ORIGINAL RESEARCH

Intergenerational Pathways Between Parental Experiences of Adverse Childhood Experiences (ACEs) and Child Weight: Implications for Intervention

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Background/Objective: **Prior research suggests an association between parental experiencing of 1 or more adverse childhood experiences (ACEs) and increased risk for overweight/obesity in children. However, the pathways through which parental experiences of ACEs lead to child weight are unclear.**

Methods: **Participants were parent and child dyads from racially/ethnically diverse and low-income households in Minneapolis and St. Paul, Minnesota, in 2015. Parents completed an online survey regarding their own adverse experiences in childhood, their height and weight, parenting practices, and mental health. Child height and weight were obtained from electronic medical records. Structural equation modeling was used to examine the extent to which parent mental health and parenting practices mediate associations between parental ACEs and child body mass index (BMI) percentile.**

Results: **The parent mental health pathway was statistically significant in explaining the intergenerational transmission of parental ACEs to child weight. Parent ACEs were positively associated with low parent mental health, parent low mental health was correlated with higher parent BMI > 25, and parent overweight was positively related to higher child BMI percentile.**

Conclusions: **Study findings suggest that intervening on parent low mental health may be a key factor in reducing the intergenerational transmission between parental ACEs and child weight. (J Am Board Fam Med 2023;36:39–50.)**

Keywords: **Adverse Childhood Experiences, Body Mass Index, Childhood Obesity, Mental Health, Minnesota, Parenting, Structural Equation Modeling**

Introduction

Adverse childhood experiences (ACEs) are psychosocial stressors and traumatic events occurring before the age of 18, such as (1) physical abuse, sexual abuse, or neglect; (2) parental mental illness, substance abuse, or incarceration; (3) exposure to domestic violence or crime; and (4) divorce or household dysfunction.[1–3] Prior research shows intergenerational associations between parental experience of ACEs and negative health outcomes in their children.[4–7] For example, studies have shown associations between parental experience of 1 or more ACEs and increased risk for overweight/obesity, cardiovascular disease, asthma, and poor overall health among their children.[4,5,8–11] However, the pathway(s) by which

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intergenerational transmission occurs between parental ACEs and child weight is unknown. It is likely that parental ACEs are linked to child weight through several factors (eg, behavioral, psychological, biological)[5,6,8,12] that co-occur simultaneously, such as parent feeding practices,[13–19] parent physical activity (PA) practices,[19–21] parental weight,[7,8,22,23] and parental mental health.[24–26] To guide intervention development in minimizing the influence of parental ACEs on child weight, factors contributing to these associations need to be identified.

One potential pathway influencing intergenerational transmission between parental ACEs and child weight is a parenting practices pathway. For example, parental ACEs may shape food parenting practices (eg, restriction, pressure-to-eat, controlling feeding practices) or PA parenting practices (eg, low encouragement/support for engaging in PA) that could lead to child unhealthful eating or lower levels of PA, resulting in higher child weight status.[13,27,28] An additional pathway to explore is a parental mental health pathway. Specifically, parents' mental health and weight status may influence the relationship between parental ACEs and childhood health, given prior research showing associations between parental weight and depression and associations with child overweight/obesity status, unhealthy diet quality, and lower levels of PA.[7,8,22–26,29,30]

It is also important to understand how the relationship between parental ACEs and child weight may be experienced by children from diverse racial/ethnic groups. Prior studies investigating intergenerational transmission of ACEs have been limited by having samples that are less diverse and not inclusive of families from immigrant/refugee backgrounds.[5] Given diverse populations have been shown to have higher prevalence of ACEs[4,5,31] and that children from minoritized race/ethnicities may be at higher risk for obesity,[32–35] it is critical to include diverse samples.[19]

Family systems theory (FST)[36,37] supports our study research question, hypothesis, and analysis. FST posits that traumatic experiences in childhood can result in maladaptive patterns that are transmitted to the next generation. In the case of ACEs, parents who experience trauma as children may be more likely to internalize these experiences, resulting in mental health problems that then may influence their regulation of eating and potentially lead to overeating and overweight status in adulthood. Parental modeling of overeating may then be transmitted to their children, who also overeat and then have increases in their body mass index (BMI) percentile. Furthermore, a parent's ability to engage in self-care from potential mental health problems resulting from exposure to ACEs may negatively influence such parenting practices as modeling healthy eating, engaging in healthy feeding practices, doing PA, and encouraging these behaviors in children. These patterns are then transmitted from 1 generation to the next unless these intergenerational patterns are intentionally interrupted.

