



Published in final edited form as:

Pediatr Obes. 2019 August ; 14(8): e12518. doi:10.1111/ijpo.12518.

Factors Associated with Depression and Anxiety Symptoms among Children Seeking Treatment for Obesity: A Social-Ecological Approach

Daniel H. Sheinbein¹, Richard I. Stein², Jacqueline F. Hayes², Mackenzie L. Brown², Katherine N. Balantekin³, Rachel P. Kolko Conlon⁴, Brian E. Saelens⁵, Michael G. Perri⁶, R. Robinson Welch², Kenneth B. Schechtman², Leonard H. Epstein³, Denise E. Wilfley²

¹University of Missouri School of Medicine, Columbia, MO, USA

²Washington University in St. Louis, St. Louis, MO, USA

³University at Buffalo School of Medicine and Biomedical Sciences, Buffalo, NY, USA

⁴University of Pittsburgh, Pittsburgh, PA, USA

⁵Seattle Children's Research Institute and the University of Washington, Seattle, WA, USA

⁶University of Florida, Gainesville, FL, USA

Abstract

Background: Children with overweight/obesity are more likely to exhibit symptoms of depression and anxiety than are their peers without overweight/obesity; however, the rates and correlates of depression and anxiety symptoms among children seeking obesity treatment remain unclear.

Objectives: Examine the prevalence and associated factors of depression and anxiety symptoms among treatment-seeking children with overweight/obesity.

Methods: Children 7–11 years old ($N=241$) and their parents completed assessments before beginning family-based behavioral weight-loss treatment. Disorder-specific self-report questionnaires assessed child depression and anxiety. The social-ecological model served as a framework for examining factors associated with depression and anxiety symptoms.

Results: Among our sample, 39.8% (96/241) met clinical-cutoffs for depression and/or anxiety symptomatology. Specifically, of these 96, 48 met criteria for both depression and anxiety, 24 for depression only, and 24 for anxiety only. Child eating disorder pathology, parents' use of psychological control (i.e., a parenting style characterized by emotional manipulation), and lower child subjective social status were significantly associated with greater child depression

Corresponding Author: Richard I. Stein, Ph.D., Washington University School of Medicine, Campus Box 8083, 660 S. Euclid Ave., St. Louis, MO 63110, rstein@wustl.edu, *Phone:* (314) 286-0077.
author contributions

DHS, RIS, JFH, MLB, KNB, and RPKC made substantial contributions to the conception and design of the current study, analysis and interpretation of the data, and drafting and revising of the article.

BES, MGP, RRW, KBS, LHE, and DEW made substantial contributions to the conception and design of the study, and revised the article critically for important intellectual content.

Conflict of Interest: No authors have conflicts of interest relevant to this article to disclose.

symptomatology. Child eating disorder pathology and parent psychological control were significantly associated with greater child anxiety symptomatology.

Conclusion: Nearly 40% of children exhibited psychopathology symptoms, and a variety of correlates were found. Thus, pediatric weight-loss providers may consider screening for and addressing mental health concerns (and associated factors) prior to and during treatment.

Clinical Trial Registration: Childhood Obesity Treatment: A Maintenance Approach (COMPASS), [ClinicalTrials.gov](https://clinicaltrials.gov) Identifier: NCT00759746

