time for leisure activities because they are more likely to be single parents (Raley and Sweeney 2009), with sole responsibility for household work and care giving (Eyler et al. 1998), who must balance work-family responsibilities. Thus, limitations in the social environment may have had more adverse effects on levels of physical activity over time among low-SEP black women compared to other social groups.

As levels of physical activity have declined, food intake, particularly calorie-dense foods, has increased. Individuals who live in areas with an abundance of convenient high-calorie foods and have limited time for preparing meals at home are more likely to have diets characterized by excessive food intake (Harnack, Jeffery and Boutelle 2000).

Socioeconomically disadvantaged individuals and racial/ethnic minorities are more likely to live in areas that provide more opportunities for overconsumption of calorie-dense foods (Lovasi et al. 2009) and socially disadvantaged women may be in a uniquely difficult position with respect to food intake because they lack the time and economic resources necessary for consuming a healthy diet. Furthermore, research shows that low-SEP black women experience a cumulatively greater stress burden (Schulz et al. 2000), and their higher stress levels can lead to overconsumption of calorically-dense food and increased fat accumulation (Bjorntorp 2001; Dallman et al. 2003; Grunberg and Straub 1992). Thus, black women with few socioeconomic resources have arguably been uniquely disadvantaged with regard to the socio-environmental factors that promote weight gain.

Just as the intersection of race, gender and SEP may interact to increase weight gain among low-SEP black women, relatively more advantaged social groups, such as high-SEP white men, are likely to experience less weight gain over time. The advantages that accrue to high-SEP individuals (e.g., sufficient income and time to engage in physical activity), may help them avoid or reduce their exposure to the socio-environmental factors that promote weight gain or may enable them to mobilize resources that buffer against these exposures (House, Kessler and Herzog 1990). Furthermore, the extent of advantages associated with various socioeconomic resources will vary by race (Williams and Collins 1995). Thus, race, gender and SEP interact to determine one's exposure to the causes of weight gain and also the availability of resources to mitigate the effects of this exposure. Based on an intersectional approach to understanding social disparities in weight gain, we hypothesize that:

The most socially disadvantaged individuals, as defined by their race, gender and SEP, experienced greater weight gain over time, while the most socially advantaged individuals experienced the least weight gain. Thus black women of lower socioeconomic position should manifest the greatest gains in weight, while white men of higher socioeconomic position should experience the least weight gain.

Forces shaping disparities in weight gain may be experienced differently depending on one's position in the adult life course (Riley 1987). Thus we condition our hypothesis on age. Empirical studies of health inequality have found that racial and socioeconomic disparities vary widely by age (House, Kessler and Herzog 1990; House et al. 1994; Ross and Wu 1996). Weight gain trajectories vary considerably across age groups, reflecting life course and/or cohort variation in the way weight changes with age, and this may result in differential social patterning by age. There is an inherent age trajectory of weight gain (Sheehan et al. 2003) in which biological factors produce accelerated weight gain during early adulthood. Additionally, strong historical or period effects are often felt most keenly by those at more formative, often younger, ages (Mannheim 1952), suggesting that the factors contributing to population weight gain may have had relatively larger influence on more recent cohorts (Reynolds and Himes 2007). Therefore, *we further expect that increasing social disparities may be most evident at younger ages.*

Data and Methods

Data

This study uses data from the Americans' Changing Lives survey, a 15-year longitudinal study of the noninstitutionalized U.S. adult population ages 25 and older (House, Kessler and Herzog 1990; House et al. 1994). The study sample was obtained using a stratified, multistage area probability sample with an oversampling of both adults ages 60 and older and black adults. In 1986 (Wave 1) face-to-face interviews were conducted with 3,617 respondents, representing 70 percent of sampled households and 68 percent of sampled individuals. In 1989 (Wave 2) follow-up face-to-face interviews were successfully

completed with 2,867 (83%) of the surviving wave 1 respondents. A second follow-up was conducted in 1994 (Wave 3) via telephone or, when necessary, via face-to-face interviews with 2,562 respondents (including proxies, $n = 164$), representing 83 percent of Wave 1 survivors. In 2001 and 2002 (Wave 4), approximately 15 years after the initial interview, a fourth wave of follow-up was conducted via telephone, or face-to-face interviews when necessary, with 1,787 respondents (including proxies, $n = 95$), representing 74 percent of the surviving wave 1 ACL sample. The final analytic sample consists of 3,426 individuals after excluding nonwhite and non-black respondents ($n = 130$, 3.6% of the original sample) and respondents ages 85 and older ($n = 71$, 1.96% of the original sample), because these groups had an insufficient number of respondents and observations for inclusion in the growth curve analysis.

Measures

Body Mass Index—BMI is calculated by dividing self-reported weight (in kilograms) by height (in meters) squared. Respondents were asked about their height in the baseline interview and were asked about their weight in every interview.¹ Self-reports of height and weight are subject to reporting error, but the error is sufficiently low that self-reports are considered to be reliable estimates of BMI (Gorber et al. 2007). Comparisons of self-reported BMI in ACL Wave 2 (1989) with national estimates of BMI obtained from measured height and weight from the NHANESIII-Phase I (1988–1991) showed minimal differences, ranging from no difference for white and black men, to underreporting by .2 BMI points for black women and .9 BMI points for white women (Kuczmarski et al. 1994).

