Does optimal parenting style help offspring maintain healthy weight into mid-life?

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ABSTRACT

An authoritative parenting style is generally associated with healthier body weight in children and adolescents. However, whether the protective effect of an authoritative style on offspring body weight may persist into adulthood has seldom been investigated. In this study we examined the longitudinal association between parenting style and body mass index (BMI) change in mid-life. Longitudinal data from the Midlife in the United States Study ($N = 3929$) were analyzed using generalized estimating equations, adjusting for a range of relevant covariates. Parenting styles were assessed at phase I (1995–1996) using items measuring parental warmth and control, while BMI was assessed at phases I and II (2004–2006). Four parenting styles were derived following prior research: authoritative, authoritarian, permissive, and uninvolved styles. Compared to an authoritative style, an authoritarian style was associated with 14% higher increase in the standardized BMI change score ($\beta = 0.14$, 95% confidence interval: 0.03, 0.26). While there was suggestive evidence that an uninvolved versus authoritative style might also be associated with greater BMI increase, we found no differences between a permissive and authoritative style. This study suggested that the protective effect of an authoritative parenting style on offspring body weight may persist well into mid-life, particularly as compared to the authoritarian style and possibly the uninvolved style. Such work may reinforce the importance of a public health focus on improving parenting practices and suggest the value of implementing parenting programs, as one strategy for increasing the likelihood that individuals can maintain healthy weight well into adulthood.

1. Introduction

Obesity has been identified as a public health crisis worldwide (NCD Risk Factor Collaboration, 2017). In addition to targeting individual-level risk factors for obesity such as unhealthy diet and sedentary lifestyle, the Institute of Medicine has called for a population-based integrative approach for obesity prevention that also considers modifiable factors in the broader social environment (Committee on Accelerating Progress in Obesity Prevention, 2012).

Family represents individuals' immediate social surroundings and is potentially a critical source of social support that influences health (Alvarez et al., 2016). In particular, parenting practices may shape offspring health and well-being over the lifecourse (Britto et al., 2017). One of the most widely-studied parenting practices is parenting style. Based

on levels of parental warmth and parental control, prior researchers (Maccoby and Martin, 1983) identified four general parenting styles: the authoritative (high in both warmth and control), authoritarian (low in warmth and high in control), permissive (high in warmth and low in control) and uninvolved style (low in both warmth and control). Empirical evidence generally suggests that the authoritative style is associated with better offspring health and well-being compared to other parenting styles (Pinquart, 2016; Pinquart, 2017a; Pinquart, 2017b).

Recent research, though mostly cross-sectional, has begun to consider parenting styles in relation to childhood obesity. A number of reviews have suggested that an authoritative style is associated with healthier body weight and weight-related behaviors in children and adolescents, as compared to other parenting styles (Sleddens et al., 2011; Sokol et al., 2017; Vollmer and Mobley, 2013). In comparison,

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only a handful of studies have explored whether the protective effects of an authoritative style on maintaining healthy body weight may persist beyond adolescence, but the limited evidence does suggest a lingering beneficial influence in young adulthood (Fuemmeler et al., 2012). However, to our knowledge whether the association may extend into middle or late adulthood has never been examined. From a life-course perspective, parental influences may shape offspring health not only in childhood but also well into adulthood (Holt-Lunstad et al., 2017). Children often model dietary and exercising behaviors from their parents, and such behavioral patterns may persist into adulthood and exert long-term health effects (Sokol et al., 2017). In fact, obese children are at substantially higher risk of staying obese when they grow up into adults (Simmonds et al., 2016).

Prior studies on parenting styles and offspring body weight often considered a limited range of confounders, generally including factors such as demographic characteristics and socioeconomic status [SES] (Sokol et al., 2017). Other factors may also have important linkages to parenting styles and body weight but few studies have included them. For example, childhood familial characteristics such as family structure (Sokol et al., 2017), parental abuse (Danese and Tan, 2014), residential stability (Anderson et al., 2014; Jones, 2015) and family religiousness (Bornstein et al., 2017; Goeke-Morey and Cummings, 2017) have been linked with either parenting or children's risk of obesity. However, whether they may confound the association of parenting style with offspring body weight is understudied.

