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Childhood Abuse–Related Weight Gain: An Investigation of Potential Resilience Factors

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Abstract

Introduction: Childhood physical, sexual, and emotional abuse are linked to adult obesity, and little is known about what protective factors might mitigate this association.

Methods: Data from female (n=4,247) and male (n=1,982) participants in the longitudinal Growing Up Today cohort study from 1996 to 2013 were used to examine whether factors found to promote mental health resilience after abuse also operate as buffers (modifiers) of the abuse–weight status association. At age 20–25 years, participants were asked about their history of child abuse before age 18 years. Potential resilience factors (modifiers) included childhood family SES, neighborhood safety, supportive relationships with adult non-family members, quality of maternal relationship, family structure, religious service attendance, and prayer/meditation. Associations between child abuse and BMI at age 25–32 years were modeled using linear regression, adjusted

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for sociodemographic variables and baseline BMI. Potential modifiers were tested with interaction terms. Analyses were run in 2019–2020.

Results: Relative to no abuse, severe abuse was associated with 0.9 kg/m^2 (95% CI=0.5, 1.2) higher adult BMI, corresponding to a 46% increased risk of obesity (95% CI=1.28, 1.67). Less severe abuse was not significantly associated with BMI (β=0.1, 95% CI= −0.2, 0.4). There were no significant interactions between modifiers and abuse.

Conclusions: Factors previously found to promote resilience to mental health sequelae after abuse did not modify the association of severe child abuse with higher weight status.

INTRODUCTION

Physical, sexual, and emotional abuse in childhood are associated with significant adult mental and physical health problems,[1–5] including obesity, a leading cause of morbidity and mortality.[4,5] Yet, there is also growing evidence in the mental health literature of individuals' potential for resilience after abuse, defined as "good outcomes in spite of serious threats to adaptation or development."[6] However, an examination of the literature indicated that no published studies have examined resilience to obesity after child abuse.

Protective factors have been identified that appear to support mental health despite abuse.[7–9] Poor mental health may be an important part of the pathway from abuse to weight gain. Abuse may disrupt energy homeostasis through a variety of mental health–related behavioral and physiological effects on weight.[10] For example, abuse may interrupt development of affect regulation—that is, the ability to cope with distress—leading to obesogenic maladaptive coping behaviors[11–14] such as overeating of highly palatable (high-fat/high-sugar) foods.[15–17] Thus, factors that support positive mental health despite exposure to abuse may also protect against excessive weight gain.[11]

Resources found to support positive mental health after abuse include higher SES,[18] positive interpersonal supports,[18,19] neighborhood quality,[20] and practices such as prayer or meditation.[21,22] In one study of resilience to overweight and obesity in children exposed to adversity, positive contextual factors, such as neighborhood safety, attenuated the adversity–weight association.[23] However, this study did not include childhood abuse in its adversity measure. Thus, the aim of the current analysis is to identify factors that modify and buffer the association of childhood or adolescent physical, sexual, and emotional abuse with adult weight status. Given findings in the mental health literature, the following potential protective factors are examined: higher family social status, neighborhood safety, presence in child's life of a supportive non-family adult, child's reported quality of relationship with their mother, 2 biological parents in the home, living with extended family, religious service attendance, and prayer or meditation. It is hypothesized that there will be an interaction between each modifier and abuse such that the presence of the modifier will be associated with a reduced association between child abuse and adult weight status.

METHODS

Study Sample

The Growing Up Today Study (GUTS) cohort comprises children of participants in the longitudinal Nurses' Health Study II. In 1996, Nurses' Health Study II participants with children aged 9–14 years were asked to consent to their children's participation in GUTS; 18,526 (54%) consented, and their children (N=26,765) were invited to participate. Of these, 16,882 (*n*=9,039 who identified as female and *n*=7,843 who identified as male) returned the baseline GUTS questionnaire. GUTS participants were followed through online and mailed questionnaires annually or biennially from 1996 through 2007, in 2010, and in 2013. Child abuse was assessed retrospectively in the 2007 survey (age 20–25 years) and body weight was assessed in 2013 (age 25–32 years). Potential modifiers were primarily from surveys between 1996 and 1999, when participants were aged <18 years. However, 2 important interpersonal factors—participants' relationship with their mothers and retrospective reports of a supportive non-family adult during childhood—were available only in 2005 and 2007, respectively. Details on variables are provided in the Measures section.

