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Can the Influence of Childhood Socioeconomic Status on Men's and Women's Adult Body Mass Be Explained by Adult Socioeconomic Status or Personality? Findings From a National Sample

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Objectives: On the basis of a life-course risk-chain framework, the authors examined whether (a) residual associations between childhood socioeconomic status (SES) and adult obesity and body mass index (BMI) would be observed in women but not men after adjusting for adult SES, (b) adult Big Five personality traits would be associated with adult body mass in both genders, and (c) personality would explain unique variation in outcomes beyond child and adult SES. ***Design:*** National survey (Midlife Development in the United States study; $N = 2{,}922$). ***Main Outcome Measures:*** BMI and obesity. ***Results***: (a) In both genders, association between childhood SES and adult obesity were accounted for entirely by adult SES, but its effect on adult BMI was observed only in women; (b) higher conscientiousness was associated with lower obesity prevalence and BMI in both genders, although more strongly in women, and in men, greater obesity prevalence was associated with higher agreeableness and neuroticism; and (c) personality explained unique outcome variation in both genders. ***Conclusions***: Early social disadvantage may affect adult weight status more strongly in women owing to gender differences in the timing and nature of weight-management socialization. Personality may enhance or detract from risks incurred by childhood or adulthood SES in either gender, necessitating the consideration of dispositional differences in prevention and intervention programs.

Keywords: Obesity, BMI, socioeconomic status, personality, Midlife Development in the United States

Obesity is a major public health problem in industrialized societies (Cope & Allison, 2006; McLaren, 2007), resulting in levels of morbidity nearly comparable to smoking and poverty (Sturm & Wells, 2001). Although the direction and strength of social gradients in obesity may vary depending on a country's level of industrialization and age cohort, in many countries social inequalities in body mass appear relatively early in life (McLaren, 2007; van der Horst et al., 2007) and endure through adulthood. More important, individuals born into higher childhood socioeconomic status (SES) show lower rates of adult obesity (Sarlio-Lahteenkorva, 2007). A major question, however, is whether associations between lower childhood SES and adult obesity can be explained by adult SES (Drewnowski & Specter, 2004; Klohe-Lehman et al., 2006). If the effects of childhood SES on adult weight status are mediated entirely through adult SES, then prevention and intervention resources altering the path from childhood social disadvantage to adult social disadvantage may have a substantial impact on reducing weight-related morbidity in adulthood. If, however, childhood SES effects on adult weight status can be only partially explained by adult SES, then other paths from early social disadvantage to adult weight problems exist, requiring additional consideration in prevention and intervention efforts.

Some reports have indicated that adult SES completely mediates associations between childhood SES and adult obesity (Lawlor et al., 2005; Regidor, Gutierrez-Fisac, Banegas, Lopez-Garcia, & Rodriguez-Artalejo, 2004), and others have indicated substantial residual effects for childhood SES after adult SES has been controlled (Laaksonen, Sarlio-Lahteenkorva, & Lahelma, 2004; Langenberg, Hardy, Kuh, Brunner, & Wadsworth, 2003). Associations between obesity and both adult SES (Zhang & Wang, 2004) and childhood SES also appear stronger in women (Case & Menendez, 2007; Laaksonen et al., 2004). This raises the possibility that potential residual childhood SES risk for unhealthy adult weight is gender specific.

However, weight status in adulthood is a function not only of social gradients in the distribution of wealth and resources, but also of individual differences in behavioral tendencies and psychological factors (Cope & Allison, 2006; Glass & McAtee, 2006). A second question therefore is whether the associations of childhood social class and adult weight status can also be explained to some extent by individual personality characteristics in adulthood. The "Big Five" phenotypic personality traits of neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness make up the major axes of dispositional behavioral variation in humans (Goldberg, 1993) and constitute "intermediate pheno-

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types" reflecting a joint expression of both genetic and social environmental factors influencing health (Institute of Medicine, 2006). Three traits have been implicated directly in weight gain in adulthood (Brummett et al., 2006): lower extraversion (or low levels of positive mood, energy, and sociability) in men, higher neuroticism (or high levels of stress reactivity and general negative mood) in women, and lower conscientiousness (or low levels of reliability, achievement striving, and self-discipline) in both genders.

How do personality and socioeconomic forces work in conjunction to influence adult weight status? Life course epidemiology (Ben-Shlomo & Kuh, 2002; Kuh, Ben-Shlomo, Lynch, Hallqvist, & Power, 2003) provides at least three conceptual models. First, a *risk-chain model with triggering effects* suggests that lower childhood SES influences adult weight status entirely through lower adult SES, personality traits, or both. In other words, the initial risk of early social disadvantage triggers later risks, such as lower adult SES and low conscientiousness, that are proximally tied to obesity. Some studies have provided support for such a model, documenting complete mediation of childhood SES by adult SES (Lawlor et al., 2005; Regidor et al., 2004). However, when substantial residual associations between childhood SES and adult obesity are observed after adjusting for adult SES (Laaksonen et al., 2004; Langenberg et al., 2003), the risks of childhood SES are thought to work through additional pathways, suggesting a second risk-chain model of *partial mediation*.