This study examined the longitudinal association between parenting styles and offspring body weight over a 9-year follow-up in mid-life, controlling for a wide range of childhood family environment characteristics as potential confounders (e.g., family SES, family structure, parental abuse, residential stability, family religiousness). Parenting styles were recalled when offspring were middle-aged. Because parenting styles were retrospectively reported, as a sensitivity analysis we additionally adjusted for a number of adulthood characteristics (e.g., adulthood SES, depression, chronic health conditions) that may affect how parenting styles were recalled (Widom et al., 2004). We hypothesized that the authoritative parenting style would be associated with healthier body weight in mid-life, compared to other parenting styles.

2. Methods

2.1. Study sample

Data were from the Midlife in the United States (MIDUS) study. MIDUS was initiated in 1994–1995 to study health and well-being in mid-life. At the first wave (MIDUS I), 7108 non-institutionalized individuals aged between 25 and 74 years across the United States were enrolled through a random selection process. Participants were invited to participate in a phone interview, and then received a self-administered questionnaire (SAQ). A second wave of the study (MIDUS II) took place in 2004–2005, which followed up 70% ($N = 4963$) of the original participants. Details of the MIDUS recruitment and follow-up procedures were reported elsewhere (Brim et al., 2004; Shaw et al., 2004).

Because parenting styles and body weight were only assessed in the SAQ, the analytic sample for the present study was drawn from respondents who completed the SAQ at both waves ($N = 3929$; 569 of them either siblings or twins, and we adjusted for potential clustering by sibling status in the analyses). This study was approved by the institutional review board (IRB) at the authors' institution. The original MIDUS study was approved by the IRB at participating institutions, and all participants provided informed consent (Radler, 2014).

2.2. Measures

2.2.1. Independent variables
2.2.1.1. Parental warmth. At phase I, participants recalled parental warmth during their years of growing up. A six-item Parental

Affection Scale (Rossi, 2001) (Table S1) was used to assess maternal and paternal warmth separately (e.g., "How much love and affection did your mother/father give you?"). Response categories ranged from 1 (a lot) to 4 (not at all). When appropriate, items were reverse coded so that a higher score reflected greater warmth. Maternal and paternal warmth scores were calculated for participants with valid data on at least half of the scale items, by averaging responses across items. Following prior research, an overall parental warmth score was calculated by averaging the maternal and paternal warmth scores (Rothrauff et al., 2009). The scale had good internal consistency reliability in this sample ($\alpha = 0.89$ for the maternal scale, $\alpha = 0.91$ for the paternal scale). It also showed positive associations with multiple domains of well-being in prior work (Chen et al., 2018; Moran et al., 2018), providing some evidence for construct validity.

2.2.1.2. Parental control. Participants recalled parental control during their years of growing up at phase I. A three-item Parental Control Scale (Rossi, 2001) (Table S1) was used to assess maternal and paternal control separately (e.g., "How strict was your mother/father with her/his rules for you?"). Response options ranged from 1 (a lot) to 4 (not at all). Responses were scored so that a higher score represented greater control. Maternal and paternal control scores were calculated for participants with valid data on at least half of the scale items, by averaging responses across items. Following prior research, an overall parental control score was calculated by averaging the maternal and paternal control scores (Rothrauff et al., 2009). The scale showed acceptable internal consistency reliability in this sample ($\alpha = 0.74$ for both the maternal and paternal scale). In prior work (Enns et al., 2002), greater paternal control measured with this scale was associated with lower risk of externalizing disorders in male children, which provided some evidence for construct validity.