Analyses included participants who completed the questionnaires on which the exposure and outcome were assessed (N=6,804; *n*=4,247 female and *n*=1,982 male participants). Participants missing abuse history (*n*=260 female and *n*=213 male participants, 7%) or body weight (*n*=55 female and *n*=47 male participants, 1%) were excluded, leaving an analytic sample of 6,229. In addition, modifier analyses included participants with non-missing data on the relevant modifier variable (*n*=5,222–6,229) (Appendix Table 1). Data analyses occurred in 2019–2020.

This study was approved by the IRB of Brigham and Women's Hospital and was exempted from review by the University of Minnesota IRB.

Measures

The 2007 GUTS survey assessed physical, sexual, and emotional abuse during childhood (age 0–10 years) and adolescence (age 11–17 years), which were combined to examine abuse prior to age 18 years. Coding of abuse variables followed that of previous studies of GUTS data.[24]

Physical abuse was assessed with 2 items from the Conflict Tactics Scales,[25] asking participants whether, in childhood or adolescence, an adult in their family: (1) pushed, grabbed, or shoved them or (2) kicked, punched, or hit them with something in a way that hurt their body, or physically attacked them in some other way. Physical abuse was categorized as none, less severe (pushed/shoved but not kicked/punched/physically attacked in either childhood or adolescence), or severe (kicked/punched/physically attacked in childhood or adolescence).

Sexual abuse was ascertained with questions by Finkelhor et al.[26] asking, during childhood or adolescence: (1) whether they were *touched in a sexual way by an adult or older child or were you forced to touch an adult or older child in a sexual way when you did not want to?* and (2) *did an adult or older child force you or attempt to force you into any sexual activity*

by threatening you, holding you down or hurting you in some way when you did not want to? Sexual abuse was categorized as none, sexual touching but no forced sexual activity in childhood or adolescence, and forced sexual activity in childhood or adolescence.

Emotional abuse was measured with 3 items from the Childhood Trauma Questionnaire,[27] asking participants how often, in childhood or adolescence, (5 points from *never* to *very often*) an adult in their family yelled and screamed at them, said hurtful or insulting things to them, or punished them in a way that seemed cruel. Responses were summed and categorized into 3 levels that mirrored the prevalence of less severe and more severe abuse observed in other cohorts[28,29]: no abuse (<75th percentile), less severe abuse (75th–90th percentile), and severe abusive (>90th percentile).

Timing of abuse (any versus none) was examined by creating a series of indicator variables for: no type of abuse in either childhood or adolescence; physical, sexual, or abuse in childhood only; physical, sexual, or emotional abuse in adolescence only; and physical, sexual, or emotional abuse in both time periods.

Following a previous analysis of female participants in this cohort,[24] a combined abuse variable was coded as: none (no physical, sexual, or emotional abuse in childhood or adolescence), less severe only (less severe physical abuse, sexual touching only, or less severe emotional abuse in childhood or adolescence, with no severe abuse), and severe (severe physical abuse, forced sex, or severe emotional abuse in childhood or adolescence).

Participant BMI in kilograms divided by meters squared (kg/m^2) was based on self-reported weight and height in 2013 (age 25–32 years). Self-reported weight has been shown to have good validity in adolescents and young adults.[30,31]

In 1999 (age 12–17 years) and 2001 (age 14–19 years), participants were asked where their family's social status ranked relative to others in the U.S. (range=0–10, with lower numbers corresponding to higher status, described as *at the top of the ladder are the people who are best off—they have the most money, the highest amount of schooling, and the jobs that bring the most respect*). The average of responses at these 2 timepoints was taken. The continuous measure was used for tests of interaction, and dichotomized at the sex-specific median for stratified analyses.

Participants were asked to respond to the statement: *It's not safe enough in my neighborhood to get out and get some exercise*, at 3 time points: 1997 (age 10–15 years), 1998 (age 11–16 years), and 1999 (age 12–17 years). Response options were *always safe*, *usually safe*, *usually unsafe*, or *really unsafe*. The average of responses over these 3 reports was taken and treated as a continuous variable in interaction analyses. For stratified analyses, responses were dichotomized into *always safe* versus all other responses.

At age 20–25 years (2007), participants were asked: *In childhood (before age 11)/in adolescence (age 11–17) how often did an adult who was NOT in your family make you feel that you were important or special?* Responses options were *never*, *rarely*, *sometimes*, *often*, or *very often*.[26] The original ordinal variable was used to test interactions, and was dichotomized at *often* or *very often* for stratified analyses.