The main aim of the current study was to investigate key pathways by which intergenerational transmission of parental experiences of ACEs contributes to higher child BMI percentile in diverse children. The 2 pathways being tested include a parenting practices pathway and a parent mental health pathway. Our overall hypothesis is that parental mental health and parenting practices are key factors that will explain the intergenerational association between parental ACEs and child weight. Identifying pathways explaining the association between parental experience of ACEs and child weight will inform the development of interventions that can target these pathways to reduce the risk of child overweight and obesity.

Methods

Family Matters[38] is an incremental, mixed-methods study examining risk and protective factors for weight and weight-related disparities in children from diverse backgrounds and low-income households. Family Matters has 2 phases, including (1) phase I, a cross-sectional, mixed-methods investigation of the home environment of low-income and racially/ethnically diverse families (n = 150) with a 5- to 7-year-old child, and (2) phase II, a longitudinal cohort study of low-income and racially/ethnically diverse families (n = 1307) with a 5- to 9-year-old child. Racially/ethnically diverse families were intentionally enrolled in the study because often families from racially/ethnically diverse backgrounds are underrepresented in research, and we wanted to ensure representation across all family backgrounds to increase the likelihood of generalizability of findings. Demographics of the Family Matters sample are presented in Table 1.

Phase I included mixed-methods data collection (ie, dietary recalls, accelerometry, home food

Table 1. Family Matters Sample Demographic Characteristics and Parent Adverse Childhood Events Frequency

Parent and child participant characteristics	(n = 1307)* n (%)
Child female	637 (49%)
Child age in years (sd)	7.0 (1.5)
Child race/ethnicity	
White	234 (18%)
Black or African American	334 (26%)
Hispanic or Latino	177 (14%)
Asian American	220 (17%)
Native Hawaiian or other Pacific Islander	10 (1%)
American Indian or Native American	116 (9%)
Other	16 (1%)
Multiracial	200 (15%)
Parent female	1171 (90%)
Age in years (sd)	35.7 (7.9)
Parent born in the U.S.	859 (66%)
Parent immigrant time living in the U.S.	
Less than 1 year	8 (2%)
1 to less than 5 years	52 (12%)
5–10 years	51 (11%)
10+ years	336 (75%)
Parent race/ethnicity	
White	272 (21%)
Black or African American	340 (26%)
Hispanic or Latino	186 (14%)
Asian American	223 (17%)
Native Hawaiian or other Pacific Islander	10 (1%)
American Indian or Native American	154 (12%)
Other race/ethnicity	19 (1%)
Multiracial	103 (8%)
Parent survey language	
English	1148 (88%)
Spanish	134 (10%)
Hmong/Lus Hmoob	8 (1%)
Somali/Soomaali	17 (1%)
Parent educational attainment	
Some high school	183 (14%)
High school or associate's	521 (40%)
Some college or bachelor's	409 (31%)
Graduate degree	194 (15%)
Household income	
Less than $20,000	393 (30%)
$20,000–$34,999	323 (25%)
$35,000–$49,999	203 (16%)
$50,000–$74,999	143 (11%)
$75,000–$99,999	75 (6%)
$100,000 or more	159 (12%)
Not reported	11 (1%)
Were your parents ever separated or divorced?	533 (41.3%)
Was a household member depressed or mentally ill, or did a household member attempt suicide?	306 (23.7%)
Did a household member go to prison (including yourself)?	168 (13%)
Did you often or very often feel that you didn't have enough to eat, had to wear dirty clothes, and had no one to protect you?	163 (12.7%)
Did you often or very often feel that your family didn't look out for each other, feel close to each other, or support each other?	264 (20.5%)
Did you often or very often feel that your parents were too drunk or high to take care of you?	143 (11.1%)
Was your mother or stepmother often or very often pushed, grabbed, slapped, or had something thrown at her?	142 (11%)
Did a parent or other adult in the household often or very often swear at you, insult you, put you down, or humiliate you?	218 (16.9%)
Were you physically abused by a parent or guardian?	145 (11.2%)
Were you sexually abused by a parent or guardian?	47 (3.6%)
Were you sexually abused by someone who was not a parent or guardian?	191 (14.9%)

Note: the 1307 sample is from the Minneapolis and St. Paul, MN, area and was collected between 2015 and 2017.
*Frequency proportions may not add to 100% due to rounding.

inventory, built environment block audit, video-recorded family task, ecological momentary assessment [EMA], parent interview). More details about phase I are published elsewhere.[14,15,35,38–40] Phase II included both an online survey with the full 1307 sample and EMA with a subsample of 631 parents. The current study includes data only from the 1307 sample who took the online survey at baseline. All study materials (eg, consent forms, survey questions) were translated into Hmong, Somali, and Spanish. Translation was conducted by bilingual and bicultural staff members. All study protocols were approved by the Institutional Review Board at the University of Minnesota (1107S02666).