A third *risk accumulation model with independent additive effects* suggests that the association of early exposures, such as childhood social disadvantage, with adult obesity is essentially unmediated by adult personality. The latter may independently add to (exacerbate) and/or subtract from (compensate for) the risk conferred by childhood and adult SES. If such a model prevails, the risk conferred by disadvantaged childhood SES may be offset by protective traits in adulthood such as high conscientiousness, or the benefit of childhood advantage may be erased by personality traits linked to obesity and higher body mass index (BMI). In this case, adult personality traits would be useful for explaining heterogeneity in weight status among individuals of similar childhood or adult SES, constituting an important individual-level adjunct to societal factors, such as socioeconomic gradients, that influence weight status (Cope & Allison, 2006).

Virtually no studies have reported on the extent to which childhood social disadvantage affects standing on adult personality traits. However, a model of independent additivity for personality and SES would appear consistent with a recent report that adult temperament and childhood SES exerted largely independent effects on adult waist circumference (Sovio et al., 2007). Other findings have documented independent associations between adult BMI and childhood temperament, independent of childhood SES (Pulkki-Råback, Elovainio, Kivimäki, Raitakari, & Keltikangas-Järvinen, 2005), and BMI and childhood Big Five traits, independent of education (Hampson, Goldberg, Vogt, & Dubanoski, 2006). To the extent that childhood personality is associated with adult personality, these studies provide further clues about the possible independent additivity of adult personality.

We examined the joint influences of childhood SES, adult SES, and adult personality traits on obesity and BMI in a U.S. cohort with rich data on both the Big Five and SES in childhood and adulthood. On the basis of previous findings (Laaksonen et al., 2004; Zhang & Wang, 2004), we hypothesized that residual effects of childhood SES on adult weight status would be observed for women, but not for men. This corresponds to different life-course epidemiologic risk-chain models in which childhood SES effects are partially mediated by adult SES in women but completely mediated or triggered by adult SES in men.

We further hypothesized that adult personality would be associated with weight status independently of SES, explaining additional variation in BMI and obesity (Sovio et al., 2007). Specifically, we expected low extraversion in men, high neuroticism in women, and low conscientiousness in both genders to be associated with higher adult body mass (Brummett et al., 2006). From the perspective of life span epidemiologic models, we thus expected independent additive risks for adult personality vis-à-vis SES in both genders, although we suspected that the particular traits associated with weight status would differ in men and women.

Method

Study Population

The Midlife Development in the United States (MIDUS) study was a national survey conducted in 1995 by the John D. and Catherine T. MacArthur Foundation, which has been described extensively elsewhere (Brim, Ryff, & Kessler, 2004). Approved by ethical oversight boards, the study recruited noninstitutionalized, English-speaking adults ages 25–74 (younger [25–39] and older [61–75] individuals included for comparison purposes to midlife individuals [40–60; Brim et al., 2004]) using random-digit dialing and examined numerous social, behavioral, and psychological factors associated with health through a phone interview and mailed questionnaire. The overall response rate for the telephone portion of the study was 70%, and another 87% of these people completed the mail-in survey (Brim et al., 2004). Of the 4,242 individuals completing at least the phone interview, 2,992 (71%) had complete data on all variables of interest in the present analyses, which came from both the telephone and the survey portions. The greatest percentage of missing single variables were observed for survey questions on personality traits (14%) and employment (28%) or household income (16%). Multivariate logistic regression examining demographic differences between those with and those without complete data on variables of interest revealed that the current analysis sample did not differ from the larger sample in terms of race or gender, but the analysis sample was about half a year older (i.e., 46.5 vs. 46, $z = 2.58$, $p = .01$) and had a higher proportion of more educated people (i.e., 8.4% had less than high school education, 26.7% had high school, 30.6% had some college, and 34.3% had college or more as compared with 18.4%, 27.2%, 29.8%, and 24.5%, respectively, among those with incomplete data; $\chi^2[3, N = 2922] = 109.48$, $p < .001$).

Study Measures

We assessed BMI via survey questions asking respondents to report their height and weight. Obesity was classified as BMI of 30 kg/m^2 or above. Some studies have reported high correlations between self-reported and measured weight (Lowe, Miller-Kovach, & Phelan, 2001), and others have suggested that self-

reported height and weight may underestimate actual BMI (Taylor et al., 2006).

We measured childhood SES using Duncan's Socioeconomic Index (SEI) of respondents' parents' occupational prestige (highest of mother and father) for respondents' reports of their parents' occupation when respondents were 12–18 years old (Stevens & Cho, 1985). Focusing on the 12- to 18-year-old time period captures parental promotions or occupational advances occurring after early childhood and during the formative adolescent years. Parental SEI was standardized to a mean of 0 and a standard deviation of 1 according to the MIDUS sample to facilitate interpretation. Thus, a one-unit increase reflects a 14.46 SEI increase, roughly the difference between a milling machine operator (SEI = 21.86) and a construction inspector (SEI = 36.38). Standardized scores of −1 (i.e., taxi cab driver; SEI = 22.46), 0 (i.e., railroad yard master; SEI = 36.47), and 1 (i.e., air traffic controller; SEI = 50.11) also provide a rough index of low, average, and high parental occupational status.