Keywords

children; obesity; psychopathology; depression; anxiety; eating disorder

Introduction

Children with overweight/obesity (OW/OB) exhibit greater symptoms of depression and anxiety compared to their peers without OW/OB¹, thus leading to diminished psychosocial functioning and quality of life². While it is estimated that youth with OW/OB are 3.6 and 3.1 times more likely to experience depression and anxiety symptomatology, respectively, compared to their peers without OW/OB¹, reported rates of depression and anxiety symptomatology among children seeking treatment for OW/OB vary substantially. Some studies in this population report relatively low rates of these symptoms (7–16%)^{3–5}, whereas other studies report considerably higher rates (47–53%)^{6,7}. This discrepancy is likely related to a variety of methodological differences across studies, such as age (e.g., including versus excluding adolescents), sample size, and type of measure used to assess psychopathology. Most studies examining depression and anxiety symptoms among children with OW/OB have used parent-report measures. These assessments can be subject to response bias, such that parents' own level of psychopathology can influence how they perceive their child⁸ and report their child's level of psychopathology⁹. Moreover, child depression and anxiety symptoms often present internally and thus may escape parents' awareness¹⁰. Self-report measures may be beneficial in helping reduce this response bias, and validity data indicate that children as young as 4 years old are able to report on their depression and anxiety symptoms¹¹. Another limitation of previous studies is that many of them used combined assessments of depression and anxiety, leaving it uncertain whether the child has symptoms of depression, anxiety, or both. The use of separate measures for assessing depression and anxiety symptomatology is critical, as these forms of psychopathology differ in terms of their symptom profiles and treatment needs¹².

Only two studies^{2,7} have used child self-report measures to assess the prevalence of depression and anxiety symptomatology separately among pre-adolescent youth with OW/OB, and those studies were limited by relatively small sample sizes ($N=59-62$). Thus, the current study seeks to further explore the prevalence found in those reports^{2,7} (9–15% for depression, 23–26% for anxiety) among a larger sample of children seeking treatment for OW/OB ($N=241$) by using brief, simple self-report questionnaires^{13,14}.

The social-ecological model (SEM)¹⁵ is a theory-based framework for understanding the diverse factors that can affect or be related to a health or behavioral outcome. The SEM posits that there are often a multitude of determinants of health that range in proximity to the person, from individual-level factors, to the increasingly distal family/parent-, social/peer-, and community-level ones. The existing literature indicates that a variety of factors across these levels are associated with depression and anxiety symptoms among pre-adolescent youth with OW/OB. For example, individual-level factors such as eating disorder (ED) pathology have been shown to be associated with mental health concerns, as youth with OB who engage in loss-of-control (LOC) eating (an inability to control what and/or how much one is eating) or dietary restraint (i.e., attempting rigid/restrictive eating to control one's weight) experience higher levels of depression and anxiety symptoms compared to youth with OB who do not have LOC eating or dietary restraint^{16,17}. Family/parent-level factors also correlate with child psychopathology, as parents' psychopathology has been shown to be positively associated with psychopathology among their children with OB¹⁸. Additionally, certain forms of parenting seem to be more detrimental to child mental health status than others in this patient population⁶. In regard to social/peer-level factors, children with OB are at increased risk for teasing, and those who are teased/bullied exhibit significantly higher rates of depression compared to children with OB who are not teased/bullied¹⁹. Finally, although no relations have been shown between community-level factors and psychopathology among youth with OW/OB specifically, children who live in neighborhoods with elevated poverty and crime rates report higher psychological distress²⁰.

Previous studies have determined these relations using primarily single-predictor models. That is, some studies have focused exclusively on individual-level factors^{16,17}, whereas other studies have focused only on family/parent-level ones^{6,18}. It thus remains unclear which of these factors, when considered amongst each other, are most strongly related to depression and anxiety symptomatology. Furthermore, there are currently no studies that have examined whether factors at other SEM levels, such as subjective social status (i.e., a social/peer-level factor that reflects individuals' ranking of where they stand socially among their peers), are associated with depression and anxiety symptoms among pre-adolescent youth. Low subjective social status is associated with depression and anxiety in adults (across various ethnic and socioeconomic backgrounds)²¹, and there is reason to suspect that it may impact children similarly. In particular, children with OW/OB are often stigmatized and have higher rates of social problems²²; thus, it remains imperative to investigate whether peer-related factors, such as social problems and subjective social status, are associated with mental health concerns among this group of children.