2.2.1.3. Parenting style. Four parenting style typologies were created based on distinct constellations of parental warmth and control (Maccoby and Martin, 1983). As specific cut-points for these measures have not been validated, we followed common practice in epidemiologic studies of psychosocial characteristics (Kubzansky et al., 2014) and characterized individuals scoring in the top tertile of the distribution of scores on each subscale as being distinctively high in warmth and in control (Fig. S1). The authoritative style included participants scoring in the top tertile of both warmth and control (14.11%); the authoritarian style included respondents scoring in the bottom and middle tertiles of warmth but in the top tertile of control (18.07%); the permissive style included those scoring in the top tertile of warmth but in the bottom and middle tertiles of control (18.37%); and the uninvolved style included those in the bottom and middle tertiles of both warmth and control (49.45%). To evaluate the sensitivity of any associations to these particular cut-points, we also followed another categorization approach from prior literature (Rothrauff et al., 2009) by using a median split to define high versus low warmth or control (Fig. S2).

2.2.2. Dependent variable
2.2.2.1. Body weight. At both phases participants reported their height and weight, based on which body mass index (BMI, kg/m^2) was calculated. The self-reported BMI showed high concordance ($r = 0.92$) with BMI measured by clinicians or trained staffs in a subgroup who participated in a biomarker project at phase II ($N = 1255$, the subgroup was comparable to the full sample in terms of self-reported BMI and major demographic and health-related characteristics) (Dienberg Love et al., 2010). We calculated a BMI change score (used as a continuous variable) by subtracting BMI at phase I from BMI at phase II. To minimize influence of extreme outliers, the score was winsorized at the 1st and 99th percentile (i.e., respondents with a score < the 1st percentile or > the 99th percentile were assigned the value for the 1st and 99th percentile).

We standardized the BMI change score (mean = 0, standard deviation = 1) and used the standardized score as the dependent variable in all models, to facilitate comparison of effect estimates across studies in which BMI may follow a different distribution (Landis, 2005).

2.2.3. Covariates

2.2.3.1. Demographic factors.
Demographic covariates included participant age (in years), sex (male, female), and race (white, black, other races), all self-reported at phase I.

2.2.3.2. Childhood characteristics.
All childhood characteristics were recalled at phase I. Childhood SES was assessed with the highest educational attainment of parents (less than high school, high school, some college, college degree or higher) (Miller et al., 2011). Severe parental abuse was assessed using one question from the Conflict Tactics Inventory (Straus, 1979): "During your childhood, how often did your mother/father kicked, bit, or hit you with a fist or an object, beat you up, choked, burned or scalded you". Response options ranging from 1 (often) to 4 (never), and responses were coded so a higher score represented greater abuse. An overall parental abuse score was created by averaging the maternal and paternal abuse scores, and was used as a continuous variable (Savla et al., 2013). Two-parent family structure was assessed with a single question: "Did you live with both biological parents up until you were 16?" (yes, no). Childhood residential area was also queried (rural, small town, medium-sized town, suburbs, city, moved around). Childhood residential stability was assessed with a single question: "How many times during your childhood did you move to a totally new neighborhood or town?" Participants reporting < 3 residential moves were considered as having residential stability (Bures, 2003). Family religiousness was also queried: "How important was religion in your home when you were growing up?", with responses ranging from 1 (not at all important) to 4 (very important). The measure was used as a continuous variable.

2.2.3.3. Adulthood characteristics.
Adulthood covariates were assessed at phase I. Participants reported their current marital status (married, divorced/separate, widowed, never married) and their own educational attainment (less than high school, high school, some college, college degree or higher). Household income was also self-reported (in U.S. dollars, income greater than $300,000 was recoded as $300,000 to minimize risk of deductive disclosure), and quartiles of household income were created. Major depression (yes, no) over past year was assessed with the validated Composite International Diagnostic Interview Short Form (CIDI-SF) (Aalto-Setala et al., 2002; Kessler et al., 1998). Participants who reported ever having or taking medication for any of the following conditions were considered as having chronic physical health conditions (yes, no): cancer, heart attack, diabetes, and stroke.

2.3. Statistical analyses

All statistical analyses were performed in SAS 9.4 ($p < .05$ significance level, two-tailed). Chi-square tests and analysis of variance tests were used to examine distribution of participant characteristics by parenting styles.