Sociodemographic Characteristics—We focus on white and black individuals in this study (there was not sufficient data to analyze other racial and ethnic groups). Race and gender are measured using dummy variables for *black* and *male*, respectively. Differences by combinations of race and gender characteristics are measured using dummy variables representing one of four race/gender categories: *white women*, *black women*, *black men* and *white men*, with white women treated as the reference category.

We account for *age* differences in BMI trajectories by categorizing individuals into 15-year age groups, 25–39, 40–54, 55–69 and 70–84, based on their ages at baseline. These age groups were chosen because they reflect the natural age trajectory of weight gain, with weight accelerating in early adulthood, decelerating through mid-life, and ultimately declining in older adulthood (Sheehan et al. 2003). In addition, these 15-year age categories correspond to the study interval such that individuals who were ages 25–39 at the beginning of the study aged to 40–54 by the end of the study.

We use baseline measures of educational attainment and household income as our indicators of socioeconomic position. The distribution and meaning of education varies by cohort. Therefore, we created a cohort-adjusted measure of *educational attainment* that differentiates between the lowest, middle and highest tertiles of education, relative to the distribution of education within each of the four age groups defined above. The lowest, middle and highest education tertiles represent, respectively: 12 years or less, 13–14 years and 15–17 years among those ages 25–39; 11 years or less, 12–13 years and 14–17 years among those ages 40–54; 10 years or less, 11–12 years and 13–17 years among those ages 55–69; and 8 years

¹Those missing on height and/or weight were given imputed BMI values derived from sex-specific prediction equations that accounted for respondent's age, race and prior height and weight (when available). BMI was imputed for 79 Wave 1 respondents (2.07%), 54 Wave 2 respondents (1.58%), 44 Wave 3 respondents (1.28%) and 46 Wave 4 respondents (1.34%). Using imputed BMI maximizes our sample size. Analyses using unimputed BMI yielded virtually identical results to those obtained using imputed BMI. We also include in the analysis respondents whose BMI values at Wave 3 ($n = 151$) and Wave 4 ($n = 91$) were derived from proxy reports of their weight. Results were similar in analyses where respondents with proxy reports of weight were dropped.

or less, 9–12 years and 13–17 years among those ages 70–84.² *Household income*, defined as the total pre-tax annual income of the respondent and his/her spouse/partner in 1986, is categorized as less than \$10,000, \$10,000–\$29,999 and \$30,000 or more (reference category). These categories were created based on 1986 income and poverty levels to approximately represent below poverty level, at poverty to median income level, and above median income level, respectively. Income information was imputed for 311 cases that were missing on income using a regression-based imputation strategy (House et al. 1994).

Attrition Controls—We also include dichotomous indicators of attrition due to death (respondents who died between 1986 and 2001/2002) and non-response (respondents who were not present at all waves) in all models to control for residual effects of non-response during the study period.

Statistical Analysis

Growth curve models are used to examine gender, race, education, income and age differences in individual BMI trajectories from 1986 to 2001/2002. Growth curve models account for both the clustering of observations within individuals and unequal numbers of observations per person, and are well suited for analyzing inter-individual differences in BMI change over time (Heo et al. 2003; Singer and Willett 2003). Baseline BMI in 1986 and annual BMI growth jointly compose each individual's BMI trajectory and are modeled simultaneously in a two-level linear model. Year of interview is used as the indicator of time. At level-1 we model the individual growth trajectory, which describes within-person change in BMI over time:

$$\text{BMI}_{ij} = \beta_{0j} + \beta_{1j}(\text{TIME}_{ij}) + \varepsilon_{ij}$$

where β_{0j} represents baseline BMI for person j in 1986, $\beta_{1j}(\text{TIME}_{ij})$ represents annual BMI change for person j , and ε_{ij} is the within-person residual. Baseline BMI and BMI change are modeled as a function of time-invariant individual characteristics at level 2. The level-2 submodels assume individual variation in BMI trajectories and β_{0j} and β_{1j} are further modeled as functions of covariates Z :

$$\begin{aligned}\beta_{0j} &= \gamma_{00} + \gamma_{01}Z_{1j} + \gamma_{02}Z_{2j} + \dots + \gamma_{0k}Z_{kj} + u_{0j} \\ \beta_{1j} &= \gamma_{10} + \gamma_{11}Z_{1j} + \gamma_{12}Z_{2j} + \dots + \gamma_{1k}Z_{kj} + u_{1j}\end{aligned}$$

where u_{0j} and u_{1j} are residual errors that capture random variance in the intercept and slope across individuals. The covariates Z include the independent variables age, gender, education, income and any multiplicative combinations therein.

We use a linear term for time to model annual growth, where the baseline interview in 1986 is treated as *time* = 0 and subsequent observations are measured as the number of years elapsed since the baseline interview (approximately 2.5, 7.5 and 15 years for waves 2, 3 and 4, respectively). We chose a linear specification of time for several reasons. First, examination of individual growth plots showed that the functional form for BMI growth for most of the sample was approximately linear during the study period. Additionally, the linear growth parameter is preferred as the best approximation of change given few data points, such as we have in this study, where the data may not support more complex

²Analysis using educational categories representing less than 12 years, 12 years and more than 12 years of schooling showed a similar pattern of results as the cohort-adjusted education categories.

specifications of the functional form for change (Singer and Willet 2003). In models where we included a quadratic time parameter the quadratic slope coefficients were not significant, indicating that our data do not require a quadratic term for time.