At age 18–23 years (2005), participants were asked to rate (*strongly disagree* to *strongly agree*) how satisfied they were with their mother's: (1) love and affection, (2) emotional support, (3) sharing things in common with participant, (4) time spent with participant, (5) ability to resolve conflicts, (6) respect for participant, (7) time for fun with participant, (8) communication, and (9) general relationship. Scores were summed and the total was treated as continuous for interaction analyses and dichotomized at the sex-specific median for stratified analyses.

The 1999 questionnaire (age 12–17 years) asked participants to report the frequency (*never*, *less than once a month*, *1–3 times a month*, *once a week*, *more than once a week*) with which they attended religious services. Responses were dichotomized into regular attenders (responses of weekly or more) or irregular/non-attenders.

The 1999 questionnaire (age 12–17 years) asked participants to report the frequency (*never*, *less than once a week*, *1–6 times a week*, *once a day or more*) with which they practiced prayer or meditation. Responses were dichotomized into regular prayer/meditation (responses of weekly or more) or irregular/no prayer/meditation.

In 1996 (age 9–14 years), participants were asked: *Which adults do you live with most of the time?* Response options (of which respondent could chose multiple) were: *mother*, *father*, *stepmother*, *stepfather*, *grandmother*, *grandfather*, *other relative*, and *other adults*. Family structure was categorized as "both parents" (participant indicated living with mother and father most of the time) versus other family arrangements. A separate variable was created to represent extended family or adults other than parents in the household. Respondents living with a grandmother, grandfather, other relative, or other adults were designated as living with extended family.

Age in years at 1996 baseline and non-White race were included in sociodemographic adjusted models as potential common correlates of abuse and BMI. Perceived social status was included as a covariate in analyses where it was not being examined as a predictor or modifier. Because children with higher weight status may be more vulnerable to abuse, and are also at greater risk for heavier adult weight,[32] BMI percentile at baseline (participant's baseline BMI standardized to Centers for Disease Control and Prevention growth data) was included as an adjustment.[33] However, because some abuse-related weight gain may have occurred prior to study baseline (age 9–14 years), parameters controlling for baseline BMI may be over-adjusted; thus, sociodemographic-adjusted and baseline BMI–adjusted results are presented separately.

Statistical Analysis

The following approach was taken to identify what modifiers might buffer abuse-related weight gain. First, the overall associations of abuse with BMI were estimated. Second, the association of each hypothesized protective factor with BMI was estimated. Finally, interactions between abuse and modifiers found to predict BMI were tested; continuous or ordinal versions of the modifiers were used where possible. Models stratified by each dichotomized modifier were also run for assessment of patterns across strata of modifiers.

For the first step, linear models regressed BMI at age 25–32 years on: (1) each type of abuse separately, categorized by severity; (2) abuse by timing (childhood, adolescence, or both); and (3) combined abuse (no abuse, less severe abuse only, more severe abuse). Crude models were run first, then sociodemographics (age, race, and perceived social status) were added, and then baseline BMI was added. Adjusted models were then run adding all potential protective factors; models examining different types of abuse also mutually adjusted for the other abuse types.

Robust SEs were used to adjust for correlation between siblings (approximately 15% of those in the analytic sample also had a sibling in the sample), which were retained in the sample because their presence did not change results. Two supplemental analyses were run: Modified Poisson models were used to estimate the association of abuse with obesity, and sex **X** abuse interactions were tested and found non-significant. Thus, results are presented for male and female participants combined.

RESULTS

Of 6,229 individuals included in the analytic sample, 1,554 (24.9%) experienced less severe abuse and 1,237 (19.8%) experienced severe abuse prior to age 18 years. The sample had an average BMI of 25.3 at age 25–32 years (Table 1), and 14.6% had obesity.

After adjustment for sociodemographic variables and baseline BMI, those with less severe abuse had a similar BMI to those without abuse (β=0.1 kg/m^2, 95% CI= −0.2, 0.4). Those with severe abuse had a 0.9 kg/m^2 (95% CI=0.5, 1.2) higher BMI relative to those with no abuse (Table 2); this BMI difference translated into a risk ratio for obesity of 1.46 (95% CI=1.28, 1.67). Emotional abuse had the strongest association with BMI (less severe: β=0.8, 95% CI=0.5, 1.2; more severe: β=1.1, 95% CI=0.7, 1.6), and the only association that was maintained after mutual adjustment for all abuse types. Neither sexual nor physical abuse was related to BMI after adjustment for emotional abuse (Table 2). Abuse examined by timing (childhood versus adolescence versus both) showed that only those who experienced abuse in both childhood and adolescence (n=1,871) had an elevated BMI in adulthood (β=0.8, 95% CI=0.5, 1.1) (Table 2).