Generalized estimating equation models (GEE) were used to examine the association between parenting styles and BMI change, adjusting for clustering by sibling status. The base model adjusted for age, sex and race. A second model further adjusted for childhood SES. The third model additionally accounted for a range of other childhood familial factors. We performed several sensitivity analyses. Because parenting styles were retrospectively reported in mid-life, to account for the possibility that adulthood factors might influence how parenting styles were recalled, we additionally adjusted for adulthood characteristics concurrently assessed with parenting styles. We also

reanalyzed the primary sets of models with parenting styles created using the median split to define high versus low levels of parental warmth and control.

Because results of the primary analyses suggested that the strongest differences were between parenting styles low in warmth (i.e., authoritarian, uninvolved style) and high in warmth (i.e., authoritative style), we performed a post-hoc analysis to explore whether effects of parenting styles were primarily driven by the dimension of parental warmth. Specifically, we reanalyzed the primary models first including parental warmth and then including parental control as the independent variable in separate models. We also conducted stratified analyses to consider effects of parental warmth within low, moderate, or high levels of parental control.

In the full analytic sample ($N = 3929$), 10 participants were missing data on parenting style, 301 were missing data on body weight at baseline or the follow-up, and another 261 were missing data on covariates. Complete-case analysis would result in a loss of 14.6% ($n = 572$) of the participants. We performed a multivariate normal multiple imputation procedure (number of imputed datasets = 5) to impute missing data on all variables, as it often provides more accurate estimates compared to other methods of handling missing data (Sterne et al., 2009). We also performed complete-case analysis as a sensitivity analysis.

3. Results

Participants were predominantly white (93.48%) and slightly higher percentage female (55.48%), with the mean baseline age of 47.39 years (SD = 12.43). The mean BMI increase was 1.24 kg/m^2 (SD = 3.14) over an average of 9-years of follow-up. Participants generally reported high levels of parental warmth (mean = 2.97, range: 1 to 4) and parental control (mean = 3.00, range: 1 to 4). Descriptive analyses suggested participants with authoritative parents were more likely to report a two-parent family structure, high family religiousness and residential stability in childhood, and were more likely to be married and have no depression in adulthood, compared to those raised by authoritarian and permissive parents (Table 1).

Compared to those raised by authoritative parents, participants with authoritarian parents were 16% higher in the standardized score of BMI increase ($\beta = 0.16$, 95% confidence interval [CI]: 0.05, 0.28), adjusting for age, sex and race (Table 2). Additionally adjusting for childhood SES ($\beta = 0.16$, 95% CI: 0.05, 0.28) and other childhood covariates ($\beta = 0.14$, 95% CI: 0.03, 0.26) did not change the association. Notably, the effect size of authoritative versus authoritarian parenting style was even larger than having the highest versus the lowest category of childhood family SES (i.e., parental education as college degree or higher versus less than high school). Moreover, the association remained robust in the sensitivity analysis that further considered adulthood characteristics. To a lesser extent, the uninvolved versus authoritative style was also associated with a greater BMI increase, but the association was somewhat attenuated in the fully-adjusted model. In comparison, there was no difference in the permissive versus authoritative style in any model. Sensitivity analyses using the median split to define high versus low levels of parental warmth and control yielded similar results (Table S2). Further, the complete-case analysis also yielded somewhat attenuated but largely similar results (Table S3).

When considering individual dimensions of parenting separately, parental warmth was associated with substantially less BMI increase over time (Table 3), whereas parental control was not associated with BMI change ($p > .05$ in all models, results not shown). However, the stratified analyses suggested that effects of parental warmth were evident only for individuals scoring in the top tertile of parental control (Table 3). Results of this post-hoc analysis were consistent with our primary analyses suggesting that the authoritative style was likely associated with healthier body weight, particularly as compared to the authoritarian style.

Table 1

Participant characteristics by parenting styles in childhood (The Midlife in the United States Study 1995/1996–2004/2005 questionnaire wave, $N = 3929$).