We correct for missingness over the course of the study by using maximum likelihood estimation via the expectation maximization algorithm, thereby retaining full information on all sample members, even if they were not present at all waves (Feng et al. 2006). Wave-specific sample weights are applied in all descriptive statistics and statistical analyses. The Wave 1 sample weight includes adjustment for the differential probability of selection at baseline and non-response rates, and a post stratification adjustment to the 1986 age/race/sex/region specific Census estimates of the U.S. population. Sample weights for waves 2, 3 and 4 further adjust for non-response and attrition. Statistical analyses are conducted using the HLM software (Raudenbush and Bryk 2002).

Results

Table 1 presents wave-specific mean BMI and sample distributions by gender and race. At baseline each race/gender group had a mean BMI value that was considered “overweight” or approaching overweight ($BMI > 25$). Over the 15-year study interval mean BMI increased for each race/gender group,³ with greater increases observed among women and particularly for black women. Within 15 years black women shifted from being overweight, on average, to being obese ($BMI > 30$), on average. The age distribution is similar across race/gender groups, although white women had a slightly older age composition. White men and women had more years of schooling and higher incomes than their black counterparts.

Differences in BMI trajectories are examined with respect to *initial BMI*, representing baseline differences in 1986, and *annual BMI growth*, representing BMI change from 1986 to 2001/2002. Table 2 presents race/gender differences in BMI trajectories in Model 1, race/gender/education differences in Model 2, and race/gender/income differences in Model 3. Model 1 shows that initial BMI was 24.18 for white women and 27.0 ($24.18 + 2.81$) for black women. Black and white men had similar initial BMI (around 25.5). Relative to white women, black women experienced greater annual BMI growth (.034, n.s.), black men experienced similar growth, and white men experienced less growth ($-.034$, $p < .01$).

We also examined the interactive effects of race and gender with indicators of socioeconomic position. Model 2 shows that initial BMI was lowest among the most educated, though this association was stronger for women than men. Black women with the lowest level of education had the highest initial BMI ($23.29 + 4.41 = 27.7$). The annual growth rates suggest there were few differences in BMI change among these groups, with the exception of high-educated white men and the lowest educated black men, who had negative growth coefficients and thus experienced less growth relative to other groups. Model 3 shows race/gender differences in BMI trajectories by income. Initial BMI was lowest among high-income women but was highest among higher-income men. Just as the lowest educated black women had the highest initial BMI in the prior model, black women with the least income also had the highest initial BMI ($23.44 + 4.31 = 27.8$). The results for annual growth show that white men with the highest income experienced the least growth over time relative to other race/gender/income groups. These results suggest that education

³Although BMI increased for each race/gender group over the study period, it did not increase linearly. The increase in BMI from Wave 3 (1994) to Wave 4 (2001/2002) was more pronounced, particularly for women, than in prior waves. This non-linear feature of the unadjusted estimates shown in Table 1 is consistent with national data on BMI trends, which show that, compared to prior years, women experienced steeper BMI growth between the late 1980s/early 1990s and 2000; men’s BMI growth was approximately linear from the late 1970s to 2000 (Wang and Beydoun 2007). Although the unadjusted data suggest that BMI growth was non-linear, when we tested for non-linearity in the data we did not find significant deviation from a linear BMI trajectory.

and income differences in BMI remained largely unchanged over the study period, with the exception of increasing racial disparities among high-income men, decreasing gender disparities among high-income whites, and increasing socioeconomic disparities among white men.

We also examined interactions between age and race/gender/SEP groups (results not shown). Although there were no differences for initial BMI, with respect to BMI growth we found significant interactions with age for groups defined in terms of both race/gender/education and race/gender/income. In particular, education and income differences in BMI growth among black women varied significantly across age groups.

Table 3 shows race/gender/education differences in models stratified by baseline age. *Initial* values represent baseline BMI differences within each age group and *annual growth* coefficients show how BMI changed as individuals aged over the 15-year interval. The results for initial BMI are largely similar to those reported in Table 2; with few exceptions, initial BMI tended to be highest among those with the least education. Examining differences in annual growth by age, however, reveals a more complex pattern of results. For example, less educated white women experienced lower growth compared to more educated white women, but the differences manifested more strongly for the youngest and oldest age groups. Similarly, the least educated black men had lower growth rates at younger ages, particularly ages 40–54, but not at older ages. Age group differences in annual BMI growth among black women suggest that black women's relative disadvantage is concentrated in the youngest age group. Among black women who were ages 25–39 at baseline, the least educated experienced more rapid BMI growth over time (.095, $p < .05$), relative to other race/gender/education groups, and especially in contrast to higher educated white men ages 25–39 who experienced the least growth (–.102, $p < .01$). Thus, among those ages 25–39 at baseline, the largest differences in annual BMI growth were between the lowest educated black women and the highest educated white men.

In Figure 1 we plot BMI trajectories for the lowest educated black women and the highest educated white men ages 25–39 at baseline to demonstrate how the population increase in BMI has been experienced very differently by the most and least disadvantaged social groups. From 1986 to 2001 there was a general increase in BMI of about 3 points among those ages 25–39 at baseline. By the end of the study these individuals were 40–54 years of age and had a mean BMI of 27.7, which is considered overweight (BMI 25–29.9). Although on average adults ages 25–39 at baseline experienced increasing BMI over time, the least educated black women experienced relatively steeper BMI growth. By contrast, high-educated white men experienced the least BMI growth. While BMI increased by about 5 points for the least educated black women in this age group, it only increased by about 2 points for the highest educated white men. For an average height woman (5 feet 4 inches) this BMI growth is equivalent to gaining 30 pounds, and as a result low-educated black women, on average, became obese as they aged to 40–54.