The current study thus used the SEM as a framework to examine (across individual-, family/parent-, social/peer-, and community-levels) which (1) factors previously shown to be associated with depression and anxiety symptomatology among children with OW/OB, as well as (2) unexplored factors (e.g., subjective social status), and (3) risk factors for psychopathology in the general population of pre-adolescent youth (e.g., individual-level: demographic factors such as gender²³ and race/ethnicity²⁴; family/parent-level: family socioeconomic status [SES]²⁴; community-level: neighborhood safety²⁰), are most robustly related to depression and anxiety symptomatology. This broad-based analysis will ultimately

provide pediatric weight-loss providers with a fuller understanding of the risk factors that may accompany depression and anxiety symptomatology among their patient-population.

Therefore, the current study aims to a) use disorder-specific child self-report measures to depict the prevalence of clinically-significant depression and anxiety symptoms among children seeking treatment for OW/OB, and b) use the SEM framework as a guide to comprehensively investigate factors associated with depression and anxiety symptoms in this population.

Methods

Study Design

This study used baseline data from a multisite randomized controlled trial conducted in St. Louis, MO, and Seattle, WA²⁵, which investigated the efficacy of continued weight-control interventions following a 16-session family-based behavioral weight-loss treatment (FBT). Briefly, FBT is an evidence-based treatment for children with OW/OB, which promotes increased physical activity, encourages greater consumption of nutritious, low-energy-dense foods, and teaches behavioral strategies and parenting skills conducive to better child weight-management²⁵. Child psychopathology and its potential correlates (identified based on empirical and theoretical associations with depression and anxiety) were assessed at baseline (i.e., prior to beginning FBT) via questionnaires and semi-structured interviews that were administered by trained staff.

Participants

Participants included children 7–11 years old ($N=241$) with OW/OB (body mass index [BMI] 85th percentile for sex and age²⁶) who had at least one parent with OW/OB (body mass index [BMI] ≥ 25 kg/m²). Child-parent dyads were recruited via fliers, media, schools, and pediatrician referrals. Exclusion criteria for the child and participating parent (the parent attending FBT with his/her child) included drug/alcohol abuse, lack of English proficiency, medical conditions that limit physical activity participation, and medication regimens that alter weight (a CONSORT flow diagram is presented elsewhere²⁵). Relevant to the current study, one family was excluded based on a child psychiatric condition (i.e., bipolar disorder) that would potentially interfere with FBT. Parents provided written informed consent and children provided written assent. The institutional review boards at the respective institutions approved the study.

Measures

Child Depression Symptomatology: Children completed the 13-item Short Mood and Feelings Questionnaire (SMFQ)¹³ to assess depression symptoms. Items are rated on a scale from 0 (“not true”) to 2 (“true”), which are summed to form a total score, with higher scores indicating greater depression symptomatology. An established clinical-cutoff of 8 indicated the likely presence of depression¹³. The SMFQ demonstrates strong criterion validity and internal consistency¹³.

Child Anxiety Symptomatology: Children completed the 41-item Screen for Child Anxiety Related Disorders (SCARED)¹⁴ to assess anxiety symptoms. Items are rated on a scale from 0 (“not true or hardly ever true”) to 2 (“very true or often true”), which are summed to form a total score, with higher scores indicating greater anxiety symptomatology. An established clinical-cutoff of 25 indicated the likely presence of an anxiety disorder¹⁴. The SCARED demonstrates sound reliability and validity¹⁴.

Individual-Level Factors: Parents reported on their child’s sex, age, and race/ethnicity (dichotomized for the present analyses as non-Hispanic White versus any other race/ethnicity combination). Child percent OW, defined as the percent above the median BMI for age and sex²⁶, was calculated from height, measured with a stadiometer to the nearest 0.1cm, and weight, measured on a calibrated electronic scale to the nearest 0.1kg.