We assessed adult SES by means of a comprehensive set of indicators, consistent with both indicators implicated in recent reviews on obesity (McLaren, 2007) and the importance of implementing a wide range of SES indexes (Galobardes et al., 2006a, 2006b.) These were (a) education (indicator variables for high school, some college, or college and beyond against a reference category of less than high school); (b) annual household income (scaled in $10,000 increments); (c) respondents' adult SEI (current job, or most recent job for those unemployed or retired, standardized to mean of 0 and a standard deviation of 1); and (d) an indicator for nonretirement-related unemployment (vs. employed). Because both marriage and retirement are factors significantly tied to adult social and economic resources, we also included (a) an indicator for married (vs. single, divorced, or widowed) and (b) an indicator for retired (vs. not retired). Other adult demographic covariates included age and indicator variables for female (vs. male) and African American and other race or ethnicity (against Caucasian reference category).

We assessed Big Five phenotypic personality traits via the Midlife Development Inventory Big Five scales (Lachman & Weaver, 1997), which ask respondents how well each of four to seven trait markers for each of the Big Five (Goldberg, 1992) describe them, using a 4-point Likert scale from ranging from 1 (*not at all like me*) to 4 (*a lot like me*). Cronbach's alpha estimates of internal consistency reliability for each scale were as follows: Neuroticism, .74; Extraversion, .78; Openness to Experience, .77; Agreeableness, .80; and Conscientiousness, .58. Scores were standardized to a mean of 0 and a standard deviation of 1, based on the complete MIDUS sample, to facilitate interpretation.

Statistical Analysis

Because our hypotheses were driven by prior findings of strong gender differences in the associations of SES and personality with weight status, all analyses were stratified a priori by gender. This could be done with preservation of relatively equal power because the sampling scheme of MIDUS assured relatively equal numbers of men and women. However, because stratified analyses reveal only whether effects are significant or not in each gender, analyses also tested for significant differences in the magnitude of significant effects across gender with interaction terms.

Preliminary analyses examined the associations of childhood SES with (a) adult SES and (b) personality factors. The reason was that if adult SES was not associated with childhood SES, the former could not mediate the effect of the latter. If one or both types of SES factors were too strongly linked to personality, the possibility of independent additivity for personality traits would be diminished. We examined these relationships using seemingly unrelated regression (Greene, 2003), which estimates associations between a set of predictors and several dependent variables simultaneously, accounting for correlated error terms among the outcomes that may arise from unobserved factors that affect all the outcomes (such as response sets operating across personality scales or macroeconomic conditions influencing a number of measures of SES). Childhood SES effects on unemployment, marital status, and retirement were modeled in separate logistic regressions.

Primary analyses consisted of a series of nested generalized linear models. Because obesity rates (21%) exceeded the rare-disease threshold (10%) for which logistic regression odds ratios accurately approximate relative risk, we estimated obesity relative risks (which are prevalence ratios in cross-sectional studies) using a modified Poisson approach with sandwich-estimated standard errors. This form of relative risk regression provides more accurate relative risk estimates and confidence intervals than post hoc transformation of odds ratios (Greenland, 2004; McNutt, Wu, Xue, & Hafner, 2003; Zou, 2004). BMI was modeled with robust linear regression.

The nested models consisted of a base model (Model 1) containing parental SEI and the covariates gender, age, and race–ethnicity. The next model assessed whether parental SEI effects were mediated by adult SES by adding respondent education, household income, and adult SEI, as well as adult marital status, unemployment, and retirement. Finally, Model 3 added the Big Five. We examined changes in prevalence ratio or regression coefficient for childhood SES at each step to determine whether adult SES factors diminished associations of parental SEI or whether personality factors diminished associations of childhood or adult SES factors in Models 1 or 2.

We examined linearity assumptions for continuous personality and SES terms in all models using quadratic and cubic terms. To investigate whether the slightly greater measurement error for the Conscientiousness scale biased results toward the null as would be expected, we fit regression calibration measurement error models (Carroll, Ruppert, & Stefanski, 1995). To evaluate whether the addition of adult SES and personality factors improved multivariate model fit for obesity, we examined changes in pseudo-R^2 values in prevalence ratio models (significance determined with likelihood ratio tests) and changes in adjusted R^2 values in linear regressions (significance determined with generalized F tests). Finally, because reviews (Zhang & Wang, 2004) have suggested different gender-specific associations of SES indicators and obesity in Blacks, secondary analyses refit models in Caucasians only because low minority participation rate precluded stratified analysis. Analyses were conducted in Stata 10 Special Edition (Stata Corporation, College Station, Texas).