Participant characteristics	Full sample $N = 3929$	Parenting styles in childhood				p-Value
		Authoritative $N = 553$	Authoritarian $N = 708$	Permissive $N = 720$	Uninvolved $N = 1938$	
Baseline age, years, mean (SD)	47.39 (12.43)	47.44 (12.96)	46.88 (11.70)	48.38 (12.97)	46.93 (11.96)	0.04
Male, N (%)	1749 (44.52)	522 (47.07)	294 (38.43)	390 (45.94)	539 (45.07)	0.002
Race, N (%)						< 0.001
White	3673 (93.48)	1015 (91.52)	708 (92.55)	802 (94.46)	1140 (95.32)	
Black	148 (3.77)	68 (6.13)	30 (3.92)	24 (2.83)	24 (2.01)	
Others	108 (2.75)	26 (2.34)	27 (3.53)	23 (2.71)	32 (2.68)	
Childhood characteristics						
Highest parental education, N (%)						0.06
Less than high school	985 (25.79)	283 (26.37)	220 (29.45)	172 (21.16)	302 (25.95)	
High school	1377 (36.05)	379 (35.32)	260 (34.81)	310 (37.48)	427 (36.68)	
Some college	301 (15.73)	177 (16.50)	107 (14.32)	138 (16.69)	177 (15.21)	
College degree or higher	857 (22.43)	234 (21.81)	160 (21.42)	204 (24.67)	258 (22.16)	
Parental abuse score, mean (SD)	1.25 (0.55)	1.13 (0.39)	1.51 (0.75)	1.08 (0.28)	1.30 (0.58)	< 0.001
Lived with biological parents, N (%)	3174 (80.83)	969 (87.38)	605 (79.08)	694 (81.84)	897 (75.06)	< 0.001
Childhood residential area, N (%)						< 0.001
Rural	952 (24.55)	313 (28.58)	200 (26.42)	203 (24.08)	234 (19.91)	
Small town	1003 (25.86)	291 (26.58)	185 (24.44)	209 (24.79)	315 (26.81)	
Medium-sized town	458 (11.81)	123 (11.23)	75 (9.91)	97 (11.51)	163 (13.87)	
Suburbs	606 (15.63)	158 (14.43)	116 (15.32)	127 (15.07)	204 (17.36)	
City	697 (17.97)	173 (15.80)	135 (17.83)	169 (20.05)	218 (18.55)	
Moved around	162 (4.18)	37 (3.38)	46 (6.08)	38 (4.51)	41 (3.49)	
Residential stability, N (%)	2915 (74.84)	873 (79.15)	536 (70.71)	654 (77.58)	846 (71.51)	< 0.001
Family religiousness, N (%)						< 0.001
Religion not at all important	168 (4.28)	13 (1.17)	44 (5.75)	26 (3.07)	85 (7.12)	
Religion not very important	603 (15.37)	86 (7.77)	122 (15.95)	112 (13.21)	283 (23.70)	
Religion somewhat important	1380 (35.19)	327 (29.54)	266 (34.77)	317 (37.38)	467 (39.11)	
Religion very important	1771 (45.16)	681 (61.52)	333 (43.53)	393 (46.34)	359 (30.07)	
Adulthood characteristics						
Marital status, N (%)						< 0.001
Married	2814 (71.64)	854 (77.08)	532 (69.54)	597 (70.32)	826 (69.06)	
Divorced/separated	537 (13.67)	111 (10.02)	124 (16.21)	103 (12.13)	197 (16.47)	
Widowed	166 (4.23)	37 (3.34)	32 (4.18)	47 (5.54)	50 (4.18)	
Never married	411 (10.46)	106 (9.57)	77 (10.07)	102 (12.01)	123 (10.28)	
Educational attainment, N (%)						0.16
Less than high school	264 (6.72)	71 (6.40)	61 (7.97)	43 (5.06)	86 (7.19)	
High school	1099 (27.97)	320 (28.85)	209 (27.32)	234 (27.56)	331 (27.68)	
Some college	1145 (29.14)	323 (29.13)	224 (29.28)	231 (27.21)	366 (30.60)	
College degree or higher	1421 (36.17)	395 (35.62)	271 (35.42)	341 (40.16)	413 (34.53)	
Household income quartiles, N (%)						0.95
Bottom quartile ($0–$32,499)	931 (24.24)	254 (23.43)	180 (24.13)	192 (23.13)	298 (25.40)	
Second quartile ($32,500–$58,999)	986 (25.67)	280 (25.83)	194 (26.01)	208 (25.06)	303 (25.83)	
Third quartile ($59,000–$98,999)	965 (25.12)	269 (24.82)	191 (25.60)	213 (25.66)	292 (24.89)	
Top quartile ($99,000–$300,000 +)	959 (24.97)	281 (25.92)	181 (24.26)	217 (26.14)	280 (23.87)	
Major depression, N (%)	469 (11.94)	89 (8.03)	127 (16.60)	71 (8.36)	181 (15.13)	< 0.001
Any chronic health condition, N (%)	593 (15.09)	164 (14.79)	117 (15.29)	140 (16.49)	170 (14.21)	0.55