Age-specific race/gender/income differences in BMI trajectories are shown in Table 4. Initial BMI was not strongly patterned by income levels for any race/gender/age group. There were, however, income differences in annual BMI growth, especially for those who began the study at younger adult ages. Among those ages 25–39 at baseline, black women in the lowest (.169, $p < .01$) and middle (.154, $p < .001$) income groups experienced the greatest growth in BMI over time, while white men at the highest income level (–.061, $p < .05$) experienced the least growth. Among those ages 40–54 at baseline, black men experienced relatively less growth at the lowest income level, though this coefficient should be interpreted with caution as it was estimated using relatively small sample sizes (see

Appendix A). The results also suggest that among those ages 55–69 at baseline, the lowest income black women experienced the least growth.

Figure 2 shows BMI trajectories for black women with the lowest income and white men with the highest income who were ages 25–39 at baseline, which is again the age group for which we observe the largest disparities in BMI growth. We observe a similar pattern of diverging trajectories between the most and least disadvantaged social groups as we saw with respect to education in Figure 1. Even though on average BMI increased over time by nearly 3 points among individuals who were 25–39 at baseline, the data show that lower income black women experienced a much steeper increase of 5.3 BMI points over the same interval. Higher income white men, on the other hand, whose total increase in BMI was 1.9 points over the study period, experienced relatively less BMI growth compared to the average and much less growth compared to low income black women.

These results indicate that a more detailed picture of social disparities in BMI trajectories, both in terms of starting point and growth, emerges only after accounting for the interactive effects of race, gender, SEP and age. We find that while social disparities in BMI trajectories may not have increased in the aggregate, there is evidence that disparities have increased over time among adults who were ages 25–39 in 1986 and who became 40–54 by 2001/2002. Thus, examining gender, race and socioeconomic differences by age reveals disparities in BMI trajectories that were not apparent either in prior research or in our prior models, which merely controlled for age.

We find that the social patterning of BMI growth from the mid 1980s to 2000 is truly intersectional, especially among adults 25–39 in 1986. In this relatively young age bracket, both low-income and less-educated black women experienced large increases in BMI, about 5 BMI points in only 15 years, compared to an average increase of less than 2 BMI points for high-educated and high-income white men. The effect of these intersections of race, gender and SEP with age, are simply not evident in prior research.

Conclusion

Although it is clear that average body weight in the United States has increased dramatically over the past several decades, it has been less clear how weight increases have been distributed along dimensions of race, gender and SEP. Using growth curve analysis, we examined social disparities in BMI change to determine whether the weight gain trend from 1986–2001/2002 was concentrated among the most socially disadvantaged individuals, or whether it was more evenly distributed. Drawing on intersectionality theory, we examined differences in BMI trajectories by combinations of race, gender and socioeconomic position, in conjunction with age. Using this framework, we hypothesized that the most socially disadvantaged gained more weight compared to the more socially advantaged, and that these differences would manifest more strongly at younger ages. The findings confirmed our hypotheses and revealed a more nuanced picture of social disparities than has emerged from any previous research.

Our findings confirm some of the results found in prior work on disparities in weight change, but also yield important new insights. For example, our results reveal that the black/white disparity among women exists largely among the youngest adults. However, contrary to the prior findings of few racial differences among men (Baltrus et al. 2005; Kahn and Williamson 1991), we found that, among adults ages 25–39 in 1986 white men with higher levels of education and income experienced *less* weight gain than black men. Thus our study suggests a widening over time of racial disparities in weight in early adulthood among

women, as was expected, but also among men, which has not been consistently demonstrated in prior work.

We also found age-race-gender-specific evidence of socioeconomic disparities in BMI growth, which have not been articulated in prior work. Among adults who were 25–39 at baseline, we found that low-educated and low-income black women experienced the greatest BMI growth, while high-educated and high-income white men experienced the least amount of BMI growth. This contrast between socioeconomically disadvantaged black women and socioeconomically advantaged white men exemplifies the premise of intersectionality theory, which posits that individuals are situated within systems of inequality in which the least advantaged (i.e., low-SEP black women) have qualitatively worse outcomes compared to the most advantaged (i.e., high-SEP white men). Thus, we found support for our hypothesis that the most socially disadvantaged individuals would experience the greatest weight gain, while the most advantaged would experience the least weight gain, and that growing disparities would manifest most strongly at the youngest ages. It is particularly serious that divergence in weight gain trajectories is most evident among the youngest adults transitioning from early to middle adulthood because this is a critical period for determining future weight gain and health trajectories, and widening disparities in young adulthood may foreshadow increasing disparities in late adulthood.

This study demonstrates how conceptualizing dimensions of inequality as separate and distinct, as is done in the more traditional approach to studying health disparities, is inadequate for fully detailing the extent of disparities in weight gain trajectories. By using intersectionality theory to inform our analytic strategy, which explicitly recognized the importance of intersecting dimensions of inequality, we were able to uncover a more nuanced and informed picture of the extent of social disparities in weight gain. As a guiding framework for examining health disparities, intersectionality theory offers a novel approach for examining how systems of inequality shape health and allows researchers to move away from a research paradigm that emphasizes proximate causes and towards a paradigm that focuses on the fundamental causes of health disparities (House et al. 1990; Link and Phelan 1995).