Results

Table 1 presents descriptive statistics for the sample as a whole and stratified by BMI categories. Seemingly unrelated regression

Table 1
Sample Descriptors by Weight Category

Descriptor	Nonobese (n = 2,367): *M* (*SD*) or %	Obese (n = 625): *M* (*SD*) or %	Overall (N = 2,922): *M* (*SD*) or %
Body mass index	24.6 (3.1)	34.8 (4.6)	26.7 (5.4)
Demographics			
Age (years)	46.0 (13.4)	48.2 (11.9)	46.5 (13.1)
Race (%)			
Black	5	10	6
Other	5	4	5
Female (%)	48	52	49
Socioeconomic factors			
Parental SEI	39.0 (13.9)	35.8 (12.9)	38.3 (13.8)
Adult SEI	40.5 (14.4)	37.9 (13.8)	40.0 (14.3)
Education (%)			
<High school	8	11	8
High school	25	33	27
Some college	30	31	31
College or more	37	25	34
Median household income ($)	52,000	47,500	51,000
Married (%)	64	66	65
Retired (%)	10	8	10
Unemployed (%)	11	14	12

Note. SEI = Socioeconomic Index.

models revealed that parental SEI was associated with a number of adult SES indicators (accounting for 4%–17% of their variance) and minimally associated with adult personality traits of interest (accounting for 1%–5% of their variance). Thus, adult SES factors met criteria for potential mediation, and adult personality traits met criteria for potential additive independence.

Nested models making up the primary analyses for obesity are presented in Table 2. A 1 standard deviation increase in parental SEI amounted to a 14% reduction in obesity risk in each gender, but this effect was explained completely by adult SES factors in both men and women. Marriage was associated with higher obesity prevalence in men only. Retirement and college education were both associated with lower obesity prevalence in men. Personality traits did not appear to appreciably diminish the association of SES factors with obesity in either gender, and greater neuroticism was associated with lower obesity prevalence in men but not in women.

Table 2
Association Between Adult Obesity and Childhood and Adult Socioeconomic Status and Personality

	Men (n = 1,537)			Women (n = 1,455)		
Variable	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Age	1.01 (1.00, 1.01)	1.01** (1.01, 1.02)	1.01** (1.01, 1.02)	1.01** (1.00, 1.02)	1.01** (1.00, 1.02)	1.01** (1.00, 1.02)
Black	1.36 (0.91, 2.04)	1.32 (0.89, 1.95)	1.27 (0.87, 1.86)	1.95*** (1.50, 2.53)	1.88*** (1.43, 2.48)	1.82*** (1.38, 2.42)
Other race	1.11 (0.72, 1.72)	1.19 (0.77, 1.83)	1.17 (0.76, 1.79)	0.86 (0.50, 1.50)	0.88 (0.51, 1.52)	0.86 (0.50, 1.47)
Parental SEI	0.86* (0.77, 0.97)	0.94 (0.83, 1.07)	0.94 (0.83, 1.06)	0.86** (0.78, 0.96)	0.91 (0.81, 1.02)	0.92 (0.82, 1.03)
Adult SEI		1.04 (0.92, 1.19)	1.03 (0.90, 1.17)		0.96 (0.85, 1.10)	0.97 (0.86, 1.10)
Unemployed		0.85 (0.57, 1.26)	0.81 (0.56, 1.19)		1.09 (0.85, 1.39)	1.05 (0.82, 1.34)
Retired		0.45*** (0.28, 0.72)	0.46** (0.29, 0.74)		0.74 (0.51, 1.07)	0.71 (0.50, 1.02)
High school education		1.14 (0.80, 1.62)	1.15 (0.81, 1.63)		0.95 (0.68, 1.32)	1.06 (0.75, 1.49)
Some college education		0.97 (0.67, 1.41)	0.97 (0.66, 1.41)		0.88 (0.62, 1.25)	0.99 (0.70, 1.42)
College or more education		0.63* (0.41, 0.96)	0.63* (0.41, 0.96)		0.78 (0.50, 1.24)	0.95 (0.59, 1.52)
Married		1.48** (1.14, 1.93)	1.51** (1.16, 1.98)		0.94 (0.76, 1.17)	0.95 (0.76, 1.17)
Household income ($10Ks)		1.00 (0.98, 1.02)	1.00 (0.98, 1.02)		0.99 (0.96, 1.01)	0.99 (0.97, 1.01)
Neuroticism			0.88* (0.79, 0.98)			0.98 (0.89, 1.09)
Extraversion			0.89 (0.78, 1.02)			0.95 (0.84, 1.08)
Openness			1.09 (0.95, 1.25)			0.93 (0.83, 1.04)
Agreeableness			1.20** (1.06, 1.37)			1.14 (0.98, 1.32)
Conscientiousness			0.81*** (0.73, 0.90)			0.80*** (0.72, 0.89)
Pseudo-R^2	.0307	.0516	.0638	.0583	.0630	.0737

Note. Values are prevalence ratios (and 95% confidence intervals). Personality and SEI scores standardized (M = 0, SD = 1). Model 1 = demographic factors and childhood socioeconomic status only; Model 2 = Model 1 + adult socioeconomic status; Model 3 = Model 2 + adult personality. SEI = Socioeconomic Index.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Greater conscientiousness was associated with lower obesity prevalence in both genders.