Recruitment

Parent/child dyads were recruited for phase II from primary care clinics in Minneapolis/St. Paul in 2015. The clinics identified 5- to 9-year-old children who had recently had a well-child visit with a

recent height and weight measurement. A recruitment letter was sent from the primary care clinic inviting the family to participate in the Family Matters study. Families who did not respond to the letter received follow-up communication from research staff.

Parents and children were eligible to participate in the phase II study if they met the following eligibility criteria: (1) the child was 5 to 9 years old; (2) the person completing the survey was the primary guardian of the 5- to 9-year-old child; (3) the child lived with the parent/guardian more than 50% of the time; (4) the child was from 1 of the following racial/ethnic backgrounds: African American, Hispanic/Latino, Hmong, Native American, Somali, Ethiopian, or White; and (5) the child had a BMI greater than the fifth percentile.

Survey Development

Development of the online survey for phase II participants (n = 1307) followed best practice including using pilot data from phase I to inform survey items to retain, prioritizing validated measures, conducting a validity substudy on measured and self-report items, and carrying out test-retest on all survey items.[41–43] Phase I survey psychometrics were calculated to identify items to retain or cut. Qualitative data obtained from phase I also led to the development of new important survey measures.

In addition, test-retest reliability of the phase II online survey was completed by 125 participants (~20 per race/ethnicity) by taking the survey 2 times within 2 weeks. Intraclass correlation coefficients (ICCs) were estimated from mixed models with participant-level random intercepts to capture the degree of agreement between measurements. Agreement was high (ICC > 0.8) for more static questions (eg, receives Supplemental Nutrition Assistance Program benefits, relationship status, height, household size), moderate (ICC < 0.8 and ICC > 0.6) for questions about food-related attitudes and behaviors (eg, meal frequency, food shopping and preparation attitudes and behaviors, child eating behaviors), and low (ICC < 0.6) for questions that are expected to vary over time (eg, stress, dietary intake, home food availability).

Measures

A description of all exposure variables, pathway variables, outcome variables, and control variables used in analyses is provided in Table 2.

Statistical Analysis

Univariate descriptive statistics, frequency tabulations, and scale reliability diagnostic checks (Cronbach's α) were used to describe the sample and scale measures. Structural equation models were used to examine the indirect pathways between parent ACEs and direct measured child BMI percentile, given prior research that has consistently established the direct path between parental ACEs and child weight.[7,8,22–26,29,30] The 2 indirect pathways (parent low mental health and positive parenting) and 3 subsequent mediating paths of child BMI percentile through parent overweight (parent mental health indirect pathway) and support for PA and controlling feeding practices (each through the positive parenting pathway) were described. Standardized factor loadings were computed for scale components of each latent variable, and univariate mean and standard deviation statistics were calculated to describe overall frequency and variability of scale measures in the sample. The structural model reports standardized path coefficients for each path along the direct and indirect pathways described above. Model invariance tests were performed to examine if there were substantive differences in the system for boys and girls and separately for overweight and nonoverweight children. Path correlates computed from the full sample were found to better describe the subpopulation path coefficients, and model invariance results in each of the 2 strata were not retained. The final structural model was constructed by sequentially adding mediating paths to the direct, bivariate ACEs-BMI percentile pathway: (1) parent low mental health and positive parenting mediators, and (2) subsequent mediating paths including parent BMI > 25, support for PA, and controlling feeding practices. Confounding at the level of the household was addressed by adjusting for food insecurity status and annual household income of the ACEs-BMI percentile relationship, and confounding at the caregiver-child level was addressed by adjusting for child overweight status of the support for PA and controlling feeding associations with child BMI percentile. Visual and tabular presentations of the final structural model were presented for interpretability, and all data analysis and management was conducted in Stata 17.0 MP (College Station, TX).