This study also has several limitations. First, we use BMI based on self-reported height and weight, which can be subject to reporting bias. However, comparisons of gender/race-specific mean BMI in our data with mean BMI based on measured height and weight in the NHANES indicate that the extent of underreporting was minimal, suggesting that differential reporting did not have a substantive influence on our findings. Moreover, women are more likely to underestimate their weight (Gorber et al. 2007). If underreporting of weight occurred in our study, the result would likely be lower estimates of BMI among women, and thus our findings may actually represent conservative estimates of the difference between lower socioeconomic black women and higher socioeconomic white men.

A second limitation of this study is the small sample sizes on which to base conclusions about disparities in the oldest age groups, particularly with regard to high-SES black men and women. Small sample sizes in the oldest age group also limited our ability to make cohort comparisons. In addition, while this study utilizes 15 years of data during the period when the U.S. population experienced the most rapid weight gain, without having a longer study period we are unable to fully estimate how disparities change over the entire adult life course. However, we can create a synthetic picture of the life course by piecing together the 15-year growth trajectories for each age group, which range over the entire adult life course.

In our examination of the relationship between body weight and SEP we were sensitive to the possibility of reverse causality bias due to potential effects of body weight on socioeconomic outcomes. It is unlikely that BMI influenced educational attainment in our study because we use education reported at baseline when the study respondents were at least 25 years old, an age by which most formal education is completed. To the extent that body weight affects income, prior studies have found that the effect of weight on future income is positive for men and negative for women (Averett and Korenman 1999; Cawley 2004). However, evidence for reverse causality is fairly weak for both white men and black women, and thus the potential impact of BMI on income is very small in the two groups we focus on in this study. Furthermore, we use a baseline measure of income to predict subsequent BMI trajectories to minimize the potential bias of reverse causality. So although there is evidence that weight affects income, because the effects are primarily found among white women, and because we measure income prior to BMI change, the potential for bias is reduced in our study.

This study, the first to simultaneously examine racial, socioeconomic and gender disparities in BMI trajectories, and to do so by age, identifies those groups that have experienced a greater burden of the weight gain experienced by the U.S. population. The findings, when taken in light of the social and health consequences of overweight and obesity, paint a dismal picture of the future for adults who are already socially disadvantaged. Low SES black women may expect even poorer physical and psychological health and face more barriers to employment in the future than they do now. Understanding trends and projections for the future of obesity, and health disparities more generally, requires a focus on younger ages because these individuals have yet to experience the full extent of weight gain associated with the aging process. The increasing social disparities found in this study argue strongly for recognition of weight gain trends as a major social problem as well as an important public health issue.

Policies aimed at stemming, and potentially reversing, population weight gain should consider these widening disparities and how to target disadvantaged populations. Past policies regarding population weight gain focused primarily on improving nutrition and increasing fitness among individuals, with very little success in halting weight gain trends (Nestle and Jacobson 2000). However, the social conditions in which individuals live might make it difficult for some to adopt the lifestyle changes that have been advocated in prior policies (Swinburn and Egger 2002). Thus, population-based approaches that address the social and structural forces that shape weight gain trajectories, particularly those conditions to which the most disadvantaged are especially susceptible, may be more effective for preventing weight gain and reducing disparities therein. Furthermore, policies aimed at addressing the causes of weight gain should consider potential adverse consequences for disadvantaged individuals and the implications for health disparities. For example, taxing calorie-dense food and sugar-sweetened beverages has been suggested as a strategy for addressing excess weight gain in the United States (Jacobson and Brownell 2000). However, the result of such taxation may be that individuals with limited financial resources, who are more likely to be obese and whose diets are largely composed of foods low in nutritional value, may simply substitute for taxed foods other cheap, unhealthy foods or may reduce their food consumption to stay within their economic means, thereby increasing food insecurity (Drewnowski and Darmon 2005; Kim and Kawachi 2006).

Much has been made of the so-called obesity epidemic in public health discourse and the social media, yet whether recent weight gain trends truly represent an epidemic remains contested (Boero 2007; Campos et al. 2006; Flegal 2006; Saguy and Riley 2005;). However, our data show a striking development in which black women, particularly younger women from low socioeconomic backgrounds, have experienced a shift from an average level of

overweight to an average level of obese in a fairly short period of time. Thus, while the seriousness of the so-called obesity epidemic has been disputed with regard to the general population (Campos et al. 2006), there have clearly been significant shifts among minority women, particularly those who were likely already disadvantaged in terms of discrimination, body weight and a variety of health issues. The experiences of this group should not be ignored.

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Figure 1.
BMI Trajectories of Low-Educated Black Women and High-Educated White Men Ages 25–39 in 1986

Notes: Darker lines are from model estimates and lighter lines are from raw data. Black women are represented by solid lines and white men are represented by dashed lines. The mean BMI for all race/gender/education groups ages 25–39 in 1986 is represented by the thick solid grey line. All numbers are weighted.

Figure 2.

BMI Trajectories of Low-Income Black Women and High-Income White Men Ages 25–39 in 1986

Notes: Darker lines are from model estimates and lighter lines are from raw data. Black women are represented by solid lines and white men are represented by dashed lines. The mean BMI for all race/gender/income groups ages 25–39 in 1986 is represented by the thick solid grey line. All numbers are weighted.