Linear regressions revealed persisting residual effects of parental SEI on BMI in women but not in men (see Table 3). The left panel of Figure 1 shows the regression slopes for residual effects of parental SEI in each gender after full adjustment for adult SES and personality. In women, greater household income was also associated with lower BMI. Marriage was significantly associated with higher BMI in men but not in women. Higher agreeableness was associated with higher BMI in men but not in women. Greater conscientiousness was associated with lower BMI in both genders, but the effect was much more pronounced in women ($p < .001$). The right panel of Figure 1 depicts gender differences in adjusted regression slopes.

Finally, of demographic covariates, Black race–ethnicity was significantly associated with obesity prevalence and higher BMI in women only, whereas greater age was associated with higher BMI in both genders but showed a stronger effect in women ($p = .027$). We also observed a quadratic effect for income in men, such that higher income was associated with higher BMI up to roughly $100,000 but with lower BMI beyond $100,000. However, this effect appeared because of a relatively small proportion of men with incomes of more than $200,000, so we did not include it in final models. No other nonlinearities were apparent, and secondary analyses using only Caucasian respondents revealed nearly identical findings. Regression calibration analyses revealed that measurement error in the Conscientiousness scale biased the observed effect toward the null.

Adjusted and pseudo-R^2 values suggest that the addition of adult SES indicators improved explanatory power for both obesity in men (Δpseudo-$R^2 = .0209$, $\chi^2[8, N = 2922] = 33.65$, $p < .001$), but not in women and improved explanatory power for BMI in both genders ($\Delta R^2_{Adj} = .0235$, $F[8, 1524] = 5.68$, $p < .001$, for men, and $\Delta R^2_{Adj} = .0107$, $F[8, 1442] = 3.07$, $p = .002$, in women). Personality improved explanatory power in both genders for obesity (Δpseudo-$R^2 = .0022$, $\chi^2[8, N = 2922] = 19.42$, $p = .002$, for men, and Δpseudo-$R^2 = .0107$, $\chi^2[5, N = 2922] = 18.32$, $p = .003$, for women) and BMI ($\Delta R^2 = .0087$, $F[5, 1519] = 3.75$, $p = .002$, for men, and $\Delta R^2 = .0227$, $F[5, 1437] = 8.14$, $p < .001$, in women). At each step, models explained more overall variation in obesity and BMI in women (i.e., for final model, pseudo-$R^2 = .0737$ and $R^2_{Adj} = .0855$) as compared with men (pseudo-$R^2 = .0638$ and $R^2_{Adj} = .0460$). The proportions of explained variance attributable to personality were 19% and 19% for obesity and BMI, respectively, in men, and 15% and 27% for obesity and BMI, respectively, in women.

Conclusions

After controlling for demographics, SES, and personality in adulthood, lower childhood SES exerted no residual effects on adult obesity in either gender but remained associated with adult BMI in women. Higher conscientiousness was associated with lower obesity prevalence and BMI in both genders, although more strongly so for women's BMI. Higher agreeableness and lower neuroticism signaled greater obesity prevalence and higher agreeableness signaled higher BMI in men. For each outcome, personality explained additional unique variation. These results extend previous findings on childhood SES gradients in obesity in three ways.

First, some European studies have reported no association between childhood SES and obesity after accounting for adult socioeconomic indicators (Lawlor et al., 2005; Regidor et al., 2004), whereas others have reported substantial residual effects, particu-

Table 3
Association Between Adult Body Mass Index and Childhood and Adult Socioeconomic Status and Personality

	Men (n = 1,537)			Women (n = 1,455)		
Variable	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Age[a]	0.03** (0.01)	0.04*** (0.01)	0.04*** (0.01)	0.06*** (0.01)	0.06*** (0.01)	0.07*** (0.01)
Black	0.59 (0.63)	0.48 (0.62)	0.47 (0.61)	3.79*** (0.77)	3.74*** (0.78)	3.54*** (0.79)
Other race	0.29 (0.65)	0.46 (0.65)	0.42 (0.65)	−0.33 (0.64)	−0.23 (0.64)	−0.30 (0.63)
Parental SEI	−0.38** (0.12)	−0.19 (0.13)	−0.17 (0.12)	−0.58*** (0.15)	−0.34* (0.17)	−0.34* (0.17)
Adult SEI		−0.13 (0.13)	−0.11 (0.13)		−0.21 (0.21)	−0.19 (0.20)
Unemployed		−0.58 (0.44)	−0.69 (0.44)		0.64 (0.48)	0.48 (0.48)
Retired		−1.46*** (0.41)	−1.45*** (0.41)		−0.94 (0.62)	−1.11 (0.59)
High school education		0.54 (0.45)	0.63 (0.45)		0.39 (0.62)	0.83 (0.62)
Some college education		0.34 (0.47)	0.49 (0.47)		0.25 (0.63)	0.73 (0.64)
College or greater education		−0.46 (0.48)	−0.26 (0.49)		−0.42 (0.72)	0.20 (0.74)
Married		0.92*** (0.26)	0.89*** (0.26)		0.38 (0.36)	0.40 (0.35)
Household income ($10Ks)		0.01 (0.02)	0.02 (0.02)		−0.08** (0.03)	−0.07* (0.03)
Neuroticism			−0.15 (0.12)			−0.15 (0.16)
Extraversion			−0.06 (0.15)			−0.21 (0.21)
Openness			−0.24 (0.15)			−0.08 (0.19)
Agreeableness			0.44*** (0.12)			0.23 (0.25)
Conscientiousness[a]			−0.32** (0.12)			−1.05*** (0.21)
Adjusted R^2	.0138	.0373	.0460	.0521	.0628	.0855