Table 2. Exposure, Pathway, and Outcomes Variables Used in Analysis

Exposure variables	
Parent adverse childhood events (ACEs)	Parent ACEs were measured via the online survey through 11 validated items:[2,44] (1) Were your parents ever separated or divorced? (2) Was a household member depressed or mentally ill, or did a household member attempt suicide? (3) Did a household member go to prison (including yourself)? (4) Did you often or very often feel that you didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? (5) Did you often or very often feel that your family didn't look out for each other, feel close to each other, or support each other? (6) Did you often or very often feel that your parents were too drunk or high to take care of you? (7) Was your mother or stepmother often or very often pushed, grabbed, slapped, or had something thrown at her? (8) Did a parent or other adult in the household often or very often swear at you, insult you, put you down, or humiliate you? (9) Were you physically abused by a parent or guardian? (10) Were you sexually abused by a parent or guardian? (11) Were you sexually abused by someone who was not a parent or guardian? Response options were "Yes" or "No." Variables then were indicator coded 1 for affirmative responses and 0 for negative responses, and the mean of these variables was computed to reflect the fraction of the 11 items that were reported as present by the parent. For interpretability, this score was multiplied by 10 so that the interpretation in analysis reflected associations in 10% units. The two most common skipped items were sexual abuse by someone who was not a parent or guardian (n = 10 of 48 nonresponding parents) and not having enough to eat, had to wear dirty clothes; had no one to protect you also was skipped by 10 parents (20.8% of parents who skipped 1 or 2 ACE items). On average, these parents had lower ACE mean scores (1.27 ± 1.52) compared to the full responder parents (1.65 ± 2.2).
Pathway variables	
Parent mental health	Parent depressed mood was measured using 6 items from the validated Kessler-6 measure of depressive symptoms.[45] Parents were asked about their current level of depressed mood (i.e., How sad or depressed are you feeling right now?). Ecological momentary assessment-reported depressed mood before noon (ie, morning stress) was also analyzed as a continuous random variable with Likert scale values ranging from 0 to 4 (0 = "Not at all," 1 = "A little," 2 = "Moderately," 3 = "Quite a bit," 4 = "Extremely").
Parent body mass index (BMI)	Height and weight were assessed by self-report. Self-reported height and weight has been shown to be highly correlated with objectively measured values in adults.[38] BMI was calculated using the standard formula, weight (kg)/height (meters).[2]
Positive parenting	A positive parenting latent variable was operationalized by assessing 4 constructs: authoritative (alpha: 0.823), authoritarian (alpha: 0.530), and permissive parenting (alpha: 0.636) style as well as parenting self-efficacy (alpha: 0.572).[46] The three *parenting styles* were classified from 9 items of a pre-existing validated scale on the online survey that were operationalized as mean scores. Sample items for each parenting style include "I give my child reasons why rules should be obeyed" (authoritative), "I use physical punishment as a way of disciplining" (authoritarian), and "I threaten punishment more often than actually giving it" (permissive). Each item was collected on the original 5-item Likert scale (1 = never; 5 = always). *Parent self-efficacy* was operationalized using the Early Intervention Parenting Self-Efficacy Scale (EIPSES).[47] Parents reported on the assessment of efficacy in parenting across 6 items measured on a 4-item Likert scale (1 = strongly disagree; 4 = strongly agree). All but 1 item, "on most days I can handle the ups and downs of being a parent," was reverse scored so that the final mean score reflected efficacious parenting. The 3 parenting style scales and the parenting self-efficacy scale were all used to parameterize the positive parenting latent variable.
Parent support for physical activity (PA) practices	A supportive PA practices latent variable was modeled by combining 3 scales[48]: support for PA (alpha: 0.754), limiting sedentary activity (alpha: 0.920), and modeling of PA (alpha: 0.865). All items were measured on the online survey from a prior scale.[48] *Support for PA* was assessed through the following 3 questions from a prior scale[48]: (1) I encourage [child] to use resources in our neighborhood to be active (such as the park and the school); (2) I enroll [child] in community-based programs (such as Parks and Rec, Boys and Girls Club, YMCA) where he or she can be active; (3) I find ways for [child] to be active when school is out by, for example, enrolling him/her in summer camp and after-school programs. *Limiting sedentary activity* was assessed through 3 questions from a prior scale[48]: (1) I limit how long [child] plays video games (including PlayStation, Xbox, and Gameboys); (2) I limit how long [child] can watch TV or DVDs each day (including educational and noneducational programs); (3) I limit how long [child] can use the computer, smart phone, or tablet for things other than homework (such as playing computer games, watching YouTube, texting or snapchatting with friends. Both *support for PA* and *limiting sedentary activity* had the following response options: 1 = "Strongly disagree"; 2 = "Somewhat disagree"; 3 = "Somewhat agree"; 4 = "Strongly agree." *Modeling of PA*[48] was assessed through 4 questions from a prior scale[48] asking parents during a typical week how often they (1) Encourage [child] to do physical activities or play sports; (2) provide transportation or walk with [child] to a place where he or