Table 3 shows the association of each hypothesized modifier with BMI. After adjustment, individuals with higher social status and presence of a supportive non-family adult had an approximately 0.5 kg/m^2 lower BMI than those without (higher social status: 95% CI= −0.8, −0.3; supportive non-family adult: 95% CI= −0.9, −0.3). Extended family in the home was associated with an approximately 0.8 kg/m^2 higher BMI. Those who reported a more positive relationship with their mothers had a slightly lower BMI (−0.3, 95% CI= −0.5, −0.1) than those who reported a less positive relationship. Neighborhood safety, religious service attendance, prayer/meditation, and family structure showed null associations with BMI and were not pursued further as modifiers.

There were no statistically significant interactions of modifiers with abuse in predicting BMI (Table 4). Consistent with interaction findings, stratified analyses showed mostly similar abuse–BMI estimates in those with and without each modifier, with some minor exceptions.

For example, among those with no supportive non-family adult, there was a 1.0 kg/m^2 (95% CI=0.4, 1.6) greater BMI associated with abuse, versus 0.6 kg/m^2 (95% CI=0.2, 1.0) among those with a supportive relationship.

DISCUSSION

In this cohort, exposure to severe childhood/adolescent abuse was associated with greater adult body weight and obesity risk. Notably, emotional abuse appeared to have the strongest association with BMI, whereas sexual abuse was not found to have an association. Once adjusted for emotional abuse, physical abuse associations were also close to the null. Prior results in this cohort have found sexual abuse to be modestly associated with BMI among female participants.[24] Thus, the null finding is likely due to the inclusion of male participants. Prior findings have also found emotional abuse to be the type of abuse most strongly related to BMI. Several protective factors were found to be associated with reduced BMI in adulthood. None of these factors significantly attenuated the average weight gain associated with abuse.

There is limited literature with which to compare these findings. One study[23] examined resilience to overweight associated with adverse family experiences, finding a modest attenuation of the adversity–weight status association when certain protective factors (e.g., neighborhood safety) were present. However, interactions were not significant. Findings of the present study are similar, with qualitative comparisons across stratified models suggesting a slight attenuation with the presence of certain protective factors, but no significant interaction detected. Numerous researchers have found a range of factors that appear to protect mental health after abuse.[9,18–22,34–36] Results here indicate that similar factors may not improve weight outcomes in survivors of child abuse.

Strengths of this study include a large community-based cohort with substantial numbers of both male and female participants. With >15 years of follow-up starting in childhood, numerous potential resilience factors were measured and available for investigation. Finally, the longitudinal design allowed for clarity about the temporal order of childhood abuse and BMI, with adjustment for BMI in childhood to account for reverse causation.

Limitations

Several limitations of this study warrant attention. First, most of the potential modifiers were assessed at a single point in time via self-report, which may have prevented detection of a modifying effect. Nevertheless, these variables were almost all associated with BMI in the expected direction, suggesting they captured the domains of interest. Second, abuse during childhood and adolescence was retrospectively self-reported, with the potential for recall and social desirability biases. Although retrospective reports are potentially problematic,[37] given the challenges of prospective assessment[38] and known biases in official reports,[39,40] retrospective self-reports are currently the standard in large epidemiologic studies[41–43] and have been found to be similarly associated with obesity as prospectively assessed or objectively confirmed abuse.[4] Third, BMI was also self-reported. Correlations between self-reported and measured BMI are very high,[31] thus errors in self-report are unlikely to

substantially impact results. Finally, the GUTS sample is largely White and consists of children of nurses, limiting generalizability of the results.