Note. Linear regression coefficients (standard errors). SEI = Socioeconomic Index.
[a] Coefficient differs by gender, $p < .05$. Personality and SEI scores standardized ($M = 0$ $SD = 1$). Model 1 = demographic factors and childhood socioeconomic status only; Model 2 = Model 1 + adult socioeconomic status; Model 3 = Model 2 + adult personality.
* $p < .05$. ** $p < .01$. *** $p < .001$.

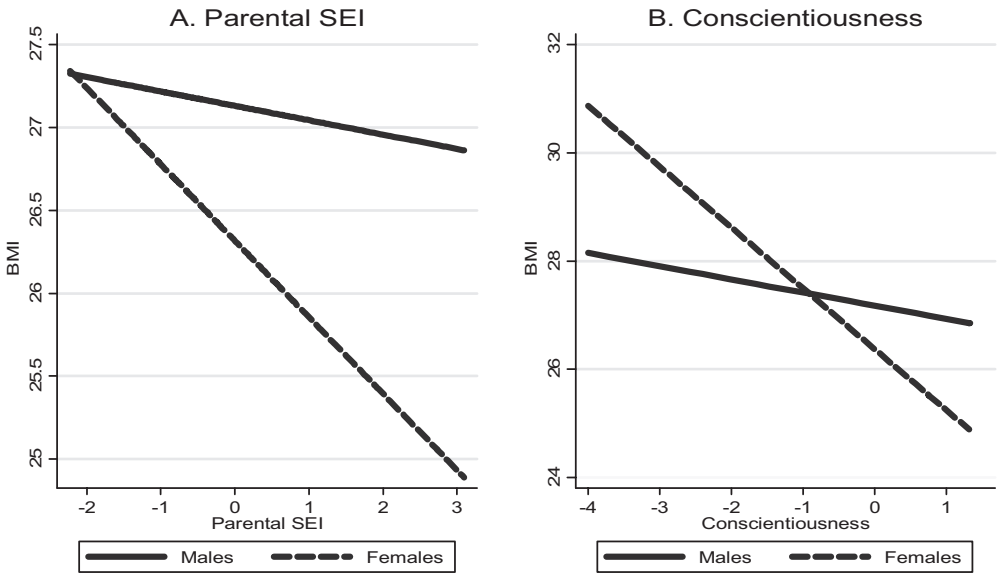

Figure 1. Fully adjusted relationship of parental Socioeconomic Index (SEI) and conscientiousness to body mass index (BMI) in men and women.

larly in women (Laaksonen et al., 2004). Our findings resemble both types of studies in that childhood SES exerted no residual effect on adult obesity in either gender but did show persisting associations with BMI in women. This suggests that the social circumstances of one's upbringing confer no residual risk for crossing the threshold of obesity—a relatively high level of BMI—but do exert a long-lasting effect when the entire spectrum of body mass is considered as a continuum in U.S. women.

Consideration of weight status as obese or nonobese represents a useful and convenient designation for clinical and public health purposes but relinquishes more nuanced information present in dimensional body mass. As a result, associations between various risk factors and the general body mass continuum may be masked, raising two possibilities. First, conflicting findings in prior studies focusing on childhood SES and obesity per se might be interpreted as evidence that some residual association between childhood SES and dimensional adult body mass exists at the population level but that it is found only inconsistently when BMI is dichotomized. Second, childhood SES may indeed show residual associations with the BMI spectrum but not with obesity itself. In other words, childhood SES shows persisting effects across the lower ranges of the BMI gradient, but these effects diminish in the upper ranges of BMI. We may have lacked power to detect subtle nonlinearities in specific regions of the BMI continuum.

The apparent tendency for childhood SES to exert residual effects on adult weight status in women but not men may be because attention to body shape and size begins at an earlier age in women and may be relatively more intense than for boys (Brownwell, 1991). Although adolescent boys' body cognitions appear to involve concern for muscularity, those of girls are focused on obesity (S. S. Wang, Houshyar, & Prinstein, 2006). Greater societal expectations arising at an earlier age may magnify the influence of dietary, exercise, weight-regulatory behaviors, or weight norms arising from childhood SES. In men, elimination of the association between childhood SES and adult obesity and BMI by adjustment for adult SES suggests that the timing of SES influences on weight management is later and/or weaker. Another possibility raised by recent investigations of gender differences in the childhood SES–adult weight phenomenon is that the biological changes faced by young women, such as puberty, may be somehow implicated in the persisting effects of childhood disadvantage on adult weight status (Case & Menendez, 2007). Gender-differential genetic contributions to obesity have also been reported (Allison, Heshka, Neale, Lykken, & Heymsfield, 1994), although sources of potential gender-differential gene–environment interactions remain unknown. Clearly, research is needed to identify the remaining pathways through which childhood SES exerts its effects.