Continued

Table 2. Continued

Exposure variables	
	she can do physical activities or play sports; (3) watch [child] participate in physical activities or sports; (4) do a physical activity or play a sport with [child]. Response options included 1 = "Never/rarely"; 2 = "Once"; 3 = "Sometimes"; 4 = "Almost every day"; 5 = "Every day."
Controlling feeding practices	A controlling feeding practices latent variable was modeled by combining 3 scales[49]: restriction (alpha: 0.675), pressuring (alpha: 0.647), and instrumental feeding (alpha: 0.594). All items were measured on the online survey. *Restriction* was assessed through the following 4 validated questions from a pre-existing scale[49]: (1) I have to make sure that [child] does not eat too many sweets (candy, ice cream, cake, or pastries) or his/her favorite foods; (2) I intentionally keep some foods out of [child]'s reach; (3) I offer sweets (candy, ice cream, cake, pastries) or favorite foods to [child] as a reward for good behavior; (4) If I did not guide or regulate [child]'s eating, he/she would eat too many junk foods/favorite foods. *Pressuring* was assessed through the following 3 validated questions[49]: (1) [child] should always eat all the food on his/her plate; 2) if [child] says "I'm not hungry," I try to get him/her to eat anyway; (3) if I did not guide or regulate [child]'s eating, he/she would eat much less than he/she should. For both *restriction* and *pressuring*, parents selected how much they agreed with each item (1 = "Disagree"; 3= "Neutral"; 5 = "Agree"). *Instrumental feeding* was assessed with the following 2 validated questions[49]: (1) if [child] misbehaves, I withhold his/her favorite foods/sweets/desserts; (2) use desserts as a bribe to get [child] to eat his/her main course (1= "Never"; 3 ="About half of the time"; 5 = "Always").[49,50]
Outcome variables	
Child BMI percentile	Child height and weight were obtained through the child's electronic medical record at their primary care clinic. Child heights and weights were converted to child BMI percentile, based on Centers for Disease Control and Prevention criteria.[51]
Control variables	
Food insecurity status	Household food insecurity was assessed via the short form of a validated scale called the Household Food Security Scale.[52] This scale was completed by the parent at the second home visit as part of the online survey. The scale is a sum of the affirmative responses to the following 6 questions about whether in the past 12 months: (1) the primary caregiver (or other adults in the household) ever cut the size of meals or skipped meals because there wasn't enough money for food; (2) that this happened more than 1 or 2 months; (3) the primary caregiver was hungry but didn't eat because they couldn't afford enough food; (4) the food they bought didn't last and they didn't have enough money to get more; (5) they couldn't afford balanced meals; and (6) they couldn't afford to eat balanced meals. A household was categorized as food secure if they had no affirmative responses to these 6 questions, and households were classified as food insecure if they answered yes to 1 or more questions.
Annual household income	Annual household income was a 1-item measure taken from a pre-existing survey.[38] Parents were asked, What was the total income of your household before taxes in the past year? Response options included: (1) Less than $20,000; (2) $20,000–$34,999; (3) $35,000–$49,999; (4) $50,000–$74,999; (5) $75,000–$99,999; (6)$100,000 or more.

Note: the 1307 sample is from the Minneapolis and St. Paul, MN, area and was collected between 2015 and 2017.

Results

Sample Demographics

The study sample (Table 1) was 90% female caregivers who were on average 35.7 (SD = 7.9) years old. Two thirds of the sample were native born (66%), with the remaining 34% being from immigrant households. Seventy-five percent (n = 336) of the immigrant households had been living in the United States for 10+ years, indicating study children were second generation (mean age = 7.0; SD = 1.5). Educational attainment of the sample included 54% of parents having some high school education or college but no degree earned. Fifty-five percent of the sample were from low-income households reporting household income <$34,999 annually. Mean ACE score in the sample was 1.64 (SD = 2.19), indicating about 2 of the 11 ACE items were reported on average, and approximately one third of the sample reported no ACEs.