CONCLUSIONS

Abuse in childhood, particularly emotional abuse, appears to predict later life weight gain. Factors found to foster resilience to abuse-related mental health detriments were not found to have a buffering impact on weight gain. Continued investigations of ways to mitigate the negative health effects of abuse are critically needed, including investigation of potentially modifiable mediators such as depressive symptoms and disordered eating. Further, prevention of child abuse itself must remain a central public health priority.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Distribution of Analysis Variables Across Abuse Categories in the Growing Up Today Study (N=6,229)

Variable	Child or adolescent abuse		
	None (n=3,438)	Less severe only[a] (n=1,554)	More severe[b] (n=1,237)
	Mean (SD) or %	Mean (SD) or %	Mean (SD) or %
Female	66.2%	58.6%	63.8%
Nonwhite	2.8%	2.5%	4.4%
Age in 1996 (baseline), years	11.5 (1.6)	11.5 (1.6)	11.5 (1.6)
Age in 2013, years	27.8 (1.7)	27.8 (1.7)	27.8 (1.7)
BMI percentile in 1996 (baseline)	55.0 (29.2)	54.8 (29.6)	57.2 (30.3)
BMI in 2013 (kg/m^2)	25.0 (5.1)	25.3 (5.3)	26.1 (6.0)
Perceived social status (range 1 to 10, with 1 being highest status)	3.7 (1.1)	3.9(1.2)	4.0(1.2)
Quality of relationship with mom (range 1 to 5, higher=better relationship)	3.4 (0.7)	3.2 (0.8)	2.8 (1.0)
Important non-family adult	72.0%	65.8%	55.4%
Neighborhood always safe	91.3%	88.4%	85.3%
Participant lives with both parents most of the time	91.4%	88.7%	82.5%
Participant lives with extended family or other adults	3.0%	3.3%	4.9%
Attends religious services weekly	59.3%	56.6%	52.8%
Prays or meditates weekly	66.9%	63.7%	60.1%

[a] 1+ type of less severe abuse (physical: pushed/grabbed/shoved; sexual: non-consensual touching; emotional: 75th percentile—<90th percentile score); no severe abuse.

[b] 1+ type of severe abuse (physical: kicked/punched/hit; sexual: forced sex; emotional: ≥90th percentile score).

Table 2.

Linear Regression Results of BMI at Age 25–32 Years as a Function of Type and Timing of Abuse Exposure in Childhood (Age 0–10 Years) and/or Adolescence (Age 11–17 Years) in the Growing Up Today Study (N=6,229)

Abuse categorization	N	Mean BMI	Sociodemographic-adjusted [b] β[a] (95% CI)	Additionally adjusted for baseline BMI[b] β[a] (95% CI)	Mutually adjusted for protective factors and abuse types[c] β[a] (95% CI)
Combined					
None	3,438	25	0 (ref)	0 (ref)	0 (ref)
Less severe only[d]	1,554	25.2	0.2 (−0.2, 0.5)	0.1 (−0.2, 0.4)	0.1 (−0.3, 0.4)
More severe[e]	1,237	26.1	1 (0.6, 1.4)	0.9 (0.5, 1.2)	0.7 (0.3, 1.1)
Physical					
None	4,157	25.1	0 (ref)	0 (ref)	0 (ref)
Less severe (pushed, grabbed, shoved)	1,375	25.3	0.2 (−0.2, 0.5)	0.3 (0.0, 0.5)	−0.1 (−0.4, 0.3)
More severe (kicked, punched, hit)	730	26.3	1.2 (0.7, 1.7)	1.1 (0.6, 1.5)	0.2 (−0.4, 0.7)
Sexual					
None	5,651	25.3	0 (ref)	0 (ref)	0 (ref)
Less severe (non-consensual touching)	429	25.3	0.1 (−0.5, 0.6)	0.0 (−0.5, 0.5)	−0.3 (−0.8, 0.3)
More severe (forced sex)	304	25.6	0.3 (−0.4, 1.0)	0.3 (−0.3, 0.9)	0.0 (−0.6, 0.6)
Emotional					
None	4,811	25	0 (ref)	0 (ref)	0 (ref)
Less severe (75th−<90th percentile)	843	25.9	1 (0.6, 1.4)	0.8 (0.5, 1.2)	0.7 (0.3, 1.2)
More severe (≥90th percentile)	671	26.5	1.6 (1.0, 2.1)	1.1 (0.7, 1.6)	1.0 (0.4, 1.6)
Any vs none in childhood and/or adolescence					
No abuse in childhood or adolescence	2,914	24.9	0 (ref)	0 (ref)	0 (ref)
Abuse in childhood only	986	25.2	0.1 (−0.3, 0.5)	0 (−0.3, 0.4)	0.1 (−0.3, 0.4)
Abuse in adolescence only	443	25	0 (−0.6, 0.6)	0.1 (−0.4, 0.5)	0.0 (−0.6, 0.5)
Abuse in childhood and adolescence	1,871	25.9	0.9 (0.6, 1.2)	0.8 (0.5, 1.1)	0.7 (0.3, 1.0)

[a] Difference between BMI at age 25–32 years compared to those with no abuse.