A second important feature of these findings is that different adult SES factors were associated with obesity rates and BMI in men and women. This parallels the conclusion of comprehensive reviews (McLaren, 2007). For men, obesity prevalence was much lower in those with a college or beyond education as compared with those with less than a high school education. Education associations with obesity and BMI were nonsignificant in women, in whom higher household income was instead associated with lower BMI. The protective effect of retirement against obesity and the risk conferred by marital status were both restricted to men. Thus, "conventional" measure of SES—household income, for women's BMI, and education, for men's obesity prevalence—showed expected associations in both genders, but in men SES factors tied to life transitions such as marriage and retirement appeared to be additional correlates.

These findings are consistent with observed gender-differential changes in food consumption patterns associated with marriage, such as the transition from cooking relatively infrequently and/or poor-tasting food as a bachelor to greater availability and quality of food prepared by one's wife, which may lead to significant weight gain in men 2 years after marriage (Jeffrey & Rick, 2002). Married men are also more likely to be overweight than never-

married, divorced, separated, or widowed men (Hanson, Sobal, & Frongillo, 2007). Marital status appears to be such a powerful determinant of weight status in men that, other than age, it is the strongest predictor of obesity for men in Poland (Lipowicz, Gronkiewicz, & Malina, 2002). Gender differences in typical postretirement activities may also exist, such as participation by men in hobbies requiring greater energy expenditure like golfing or carpentry.

Third, and perhaps most important, was the finding that personality contributed additively and largely independently to outcome variation in both men and women. In both genders, higher conscientiousness was associated with lower obesity prevalence and BMI, but the effect for BMI was stronger in women, consistent with prior longitudinal findings (Brummett et al., 2006). Higher conscientiousness involves greater self-discipline with respect to diet and exercise (Goldberg & Strycker, 2002; Roberts, Walton, & Bogg, 2005), and the effects of self-restraint may be potentiated in women by the culturally induced focus on body weight. More agreeable men also appeared to have a higher prevalence of obesity and higher BMI. Agreeableness involves compliance, trust, acquiescence, and interpersonal deference (Goldberg, 1993), and it is possible that such characteristics may raise susceptibility to overeating by reducing adaptive skepticism to marketing campaigns for high-caloric foods, increasing food consumption out of social obligation, or enhancing susceptibility to interpersonal influence and social contagion encouraging overeating (Christakis & Fowler, 2007). More agreeable men may be more sensitive to interpersonal stressors or threats, which can increase daily snacking (O'Connor, Jones, Conner, McMillan, & Ferguson, 2008). We observed a nonsignificant prevalence ratio only slightly less in magnitude for higher agreeableness in women, and secondary analyses indicated that the small difference in magnitude was not statistically significant. Thus, this may have been one case in which the slight difference in sample sizes resulted in less power to detect a similar-sized effect in women, so we caution against premature of dismissal of the possibility that agreeableness is associated with weight status in women.

A final personality finding of note was that higher neuroticism was significantly associated with lower rather than higher obesity prevalence in men and unassociated with obesity (with the nonsignificant estimate suggesting higher prevalence) in women. These findings are consistent with the possibility that neuroticism can reflect adaptive concern over health (Friedman, 2000), at least in men, whereas the hint of an opposing effect in women was consistent with prior speculation that the trait is linked to maladaptive coping strategies such as overeating and inactivity in women (Brummett et al., 2006). Another intriguing complexity was that neuroticism was not associated with BMI in either gender. This may mean that in men, the health concern signaled by neuroticism is less likely to produce weight control behaviors at levels of BMI below the obesity threshold but becomes sufficiently activated at higher BMI to prevent passage over the obesity threshold. In other words, being only a little overweight may not activate men's health anxiety enough to reveal protective benefits, but when one's weight approaches more obviously and severely unhealthy levels, dispositional worry serves an adaptive function. Such possibilities warrant future consideration.

Overall, findings are consistent with life-course epidemiologic risk-chain models in which the effect of childhood SES on adult weight status is only partially mediated by adult SES in women and completely mediated by adult SES factors in men. The role of personality in the risk chain would appear to be additive and independent in both genders. Two important conceptual implications exist. First, the residual effects of childhood (dis)advantage in women suggest remaining pathways to adult weight status that require additional investigation. Second, the largely independent effects of SES and personality mean that an adaptive adult personality profile may to some degree offset the risk of lower childhood SES, or a risky personality profile may wash out the protective effects of early life advantage.