Scale Factor Loadings on Latent Variables

Parent Low Mental Health Latent Variable

Univariate statistics reported in Table 3 indicate that psychological distress (mean = 1.8; SD = 0.86) and anxiety (mean = 2.1; SD = 1.00) were low in the sample, and resilience was high (mean = 3.6; SD = 0.71). Factor loadings were strongest for the

Table 3. Standardized Latent Variable Relationships with Observed Cross-Sectional Survey Items

Latent variable	Univariate mean ± SD	*B**	95% CI	*P* value
Parent low mental health				
Depression scale	1.8 ± 0.86	0.86	(0.82, 0.89)	<.001
Anxiety scale	2.1 ± 1.00	0.87	(0.83, 0.90)	<.001
Resilience scale	3.6 ± 0.71	−0.46	(−0.50, −0.41)	<.001
Positive parenting				
Authoritative scale	4.2 ± 0.81	0.07	(0.01, 0.14)	.049
Authoritarian scale	1.9 ± 0.65	−0.66	(−0.72, −0.60)	<.001
Permissive scale	1.8 ± 0.76	−0.65	(−0.71, −0.58)	<.001
Self-efficacy scale	3.9 ± 0.46	0.40	(0.33, 0.46)	<.001
Controlling feeding practices				
Pressuring	3.0 ± 1.05	0.51	(0.44, 0.58)	<.001
Restriction	3.3 ± 1.00	0.56	(0.49, 0.63)	<.001
Instrumental	2.0 ± 0.99	0.55	(0.48, 0.61)	<.001
Support for physical activity (PA)				
Modeling of PA	3.3 ± 0.97	0.60	(0.52, 0.67)	<.001
Support for PA	3.0 ± 0.84	0.77	(0.68, 0.86)	<.001
Limit sedentary activity	3.4 ± 0.80	0.34	(0.28, 0.41)	<.001

Abbreviations: SD, standard deviation; CI, confidence interval.
Note: the 1307 sample is from the Minneapolis and St. Paul, MN, area and was collected between 2015 and 2017.
*Standardized coefficients.
Interpretation example: The latent variable, "Parent Low Mental Health," was constructed from three mean-scaled items that characterize parent self-reported depressive, anxiety, and resilience items. In this sample, the latent construct was positively correlated with the depression and anxiety scales and negatively correlated with the resilience scale.

depression and anxiety scale measures and moderate for the resilience measure, which was inversely related to the parent low mental health latent variable.

Positive Parenting Latent Variable

Authoritative parenting was frequently reported (mean = 4.2; SD = 0.81), as was self-efficacy in parenting (mean = 3.9; SD = 0.46). Although authoritarian and permissive parenting were reported less frequently (mean = 1.9 and mean = 1.8, respectively), factor loadings were inversely related to the latent variable and highest among these 2 scale measures, indicating a positive parenting interpretation of the latent construct.

Controlling Feeding Latent Variable

Pressuring (mean = 3.0; SD = 1.05) and restriction (mean = 3.3; SD = 1.0) were moderately reported in the sample, and instrumental feeding was less frequently reported (mean = 2.0; SD = 0.99). Each feeding scale measure had positive factor loadings between 0.51 and 0.56, indicating an interpretation of the latent variable as controlling feeding.

Support for PA Latent Variable

Modeling of PA (mean = 3.3; SD = 0.97) and support for PA (mean = 3.0; SD = 0.84) had the highest factor loadings and were positively related to the latent construct (factor loadings of 0.60 and 0.77, respectively). Limiting of sedentary activity was moderate in the sample (mean = 3.4; SD = 0.80) and had the weakest, positive factor loading (0.34) of the 3 scale measures used to operationalize the support for PA latent variable.