[b] Adjusted for baseline age, non-White race, and perceived SES in adolescence.

[c] Adjusted for baseline age, non-White race, and perceived SES in adolescence, baseline BMI, quality of maternal relationship, presence of supportive non-family adult, neighborhood safety, living with both parents, living with extended family, religious service attendance, prayer/meditation; models of individual abuse types (physical, sexual, emotional) are mutually adjusted for other types.

[d] 1+ type of less severe abuse (physical: pushed/grabbed/shoved; sexual: non-consensual touching; emotional: 75th percentile—<90th percentile score); no severe abuse.

[e] 1+ type of severe abuse (physical: kicked/punched/hit; sexual: forced sex; emotional: ≥90th percentile score).

Table 3.

Linear Regression Results of BMI at Age 25–32 Years as a Function of Hypothesized Protective Factors in Childhood (Ages 0–18 Years) in the Growing Up Today Study (N=6,229)

Hypothesized protective factor	N	Mean BMI	Crude β[a] (95% CI)	Model Sociodemographic-adjusted[b] β[a] (95% CI)	Additionally adjusted for baseline BMI[b] β[a] (95% CI)
Social status					
Lower	3,035	25.7	0 (ref)	0 (ref)	0 (ref)
Higher	3,194	24.9	−0.8 (−1.0, −0.5)	−0.8 (−1.0, −0.5)	−0.5 (−0.8, −0.3)
Neighborhood safety					
Not always safe	2,070	25.5	0 (ref)	0 (ref)	0 (ref)
Always safe	3,914	25.2	−0.3 (−0.6, 0.0)	−0.3 (−0.7, 0.0)	−0.2 (−0.5, 0.1)
Adult outside the family made participant feel important or special					
Never, rarely, sometimes	1,924	25.7	0 (ref)	0 (ref)	0 (ref)
Often or very often	4,305	25.0	−0.7 (−1.0, −0.4)	−0.6 (−0.9, −0.3)	−0.6 (−0.9, −0.3)
Relationship with mother					
Less positive	3,037	25.4	0 (ref)	0 (ref)	0 (ref)
More positive	2,799	25.2	−0.2 (−0.5, 0.1)	−0.2 (−0.5, 0.1)	−0.3 (−0.5, −0.01)
Religious service attendance					
Less than weekly	2,225	25.2	0 (ref)	0 (ref)	0 (ref)
Weekly or more	3,004	25.3	0.1 (−0.2, 0.4)	0.1 (−0.2, 0.4)	0.2 (0.0, 0.5)
Prayer/meditation					
Less than weekly	1,817	25.4	0 (ref)	0 (ref)	0 (ref)
Weekly or more	3,424	25.2	−0.2 (−0.6, 0.0)	−0.2 (−0.5, 0.1)	0.0 (−0.2, 0.3)
Family structure					
As child, lived with single parent or step parents	653	25.7	0 (ref)	0 (ref)	0 (ref)
As child, lived with both parents	5,576	25.2	−0.5 (−1.0, −0.1)	−0.4 (−0.8, 0.1)	−0.1 (−0.5, 0.3)
Extended family					
No extended family	6,024	25.2	0 (ref)	0 (ref)	0 (ref)
Extended family	205	26.4	1.2 (0.4, 2.0)	1.1 (0.3, 1.9)	0.8 (0.1, 1.5)

[a] Difference between BMI at age 25–32 years compared to those with no abuse.

[b] Adjusted for baseline age, non-White race, and perceived social status in adolescence (perceived social status not adjusted in models examining social status as a predictor).

Table 4.