At the level of primary prevention early in the life course, our findings support the need for careful consideration of educational and prevention programs in lower SES girls (Kaplan, 2000). Results also suggest attention to individual personality traits across the adult life course in prevention and intervention programs for both sexes. Dispositional psychological factors affect attention and response to preventive health messages (Dutta-Bergman, 2003; Kreuter & Wray, 2003), possibly explaining why media-based public health campaigns yield variable results at the level of the individual. An intriguing avenue for future inquiry might be to examine whether public health obesity education campaigns tailored to the personality characteristics associated with obesity in each gender are more effective than those not tailored in this way. However, in the absence of more definitive data, this is best regarded as a topic of translational research rather than as an area for current policy implementation.

Interventions may also benefit from tailoring according to patients' trait profiles (Noar, Benac, & Harris, 2007). Individuals lower in conscientiousness are likely to require extremely gradual change in diet and exercise regimens or treatments that are less dependent on daily adherence because their tendencies toward disorganization, unreliability, and poor self-discipline may lead to failures in one-size-fits-all treatments. Agreeable individuals may need to develop a more skeptical attitude toward the mass marketing of high-caloric food choices while also developing social skills that enable them to resist and/or assertively refuse social pressures that may enhance obesity risk. Men low in neuroticism who are approaching BMIs of 30 may benefit from the induction of health anxiety to reduce risk of passage into obesity. A final implication for research is the necessity of considering both obesity and BMI in further studies because each may be sensitive to different factors that ultimately influence body weight.

Findings must be qualified by several limitations. Because the MIDUS survey was cross-sectional, we lack data on personality and BMI in childhood and could not assess temporal relationships between variables, limiting our ability to ascertain causal sequences. For instance, in the United States, low social class continues to be associated with childhood overweight and obesity, and as many as 80% of overweight children become obese adults (Y. Wang & Beydoun, 2007). We were unable to examine the role of childhood obesity as a pathway for the enduring effects of childhood SES in women (Wang & Beydoun). The time frame used to assess parental SEI may also not have captured respondents' childhood SES during earlier periods or changes in SES over the course of their childhood and adolescence, and the influence of such variability on childhood SES predictive power bears future investigation. Also, although Duncan's SEI captures promotions to higher occupational titles (i.e., construction foreman vs.

construction worker) that may occur with greater time on a job, it does not capture increasing prestige that may accrue with greater time in a single occupational title and may not be sensitive to increasing socioeconomic standing from longer job tenure. As well, personality exhibits both stable and changing elements and may be influenced by environmental factors over time (Caspi & Roberts, 2001), so it is difficult to know the extent to which adult personality effects can be accounted for by personality and temperament in childhood (Hampson et al., 2006; Pulkki-Råback et al., 2005) or the extent to which traits are themselves shaped by obesity. For instance, obese men may show elevated agreeableness as an adaptation to offset the interpersonal stigma attached to their weight. Addressing such important questions will require additional investigations. The Conscientiousness scale contained greater measurement error than other personality scales. However, regression calibration analyses confirmed that this attenuated its associations with weight status, meaning that our reported estimates of the protective role of conscientiousness are conservative. Additionally, although the MIDUS study tried to recruit as representative a U.S. sample as possible, individuals of higher education and Caucasian race–ethnicity were overrepresented in sampling (Brim et al., 2004), with our analysis sample higher yet in education. We were not powered to examine race–ethnicity differences, such as the frequently reported finding that increasing SES is associated with lower obesity prevalence in Black men but with increasing obesity prevalence in Black women (Y. Wang & Beydoun, 2007). Classification of obesity was based on self-report of weight and BMI; if anything, this is likely to result in underclassification of obesity to some extent (Taylor et al., 2006), although the use of continuous BMI meant that truly obese people were still likely to fall in the upper reaches of the continuum. Future work may wish to also use waist circumference in conjunction with measured height and weight (Y. Wang & Beydoun, 2007). Accuracy of recall of childhood social class is also moderate (Batty, Lawlor, Macintyre, Clark, & Leon, 2005) but likely to underestimate rather than overestimate associations with adult health.

Strengths of the study were the conjoint estimation of childhood SES and adult SES and personality associations, rarely possible because epidemiologic surveys usually do not include personality assessments and personality studies rarely involve national samples or include comprehensive assessment of SES (Krueger, Caspi, & Moffitt, 2000). Coverage of the majority of the adult life course ensured that findings of childhood social class effects were not based only on adults in their 20s and 30s. Comprehensive sets of personality and SES factors ensured complete and nonarbitrary coverage of phenotypic traits and SES indicators (Galobardes et al., 2006a, 2006b). Finally, to our knowledge, this study represents the first attempt to contextualize the links between adult body mass and childhood SES and adult SES and personality factors in the life course risk-chain theoretical framework.

Obesity affects all strata of society (Cope & Allison, 2006): Although there is evidence for BMI gradients associated with childhood SES in women, not everyone who experienced childhood disadvantage develops a high body mass, and not everyone who experienced advantage enjoys a healthy weight. Personality traits in adulthood may substantially add to or detract from childhood and adult SES risks in both men and women and bear further investigation in life course risk-accumulation models for other health outcomes.

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