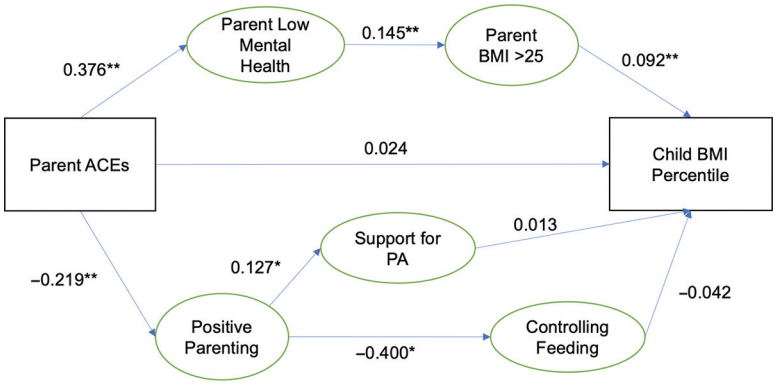
Indirect Path Correlates of the Relationship between Parent ACEs and Child BMI Percentile

The final structural model reports standardized path coefficients visually in Figure 1 and separately in table form (Table 4) with interpretation examples of the standardized component pathways.

Parent Mental Health Pathway

The parent mental health pathway was the strongest modeled pathway for explaining the association between parent ACEs and child weight status. Parent ACEs were positively associated with low parent mental health (β = 0.376; $P < .001$), parent

Figure 1. Structural equation model standardized path correlates of parent adverse childhood experiences (ACEs) on child body mass index (BMI) percentile: direct and indirect pathways (n = 1307 caregivers).



a. Model adjusted for food insecurity status and income; child overweight status of the controlling feeding-BMI%ile and support for PA-BMI%ile relationships
*b. Statistical significance indicated at: * P < 0.01; ** P < 0.001*

Note: the 1307 sample is from the Minneapolis and St. Paul, MN area and was collected between 2015-2017.

low mental health was correlated with higher parent BMI > 25 (β = 0.145; $P < .001$), and parent overweight was positively related to higher child BMI percentile (β = 0.092; $P < .001$).

Parenting Practices Pathway

The positive parenting pathway was also modeled; however, there was not strong evidence that the support for PA and controlling feeding mediating pathways were associated with child BMI percentile (β-support for PA = 0.013; $P = .582$; β-controlling feeding = −0.042; $P = .103$). Positive parenting was observed to be less common as ACEs increased (β = −0.219; $P < .001$), and the association between positive parenting and support for PA was 0.127 ($P = .003$) and positive parenting and controlling

Table 4. Standardized Indirect Parent Adverse Childhood Events-Child Body Mass Index (BMI) Pathways Mediated by Parent Low Mental Health and Positive Parenting (n = 1307 Children)

Latent variable	$\beta 1$*	$\beta 2$*	$\beta 3$*
Indirect pathways			
Parent mental health pathway			
Adverse childhood events (ACEs) → parent low mental health → parent BMI > 25 → child BMI percentile	**0.376**††	**0.145**††	**0.092**††
Positive parenting pathways			
ACEs → positive parenting → support for physical activity (PA) → child BMI percentile	**0.219**††	**0.127**†	0.013
ACEs → positive parenting → controlling feeding practices → child BMI percentile	**−0.400**††	−0.042	

Note: the 1307 sample is from the Minneapolis and St. Paul, MN, area and was collected between 2015 and 2017.
*Standardized coefficients.
Models include adjustments for food insecurity status and income of the parent ACEs-BMI percentile relationship; child overweight status of the controlling feeding-BMI percentile, and support for PA-BMI percentile relationships. Boldfaced coefficients are significant at the following levels: †$P < .01$; ††$P < .001$.
Interpretation example: parent ACEs-child BMI percentile indirect relationships were modeled with controls for household food insecurity status and income. At the dyad level, child overweight was controlled for the support for PA and controlling feeding relationship with child BMI percentile. Three indirect pathways operating through parent mental health and positive parenting were modeled. Component path coefficients were standardized for interpretability ($\beta 1$, $\beta 2$, and $\beta 3$). There was strong statistical evidence at $P < .001$ for all low mental health path coefficients, indicating parent ACEs were positively associated with lower parent mental health ($\beta 1 = 0.376$), low parent mental health was correlated with parent BMI > 25 ($\beta 2 = 0.145$), and parent BMI >25 was associated with elevated child BMI percentile ($\beta 3 = 0.092$).

feeding practices was negatively associated (β = −0.400; $P < .001$).