BMI at Age 25–32 Years as a Function of Abuse Exposure (None, Less Severe[a], More Severe[b]) in Childhood or Adolescence (Age <18 Years) Across Levels of Hypothesized Modifiers (N=6,229[c])

Abuse exposure	N	Mean BMI	P interaction	Crude β[d] (95% CI)	Model Sociodemographic-adjusted[e] β[d] (95% CI)	Additionally adjusted for baseline BMI[e] β[d] (95% CI)
Unstratified / overall model			–			
None	3,438	25.0		0 (ref)	0 (ref)	0 (ref)
Less severe	1,554	25.2		0.2 (−0.1, 0.5)	0.2 (−0.2, 0.5)	0.1 (−0.2, 0.4)
More severe	1,237	26.1		1.0 (0.7, 1.4)	1.0 (0.6, 1.4)	0.9 (0.5, 1.2)
Social status			0.60			
Higher						
None	1,889	24.7		0 (ref)	0 (ref)	0 (ref)
Less severe	745	25.0		0.2 (−0.2, 0.7)	0.2 (−0.2, 0.6)	0.2 (−0.2, 0.6)
More severe	560	25.4		0.7 (0.2, 1.2)	0.6 (0.1, 1.1)	0.6 (0.2, 1.0)
Lower						
None	1,549	25.4		0 (ref)	0 (ref)	0 (ref)
Less severe	809	25.5		0.1 (−0.4, 0.6)	0.2 (−0.3, 0.6)	0.1 (−0.3, 0.5)
More severe	677	26.6		1.3 (0.7, 1.8)	1.3 (0.7, 1.8)	1.0 (0.6, 1.5)
Adult outside the family made participant feel important/ special			0.10			
Often or very often						
None	2,536	24.9		0 (ref)	0 (ref)	0 (ref)
Less severe	1,051	25.1		0.2 (−0.1, 0.6)	0.1 (−0.2, 0.5)	0.2 (−0.2, 0.5)
More severe	718	25.6		0.7 (0.2, 1.1)	0.7 (0.2, 1.2)	0.6 (0.2, 1.0)
Never, rarely, sometimes						
None	902	25.4		0 (ref)	0 (ref)	0 (ref)
Less severe	503	25.5		0.1 (−0.5, 0.7)	0.1 (−0.6, 0.7)	−0.1 (−0.6, 0.5)
More severe	519	26.8		1.4 (0.7, 2.0)	1.3 (0.6, 2.0)	1.0 (0.4, 1.6)
Relationship with mother			0.66			
More positive						
None	1,836	24.9		0 (ref)	0 (ref)	0 (ref)
Less severe	593	25.4		0.5 (0.0, 1.0)	0.4 (−0.1, 0.9)	0.3 (−0.1, 0.7)
More severe	370	26.3		1.4 (0.7, 2.0)	1.2 (0.6, 1.9)	0.9 (0.4, 1.5)

Abuse exposure	N	Mean BMI	P interaction	Crude β[d] (95% CI)	Model Sociodemographic-adjusted[e] β[d] (95% CI)	Additionally adjusted for baseline BMI[e] β[d] (95% CI)
Less positive						
None	1,407	25.2		0 (ref)	0 (ref)	0 (ref)
Less severe	858	25.2		−0.1 (−0.5, 0.4)	−0.1 (−0.6, 0.3)	−0.0 (−0.5, 0.3)
More severe	772	26.0		0.7 (0.2, 1.3)	0.7 (0.2, 1.3)	0.7 (0.2, 1.1)
Extended family			0.26			
Extended family						
None	97	26.9		0 (ref)	0 (ref)	0 (ref)
Less severe	48	26.4		−0.6 (−2.4, 1.3)	−0.2 (−2.1, 1.8)	0.2 (−1.6, 1.9)
More severe	60	26.5		−0.4 (−2.5, 1.7)	−0.2 (−2.4, 1.9)	0.7 (−1.2, 2.6)
No extended family						
None	3,341	25.0		0 (ref)	0 (ref)	0 (ref)
Less severe	1,506	25.2		0.2 (−0.1, 0.6)	0.2 (−0.2, 0.5)	0.1 (−0.2, 0.4)
More severe	1,177	26.1		1.1 (0.7, 1.5)	1.0 (0.6, 1.4)	0.9 (0.5, 1.2)

[a] 1+ type of less severe abuse (physical: pushed/grabbed/shoved; sexual: non-consensual touching; emotional: 75th percentile—<90th percentile score); no severe abuse.

[b] 1+ type of severe abuse (physical: kicked/punched/hit; sexual: forced sex; emotional: ≥90th percentile score).

[c] Sample sizes for stratified models may differ due to missingness of individual modifier data.

[d] Difference between BMI at age 25–32 years compared to those with no abuse.

[e] Adjusted for baseline age, non-race, and perceived social status in adolescence (perceived social status not adjusted in models examining social status as a modifier).