Note. Percentages refer to the proportion of individuals within each parenting style category with that characteristic. p comes from χ^2 or analysis of variance tests.

4. Discussion

This is the first longitudinal study suggesting that the authoritative parenting style may exert a protective effect on offspring body weight well into mid-life, particularly as compared to the authoritarian style and also possibly the uninvolved style. However, there was no difference between the authoritative and permissive style. The post-hoc analyses on individual dimensions of parenting also indicated that parental warmth may help offspring maintain healthy body weight, only when a high level of parental control was also present.

Findings of this study are consistent with prior work in younger populations which generally suggested that the authoritative parenting style was associated with healthier body weight in children and adolescents, as compared to other parenting styles (Sokol et al., 2017). This study expands prior literature by adding evidence that the protective effect of the authoritative style may persist into mid-life. Parental warmth may provide children with a sense of emotional security and self-worth. Such experiences could facilitate the formation of developmental assets such as social integration and self-regulation, which may

help increase resilience and reduce unhealthy coping strategies (e.g., binge eating) under stressful situations (Holmes, 2014). In addition, authoritative parents may also teach children healthy practices and set reasonable expectations on their behaviors. Some of these behavioral patterns including diet and exercise habits may persist into adulthood and affect one's weight trajectories (Kwon et al., 2015; Watts et al., 2018). However, effects may be tempered by influences occurring later in life. Thus, while parental influences set a developmental trajectory, social relationships developed in later life may redirect the course. For instance, as individuals transition to adolescence and adulthood, peers and partners may reshape one's behavioral perceptions and patterns (e.g., smoking, diet), and offset early parental influences (Scalici and Schulz, 2014).

Compared to the authoritative style, the elevated BMI increase associated with the authoritarian style was particularly pronounced, and this finding may be attributable to the synergistic effects of low parental warmth and high parental control. Although the dimension of parental control was not associated with BMI change in this middle-aged sample, prior studies have separately linked low parental warmth and excessive

Table 2

Parenting styles in childhood and BMI change in mid-life (The Midlife in the United States Study 1995/1996–2004/2005 questionnaire wave, *N* = 3929).