Previous work in this sample has shown that children with obesity present with varying patterns of ED pathology²⁷. As such, given that ED pathology is a multidimensional construct²⁷, three measures were used to assess ED pathology, in order to capture its distinct features: The Youth Eating Disorder Examination Questionnaire (YEDE-Q)²⁸, the Emotional Eating Scale for Children and Adolescents (EES-C)²⁹, and an abbreviated version of the Child Eating Disorder Examination (ChEDE)³⁰. The YEDE-Q is a 39-item child self-report measure that assesses disordered eating attitudes and behaviors²⁸. Specifically, the YEDE-Q measures four subscales: eating-, shape-, and weight-concern, as well as dietary restraint. The present study used the global score, which is the average of those four subscales. The EES-C is a 25-item self-report questionnaire wherein children indicate their desire to eat in the presence of three emotions (i.e., anger/frustration, depression, and anxiety), on a scale from 0 (“no desire”) to 4 (“overwhelming urge to eat”); the present study used the global score, calculated as the mean of all items. The ChEDE is a semi-structured interview that was conducted by trained assessors and administered to the child. It was used to assess whether and how many times children had engaged in LOC eating during the past 3 months. All three measures assess separate, non-overlapping constructs of ED pathology; have low inter-correlations (ranging from .28 to .33); and demonstrate strong reliability and validity^{28,29,31}. For the present analyses, based on previous findings using LOC data in children³², LOC eating was dichotomized to any LOC episodes versus none.

Family/Parental-Level Factors: Family SES was measured using the Barratt Simplified Measure of Social Status³³, which uses educational attainment and occupational status to determine an SES score. Adult psychopathology was assessed for the participating parent via the Brief Symptom Inventory (BSI)³⁴, a 53-item adult self-report questionnaire that captures nine symptom domains and (used in the present analyses) a global severity index of psychopathology. Items, rated on a scale from 0 (“not at all”) to 4 (“extremely”), are summed, and the total is transformed to a *T*-score. The BSI exhibits strong reliability and validity³⁵.

To assess childrearing behaviors, children completed the Child’s Report of Parental Behavior Inventory (CRPBI), 30-item version³⁶, which demonstrates strong discriminative validity and internal consistency³⁶. The CRPBI measures three parenting dimensions: firm vs. lax control (i.e., if the parent uses strict rules and hard punishment to influence child

behaviors), psychological control vs. autonomy (i.e., if the parent uses emotionally-manipulative tactics to influence child behaviors), and acceptance vs. rejection (i.e., if the parent openly displays love and affection for the child). The present analyses used the child's ratings of the participating parent. Higher scores on the respective subscales indicate greater firm control, psychological control, and acceptance.

Social/Peer-Level Factors: Parents completed the Child Behavior Checklist³⁷, a comprehensive assessment of children's behavioral and emotional functioning, which demonstrates strong validity and reliability³⁷. For the current study, the 11-item Social Problems scale (e.g., if the child is teased or lonely) was used. Items are rated from 0 ("not true") to 4 ("very true or often true"), summed, and the subscale is converted to a *T*-score, with higher values indicating greater social problems. To assess subjective social status, children completed a questionnaire adapted from the MacArthur Scale³⁸. It consists of a graphic of a 10-rung ladder, with instructions asking children to think of the ladder as representing where people stand socially in their school (the top and bottom of the ladder indicate people with the highest and lowest respect/social standing, respectively). Children placed an "x" on the rung indicating their social standing; responses were coded to a score ranging from 0 (below the bottom rung) to 10.5 (above the top rung). The scale demonstrates strong predictive utility and test-retest reliability³⁹.

Community-Level Factors: Community factors included two objective markers of neighborhood characteristics derived using the family's zip code: educational attainment (i.e., percent of adult residents who earned a high school degree or higher education), and median household income, both based on 2010 U.S. Census data⁴⁰. Also, parents reported their perception of their neighborhood's safety in terms of crime and being outdoors via the Neighborhood Environment Walkability Scale (NEWS)-Abbreviated⁴¹. This scale demonstrates sound criterion and factorial validity⁴¹.

Statistical Analysis

All analyses were performed using IBM SPSS Statistics for Windows, version 24 (IBM Corp., Armonk, NY). First, frequency analyses were used to examine the prevalence of those meeting clinical-cutoffs for depression and anxiety symptomatology. Second, bivariate Pearson product-moment correlations and *T*-tests were used to examine zero-order relations of factors potentially associated with child depression and anxiety symptomatology. Finally, all variables significant ($p < .05$) at zero-order were entered into hierarchical linear regression models. The block-design structure was based on the decreasing proximity, to the child, of the different levels within the SEM framework; thus, for each model, individual-, family/parental-, social/peer-, and community-level factors were entered into blocks 1, 2, 3 and 4, respectively.