Discussion

Results of the current study support and extend prior research demonstrating the intergenerational transmission between parental experience of ACEs and child BMI percentile.[7,8,22–26,29,30] Our hypothesized parent mental health pathway was supported, which considered that parent mental health would explain the intergenerational association between parental ACEs and child weight. Specifically, parental experience of ACEs was associated with lower parent mental health, which was associated with higher parental BMI, which was associated with higher child BMI percentile. This finding provides insight into potential targets for childhood obesity interventions in that targeting parent mental health may have a higher likelihood of impacting child BMI than parent BMI directly or via parenting practices.

Our parenting practices pathway hypothesis was not supported. However, the significant associations between factors on this pathway including parental experiences of ACEs and low positive parenting, positive parenting and more support for PA, and positive parenting and less controlling feeding practices are consistent with prior research showing the importance of these potential factors leading to parents engaging in these parenting practices.[18,53–55] In contrast with our hypothesis, these factors were not significantly associated with child BMI percentile. It seems possible that since ACEs are traumatic experiences they are more likely to be manifested via parenting emotion (eg, depressive or anxiety symptoms) versus parenting behavior alone (eg, parent feeding or PA practices). This study finding may ultimately provide insight for intervention approaches, suggesting that solely targeting parenting practices—as is common in many childhood obesity prevention/interventions—without addressing parent mental health may not disrupt the intergenerational transmission between parental experience of ACEs and child weight.

Our study findings align with FST, which posits that patterns, both adaptive and maladaptive, are transmitted from 1 generation to the next.[56,57] Specifically, the significant parent mental health pathway finding in this study exemplifies the dyadic nature of how intergenerational transmission may occur. For example, it may be that exposure to ACEs led to depressive symptoms that impeded parents' regulation of healthy eating and PA, which led to overeating and overweight status in adulthood. Then, parental modeling of overeating and less PA may have been transmitted to their children, who also overate and then had increases in their BMI percentile.

This study has several strengths, one of which includes the diversity of a large sample, including many immigrant/refugee households, which is often an understudied population. Another strength of our study was that it included validated measures of ACEs, mental health, and parenting practices and used structural equation modeling analyses to allow for identifying mediational pathways. The high number of ACEs our sample of parents experienced is both a strength and a limitation. It mitigates potential bias in the statistical analysis but also potentially limits the generalizability of the results to a more at-risk population despite recruitment from a general population. Another limitation is that this study was cross-sectional, thus we cannot conclude directionality or causality of the constructs. In addition, all plausible pathways between parental ACEs and child BMI percentile could not be explored (eg, shared eating environment, genetic factors), and future research would benefit from including these factors. There were also limitations with measures, including the use of retrospective report of parent ACEs, parent-reported height/weight, limitations of BMI as a measure of child health, and, because ACEs were reported retrospectively by participants, they may have been under or overreported. In addition, the age range of children in our sample, 5 to 12 years old, means that younger children and adolescents were not included, and their pathways between parent ACEs and child BMI percentile may differ.

There are important implications of our study results for both researchers and health care providers who work with parents and school-aged children. Researchers working with parents who have experienced ACEs should consider interventions that target parental mental health to mitigate depressive and anxiety symptoms to reduce the risk of high BMI in parents and then ultimately lower risk of high BMI percentile in their children. Likewise, it may be important for health care providers who work with parents to first screen for ACEs, and then once ACE history is known, consider screening for depressive and anxiety symptoms to potentially avoid development of unhealthy

eating and activity patterns and reduce stress that may contribute to obesity over the lifespan. This may be especially important for providers who work with bariatric patients. If parents screen positive for ACEs and/or depressive or anxiety symptoms, a referral for outpatient or in-home mental health services may be an important avenue through which to reduce the impact of parental ACEs on child BMI percentile. For example, in alignment with FST, a family therapist who can address the intergenerational patterns and dyadic nature of these patterns would be an important referral to consider. Furthermore, for health care providers, it is important to consider the potential long-term impact of exposure to ACEs on the families that they work with and how they interact with these families. It may be important to prioritize training in trauma-informed care.

Conclusions

The current study, in combination with prior research,[7,8,22–26,29,30] demonstrates that not only do childhood ACEs impact children well into adulthood but also that the impact of those experiences may affect the health of the next generation. Current study results showed that parents' ACEs influenced their child's BMI via a parent mental health pathway such that parental history of ACEs was associated with poorer parental mental health, which then was associated with higher parent BMI and higher child BMI percentile. This pathway may be an important 1 to consider building interventions around to reduce child BMI percentile and for health care providers to screen for and intervene in when working with parents who have a history of ACEs and their school-aged children.

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