	Model 1 β (95% CI)	Model 2 β (95% CI)	Model 3 β (95% CI)	Model 4 β (95% CI)
Parenting styles (Authoritative as ref)				
Authoritarian style	0.16 (0.05, 0.28)**	0.16 (0.05, 0.28)**	0.14 (0.03, 0.26)*	0.12 (0.01, 0.23)*
Permissive style	0.06 (−0.06, 0.17)	0.06 (−0.05, 0.18)	0.07 (−0.05, 0.18)	0.06 (−0.06, 0.17)
Uninvolved style	0.11 (0.01, 0.20)*	0.11 (0.01, 0.20)*	0.10 (−0.00, 0.20)	0.08 (−0.02, 0.18)
Age (standardized)	−0.21 (−0.24, −0.18)***	−0.22 (−0.25, −0.19)***	−0.22 (−0.25, −0.19)***	−0.21 (−0.25, −0.17)***
Male (female as ref)	−0.09 (−0.15, −0.02)**	−0.09 (−0.15, −0.02)**	−0.09 (−0.16, −0.02)**	−0.07 (−0.13, −0.002)*
Race (White as ref)				
Black	0.14 (−0.06, 0.33)	0.12 (−0.08, 0.32)	0.11 (−0.09, 0.31)	−0.10 (−0.10, 0.30)
Others	0.08 (−0.15, 0.31)	0.09 (−0.14, 0.31)	0.08 (−0.15, 0.31)	0.05 (−0.17, 0.28)
Childhood characteristics				
Parental education (< high school as ref)				
High school		0.01 (−0.09, 0.10)	0.02 (−0.08, 0.12)	0.02 (−0.07, 0.12)
Some college		−0.01 (−0.11, 0.09)	0.00 (−0.10, 0.11)	0.02 (−0.08, 0.13)
College degree or higher		−0.14 (−0.24, −0.04)**	−0.11 (−0.22, −0.01)*	−0.08 (−0.18, 0.03)
Parental abuse score (standardized)			0.04 (0.00, 0.07)*	0.03 (−0.01, 0.06)
Lived with biological parents (no as ref)			0.02 (−0.06, 0.10)	0.04 (−0.05, 0.12)
Childhood residential area (rural as ref)				
Small town			−0.03 (−0.12, 0.06)	−0.03 (−0.12, 0.06)
Medium-sized town			−0.06 (−0.18, 0.05)	−0.07 (−0.19, 0.05)
Suburbs			−0.06 (−0.16, 0.05)	−0.07 (−0.17, 0.04)
City			−0.07 (−0.17, 0.03)	−0.08 (−0.18, 0.03)
Moved around			−0.15 (−0.35, 0.05)	−0.15 (−0.35, 0.05)
Childhood residential stability (no as ref)			−0.03 (−0.12, 0.05)	−0.04 (−0.12, 0.05)
Family religiousness (not at all as ref)				
Religion not very important			−0.16 (−0.35, 0.03)	−0.17 (−0.36, 0.02)
Religion somewhat important			−0.12 (−0.29, 0.05)	−0.12 (−0.29, 0.05)
Religion very important			−0.12 (−0.28, 0.05)	−0.11 (−0.27, 0.05)
Adulthood characteristics				
Marital status (married as ref)				
Divorced/separated				0.22 (0.12, 0.33)***
Widowed				0.17 (−0.01, 0.36)
Never married				0.13 (0.00, 0.25)*
Education attainment (< high school as ref)				
High school				0.05 (−0.10, 0.20)
Some college				−0.04 (−0.20, 0.12)
College degree or higher				−0.08 (−0.12, −0.05)
Household income (bottom quartile as ref)				
Second quartile				0.06 (−0.04, 0.15)
Third quartile				0.10 (0.00, 0.21)*
Top quartile				0.11 (0.01, 0.22)*
Major depression (no as ref)				0.16 (−0.28, −0.04)**
Any chronic health condition (no as ref)				−0.01 (−0.11, 0.09)

Note: Generalized estimating equations with normal distribution and identity link were used in all models to estimate the mean change in BMI (standardized score, mean = 0, standard deviation = 1) by parenting styles, adjusting for clustering by sibling status.

  * $p < .05$.

  ** $p < .01$.

  *** $p < .001$.

Table 3

Parental warmth in childhood and BMI change in mid-life, stratified by levels of parental control (The Midlife in the United States Study 1995/1996–2004/2005 questionnaire wave, *N* = 3929).