Table 1

Mean BMI at Each Interview and Distribution of Sample Characteristics at Baseline, by Gender/Race

	White Women	Black Women	Black Men	White Men
Mean BMI				
1986	24.8 (4.9) [‡]	27.6 (5.8) [‡]	26.2 (4.2)	26.1 (4.1)
1989	25.3 (5.0) [‡]	28.1 (6.2) [‡]	26.7 (4.4)	26.6 (4.4)
1994	25.7 (5.1) [‡]	28.6 (5.9) [‡]	27.3 (4.1)	27.0 (4.6)
2001/2002	26.7 (5.6) [‡]	30.4 (6.7) [‡]	28.5 (4.8)	27.9 (4.9)
Age %				
25–39	37.4	43.2	44.0	45.0
40–54	25.5	27.5	32.0	23.5
55–69	23.0	18.5	16.5	21.8
70–84	14.1	10.9	7.5	9.8
Education %				
Highest tertile	29.1	17.9	21.8	36.6
Middle tertile	39.5	29.7	31.2	31.5
Lowest tertile	31.4	52.5	47.0	31.9
Income %				
\$30,000+	39.5	21.8	22.4	47.2
	41.0	34.6	43.8	40.6
< \$10,000	19.5	43.6	33.8	12.2
Unweighted N	1,385	763	390	888

Notes: N = 3,426

Numbers represent weighted means, with standard deviations in parentheses and weighted percents.

[‡] Indicates p < .05 for within-race comparison with men.[‡] Indicates p < .05 for within-sex comparison with white.

Interactive Effects of Gender/Race, Gender/Race/Education and Gender/Race/Income on Initial BMI and Annual BMI Growth from 1986–2001/2002

Table 2

	Model 1			Model 2			Model 3		
	Gender/Race			Gender/Race/Education			Gender/Race/Income		
	Initial	Annual Growth		Initial	Annual Growth		Initial	Annual Growth	
Constant ^a	24.18 (.23) ***	.195 (.012) ***		23.29 (.31) ***	.209(.018) ***		23.44 (.27) ***	.201 (.015) ***	
Age:									
25–39	(omitted)			(omitted)			(omitted)		
40–54	1.62 (.28) ***	.050 * (.015) *		1.87 (.28) ***	-.051(.016) **		1.66 (.28) ***	-.049 (.015) **	
55–69	1.66 (.25) ***	-.208 (.014) ***		1.81 (.26) ***	-.209(.015) ***		1.55 (.26) ***	-.208 (.015) ***	
70–84	.86 * (.33) *	-.304 (.021) ***		1.05 (.34) ***	-.306(.021) ***		.62 (.34) †	-.304 (.021) ***	
White Female									
Highest Education/Income	(omitted)			(omitted)			(omitted)		
Middle Education/Income				.58 (.35) †	-.015(.020)		1.77 (.35) ***	-.007 (.020)	
Lowest Education/Income				1.84 (.41) ***	-.024(.024)		1.60 (.42) ***	-.017 (.026)	
Black Female	2.81 (.29) ***	.034 (.020)							
Highest Education/Income				2.66 (.54) ***	.020(.045)		2.76 (.54) ***	-.012 (.040)	
Middle Education/Income				2.92 (.53) ***	.023(.038)		3.26 (.46) ***	.056 (.032) †	
Lowest Education/Income				4.41 (.42) ***	.018(.029)		4.31 (.44) ***	.027 (.034)	
Black Male	1.51 (.30) ***	-.004 (.020)							
Highest Education/Income				2.45 (.51) ***	.010(.025)		2.68 (.43) ***	.000 (.031)	
Middle Education/Income				1.98 (.51) ***	.020(.030)		2.98 (.50) ***	-.031 (.032)	
Lowest Education/Income				2.62 (.50) ***	-.066(.039) †		.050 (.48)	.015 (.044)	
White Male	1.37 (.23) ***	-.034 * (.013) *							
Highest Education/Income				1.96 (.39) ***	-.063(.020) **		2.35 (.32) ***	-.056 (.018) **	
Middle Education/Income				1.98 (.38) ***	-.037(.021) †		2.08 (.37) ***	-.022 (.019)	
Lowest Education/Income				2.74 (.40) ***	-.039(.027)		1.87 (.51) ***	-.028 (.046)	

	Model 1			Model 2			Model 3		
	Gender/Race			Gender/Race/Education			Gender/Race/Income		
	Initial	Annual Growth	Initial	Annual Growth	Initial	Annual Growth	Initial	Annual Growth	Initial
Attrition due to:									
Death	-.38 (.29)	-.077* (.025)*	-.52 (.29) [†]	-.075(.025)**	-.39 (.29)	-.079 (.025)**			
Non-Response	-.52 (.21)*	-.008 (.015)	-.65 (.21)**	-.007(.015)	-.59 (.21)**	-.010 (.015)			
Variance Components									
Level 1: Within-person		2.399		2.398		2.398			
Level 2: Between-person	19.49(.00)***	.039 (.000)***	19.20 (.00)***	.039(.000)***	19.25 (.00)***	.039 (.000)***			
Goodness of Fit									
χ^2 (df 4)		582.41***		604.79***		596.67***			

Note: Robust standard errors are reported in parentheses beside the parameter estimates. Education and Income are measured in 1986. Highest Education = 3rd tertile, Middle Education = 2nd tertile, Lowest Education = 1st tertile; Highest Income = \$30k, Middle Income = \$10–30k, Lowest Income = \$10k.

^d Constant represents a white female ages 25–39 in Model 1, with highest education in Model 2, or with highest income in Model 3.