	Full sample β (95% CI)	Stratified by parental control		
		Bottom tertile β (95% CI)	Middle tertile β (95% CI)	Top tertile β (95% CI)
Model 1	−0.05 (−0.08, −0.02)**	−0.06 (−0.11, 0.00)	−0.01 (−0.07, 0.04)	−0.08 (−0.14, −0.02)**
Model 2	−0.05 (−0.08, −0.01)**	−0.05 (−0.11, 0.01)	−0.01 (−0.07, 0.05)	−0.08 (−0.14, −0.02)*
Model 3	−0.04 (−0.07, −0.003)*	−0.03 (−0.09, 0.04)	−0.01 (−0.07, 0.05)	−0.08 (−0.15, −0.01)*

Note: Generalized estimating equations with normal distribution and identity link were used in all models to estimate the mean change in BMI (standardized score) by change in parental warmth (standardized score, mean = 0, standard deviation = 1), adjusting for clustering by sibling status.

Model 1 adjusted for participant age, sex and race.

Model 2 additionally adjusted for childhood socioeconomic status (assessed by parental education).

Model 3 additionally adjusted for other childhood family environment factors (including parental abuse, whether lived with both biological parents, childhood residential area, childhood residential stability, and family religiousness).

  * $p < .05$.

  ** $p < .01$.

parental control with increased risk of childhood obesity (Gartstein et al., 2018; Larsen et al., 2015; Rhee et al., 2016). Low parental warmth may result in higher emotional distress and low self-efficacy, while high parental control may lead to lack of capacity for reasoning and self-regulation. Each of these sequelae could increase risk of adopting unhealthy weight-related behaviors to cope with distress (Larsen et al., 2015; Topham et al., 2011). Somewhat unexpectedly, evidence suggesting the uninvolved versus authoritative parental style was associated with higher offspring BMI increase was modest in this study. This might be due in part to participant characteristics specific to this sample, who generally reported high levels of parental warmth and control. The limited variation might attenuate our ability to detect effects of an uninvolved style, if any.

This study has several limitations. First, parenting style and other childhood characteristics were retrospectively reported in mid-life, which may be subject to recall bias. However, there has been evidence suggesting that concerns about retrospectively reported childhood experiences may not be as significant as previously thought (Patten et al., 2015). For instance, in prior work, childhood maltreatment experiences as recalled in adulthood showed high concordance with official records such as data from Child Protective Services and medical records, suggesting reasonable validity (Pinto et al., 2014; Shin et al., 2013). In addition, the longitudinal study design and sensitivity analyses adjusting for adulthood characteristics provide reassurance that the observed associations are not entirely due to bias. Second, although this study adjusted for a wide range of childhood characteristics, residual confounding is possible by other factors for which information was not available such as childhood health status and parental mental health. Due to the lack of temporal separation in the assessments of childhood parenting style and adulthood health-related characteristics, we did not perform a causal mediation analysis (VanderWeele, 2015), and as a result it remains unclear whether parenting styles may have a direct effect on offspring adulthood weight, or only indirectly through shaping children's later life experiences. Finally, MIDUS participants did not comprise a nationally representative sample (e.g., predominantly white), thus results of this study may not be generalizable to other populations. These limitations were, however, balanced by strengthens including the prospective study design, the large sample size with a 9-year follow-up, and the rigorous confounding control in this study.

The World Health Organization has called for parenting programs at the population level (World Health Organization, 2007, 2009), yet the progress on implementing large-scale parenting programs has been relatively slow (Chu et al., 2012). Such programs seek to improve general parenting styles (e.g., reducing coercive discipline practice) and specific parenting practices (e.g., improving skills in communicating about health), and have been linked to multiple better health and well-being outcomes in children including reduced risk of obesity (Gerards et al., 2012; Hubbs-Tait et al., 2016; Yap et al., 2016). This study further suggests that the beneficial effects of such programs, if any, on children's body weight may persist into mid-life, and helps strengthen the case for implementing parenting programs at the population level. Further research on parenting styles and the broader family environment can help inform more targeted interventions, and identify resources within the family that may be targeted for improving obesity prevention and control.

Conflict of interest disclosures

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2019.03.001.

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