[†] p < .10
* p < .05
** p < .01
*** p < .001 (two-tailed tests)

Table 3

Interactive Effects of Race/Gender/Education on Initial BMI and Annual BMI Growth from 1986–2001/2002, by Baseline Age

Baseline	Ages 25–39			Ages 40–54			Ages 55–69			Ages 70–84		
	Initial	Annual Growth	Initial	Annual Growth	Initial	Annual Growth	Initial	Annual Growth	Initial	Annual Growth	Initial	Annual Growth
Constant ^a	23.21(.46)***	.230 (.029)***	24.77 (.63)***	.145 (.025)***	25.67 (.38)***	-.039(.022) [†]	24.68 (.50)***	-.069(.031) [*]				
White Female		(omitted)		(omitted)		(omitted)		(omitted)				
Highest Education												
Middle Education	.25(.71)	-.098 (.037)**	.47 (.75)	.043 (.034)	.57 (.50)	.053(.032) [†]	.73 (.57)	-.100 (.042) [*]				
Lowest Education	1.23(.64) [†]	-.034 (.037)	3.23 (1.1)**	-.011 (.057)	2.29 (.60)	-.042(.045)	1.81 (.74) [*]	-.006(.072)				
Black Female												
Highest Education	2.51(.89)**	.064 (.082)	2.89 (.97)**	-.013 (.047)	3.12 (.90)***	-.047(.075)	3.67 (1.21)**	-.058(.088)				
Middle Education	1.51(.85) [†]	.038 (.057)	3.67 (.91)***	.057 (.071)	4.80 (1.3)***	-.075(.090)	2.66 (.93)**	-.010(.094)				
Lowest Education	4.20(.70)***	.095 (.047) [*]	5.04 (.99)***	-.077 (.053)	5.10 (.69)***	-.063(.054)	2.85 (.84)***	-.094(.077)				
Black Male												
Highest Education	2.17(.73)**	-.002 (.035)	3.15 (1.1) [*]	.010 (.047)	2.42 (1.0) [*]	.014(.077)	.41 (.67)	.133(.117)				
Middle Education	2.70(.80)***	.002 (.048)	1.30 (.92)	.035 (.041)	2.48 (1.0) [*]	.047(.087)	1.09 (.73)	-.053(.162)				
Lowest Education	3.24(.79)***	-.028 (.064)	3.10 (1.1) [*]	-.174 (.066)**	1.19 (.89)	.011(.077)	1.69 (.79) [*]	.037(.083)				
White Male												
Highest Education	2.09(.64)**	-.102 (.033)**	2.64 (.83)**	-.056 (.039)	.91 (.57)	.048(.035)	1.28 (.91)	-.120(.069) [†]				
Middle Education	2.72(.64)***	-.058 (.035) [†]	2.87 (.81)***	-.034 (.040)	.03 (.63)	.028(.030)	1.51 (.72)	-.118(.057) [*]				
Lowest Education	3.36(.61)***	-.061 (.039)	3.25 (1.1)**	-.031 (.077)	1.79 (.69)**	-.101(.043)	.56 (.65)	.048(.057)				
Attrition due to:												
Death	-.24(.91)	.022 (.108)	.23 (.69)	-.032 (.081)	-.68 (.41) [†]	-.093(.034)**	-.46 (.44)	-.104(.035)**				
Non-Response	-.61(.35) [†]	-.016 (.021)	-1.09 (.44) [*]	-.020 (.033)	-.71 (.37) [†]	-.002(.029)	-.35 (.46)	.066(.040)				
Unweighted N	1011		625		1098		692					

Note: Robust standard errors are reported in parentheses beside parameter estimates. Education is measured in 1986.

Age 25–39: Highest Education = 15–17 years, Middle Education = 13–14 years, Lowest Education < 13 years.

Age 40–54: Highest Education = 14–17 years, Middle Education = 12–13 years, Lowest Education < 12 years.

Age 55–69: Highest Education = 13–17 years, Middle Education = 11–12 years, Lowest Education <11 years.
 Age 70–84: Highest Education = 13–17 years, Middle Education = 9–12 years, Lowest Education <9 years.

^a Constant represents a white female in the highest education category.

[†] p < .10
 * p < .05
 ** p < .01
 *** p < .001 (two-tailed tests)

Table 4
Interactive Effects of Race/Gender/Income on Initial BMI and Annual BMI Growth from 1986–2001/2002, by Baseline Age

Baseline	Ages 25–39			Ages 40–54			Ages 55–69			Ages 70–84		
	Initial	Annual Growth	Initial	Annual Growth	Initial	Annual Growth	Initial	Annual Growth	Initial	Annual Growth	Initial	Annual Growth
Constant ^a	23.23 (.37) ***	.187 (.021) ***	25.04 (.46) ***	.170 (.021) ***	25.85 (.41) ***	-.001 (.025) ***	23.46 (.80) ***	-.088 (.057)				
White Female												
\$30,000+		(omitted)		(omitted)		(omitted)		(omitted)		(omitted)		
\$10,000–29,999	.96 (.60)	.012 (.032)	1.40 (.76)	-.014 (.039)	.40 (.53)	-.014 (.035)	2.45 (.85) **	-.066 (.062)				
< \$10,000	1.82 (.94) †	-.016 (.052)	.58 (.11)	-.005 (.050)	.39 (.61) **	-.035 (.042)	2.20 (.87) **	-.015 (.064)				
Black Female												
\$30,000+	3.11 (.83) ***	-.005 (.058)	2.56 (.75) ***	-.012 (.065)	2.97 (1.5) †	-.061 (.104)	4.43 (6.7)	.004 (.449)				
\$10,000–29,999	2.13 (.64) ***	.154 (.045) ***	4.40 (.81) ***	-.012 (.065)	4.53 (1.1) ***	-.009 (.073)	4.10 (1.7) **	.115 (.149)				
< \$10,000	4.44 (.79) ***	.169 (.056) **	3.77 (1.1) ***	-.077 (.053)	4.52 (.73) ***	-.140 (.056) *	4.18 (1.1) ***	-.105 (.090)				
Black Male												
\$30,000+	2.70 (.63) ***	.044 (.047)	2.58 (.69) ***	.010 (.047)	2.77 (1.1) *	-.056 (.070)	2.20 (3.9)	-.150 (.494)				
\$10,000–29,999	3.43 (.70) ***	.023 (.039)	2.84 (1.0) **	.035 (.041)	1.93 (.85) *	-.036 (.059)	1.91 (2.0)	.138 (.174)				
< \$10,000	.99 (.74)	.042 (.068)	-2.52 (.68) ***	-.174 (.066) **	-.47 (1.0)	.080 (.114)	3.04 (1.8) **	.007 (.133)				
White Male												
\$30,000+	2.90 (.48) ***	-.061 (.026) *	2.62 (.64) ***	-.056 (.039)	.28 (.55)	-.017 (.034)	1.50 (1.1)	-.075 (.090)				
\$10,000–29,999	2.33 (.59) ***	.000 (.028)	2.32 (.83) **	-.034 (.040)	1.08 (.65)	-.012 (.034)	2.81 (.89) **	-.110 (.071)				
< \$10,000	3.13 (1.0) **	.000 (.082)	2.44 (1.1) *	-.031 (.077)	-.57 (.87)	.049 (.050)	2.03 (.96)	.082 (.081)				
Attrition due to:												
Death	-.27 (.93)	.013 (.115)	.40 (.72)	-.032 (.081)	-.48 (.41)	-.105 (.035) **	-.53 (.41)	-.096 (.033) **				
Non-Response	-.58 (.37)	-.020 (.022)	-.93 (.45) *	-.020 (.033)	-.37 (.34)	-.020 (.028)	-.36 (.40)	.079 (.040)				
Unweighted N	1011		625		1098		692					

Note: Robust standard errors are reported in parentheses beside parameter estimates (robust standard errors could not be obtained for the 70–84 age group due to small sample size). Income is measured in 1986.

^aConstant represents a white female with a household income more than 30k.

(two-tailed tests)

$p < .01$

**

$p < .05$

*

$p < .10$

†

Appendix A
Wave-Specific Sample Sizes for Each Age Group Presented by Race and Gender Separately for Education and Income Categories

Education	Ages 25-39				Ages 40-54				Ages 55-69				Ages 70-84			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
White Female																
High	85	74	74	68	76	69	66	61	128	117	107	82	88	70	67	29
Middle	80	73	74	70	105	96	89	85	231	200	181	138	160	128	101	48
Low	165	136	135	124	47	38	39	29	123	95	89	55	97	76	55	12
Black Female																
High	36	25	26	24	29	23	26	21	26	23	20	15	17	13	12	3
Middle	57	42	43	28	53	43	36	31	59	48	39	21	42	26	19	4
Low	150	113	99	71	65	54	50	31	139	110	87	45	90	67	49	12
Black Male																
High	27	21	20	14	16	14	11	10	18	12	12	8	6	3	3	0
Middle	42	31	28	22	32	21	19	15	24	19	14	8	13	7	5	1
Low	55	35	33	23	42	30	25	16	75	52	42	18	40	33	14	4
White Male																
High	115	101	101	93	69	61	63	52	92	82	76	49	27	20	15	3
Middle	77	66	66	56	60	52	54	44	93	81	68	49	64	36	22	7
Low	122	91	98	91	31	22	26	20	90	68	57	22	48	30	19	5
Income																
White Female																
\$30,000+	133	120	123	116	112	104	99	93	119	107	103	83	29	26	27	16
\$10,000-29,999	146	119	120	115	79	70	64	60	229	198	180	137	153	118	104	46
< \$10,000	51	44	40	31	37	29	31	22	134	107	94	55	163	130	92	27
Black Female																
\$30,000+	46	33	34	23	32	27	30	22	14	13	12	7	2	2	2	1
\$10,000-29,999	90	65	64	44	57	46	41	39	62	54	44	25	27	18	15	4
< \$10,000	107	82	70	56	58	47	41	22	148	114	90	49	120	86	63	14
Black Male																
\$30,000+	34	29	29	21	31	24	19	18	26	15	18	11	3	0	1	0

	Ages 25-39				Ages 40-54				Ages 55-69				Ages 70-84			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
\$10,000-29,999	65	36	36	25	45	31	28	19	39	32	25	13	14	11	9	2
< \$10,000	25	22	16	13	14	10	8	4	52	36	25	10	42	32	12	3
White Male																
\$30,000+	147	126	130	120	92	82	86	70	104	92	83	56	16	11	6	6
\$10,000-29,999	136	114	114	104	49	39	41	36	126	107	96	55	80	51	36	4
< \$10,000	31	18	21	16	19	14	16	10	45	32	22	9	43	24	14	5

Note: Numbers are unweighted sample sizes.