Results

Prevalence of Depression and Anxiety

Among our sample of 241 children, more than one-third (39.8%; $N=96$) met criteria for a clinically-significant level of at least one form of psychopathology examined. Of these 96,

48 met criteria for both disorders, while 24 met criteria for only depression symptomatology, and 24 for only anxiety symptomatology.

Thus, among our overall sample, 29.9% ($N=72$ [48 with and 24 without anxiety]) met clinical-cutoffs for depression symptomatology. Similarly, 29.9% ($N=72$ [48 with and 24 without depression]) met clinical-cutoffs for anxiety symptomatology.

Bivariate associations

Zero-order associations of child depression and anxiety symptomatology with SEM-level factors are shown in Tables 1 (continuous variables) and 2 (dichotomous variables). Of note, child ED pathology (all three measures), parent's use of psychological control, child social problems, and family's perceived neighborhood outdoor safety were significantly associated with both child depression and anxiety symptomatology. In addition, parent psychopathology, parent's use of firm control, and child subjective social status were significantly associated only with child depression symptomatology, whereas child's sex and the family's median neighborhood household income showed a significant association only with child anxiety symptomatology.

Hierarchical Regressions

Regression models for depression and anxiety symptomatology are shown in Tables 3 and 4, respectively. Greater child ED pathology (emotional eating and global ED pathology), parent's use of psychological control, and lower child subjective social status were significantly associated with greater child depression symptomatology (overall model $F(9,215)=21.48, p<.001$; Table 3). Greater child ED pathology (emotional eating and global ED pathology) and parent's use of psychological control were significantly associated with greater child anxiety symptomatology (overall model $F(8,215)=23.74, p<.001$; Table 4).

Discussion

A substantial percentage (~40%) of children from families seeking FBT met criteria for clinically significant depression and/or anxiety symptomatology. The prevalence of depression symptomatology found in the present sample (29.9%) is much greater than the prevalence (9–15%) obtained in two previous studies that utilized child self-report measures^{2,7}, while the prevalence of anxiety symptomatology (29.9%) is only slightly larger than that in those previous reports (23–25%)^{2,7}, despite similar sample demographics across all three studies. The higher rate of depression symptomatology found in the current study compared to the previous studies may be due to differences in assessment methodologies (i.e., the SMFQ in the present study, versus the Children's Depression Inventory [CDI] and Behavior Assessment System for Children [BASC] in the other two studies). These questionnaires have varying response formats -- the CDI requires children to compare three statements in order to complete each item, and the BASC requires children to rate the frequency of their behavior using a four-point Likert-type scale; the SMFQ, on the other hand, only requires children to make true/not true/sometimes statements for each item. The ease and simplicity of the SMFQ may be more cognitively appropriate for this age range, and thus better capture self-reported depression symptoms¹³ for this population of children.

However, additional research is needed to replicate these findings by further comparing symptomatology rates across the different self-report measures.

In the full regression models, individual-, family/parental-, and social/peer-level SEM factors were significantly associated with depression symptomatology, whereas only individual- and family/parental-level SEM factors were associated with anxiety symptomatology. ED pathology (emotional eating and global ED pathology, but not LOC eating) was associated with both depression and anxiety symptomatology, which is consistent with previous findings regarding the high comorbidity of ED pathology and negative affect⁴². For example, dietary restraint as well as prolonged periods of starvation often lead to depressive-like symptoms such as emotional instability and lethargy⁴³. Emotional eating, on the other hand, usually manifests as a mechanism to cope with negative affect⁴⁴. When in reaction to anxiety, emotional eating acts as a biological response to limit hyperarousal⁴⁴, and in reaction to depression, it provides temporary feelings of gratification/satisfaction⁴⁴. Although emotional eating serves to alleviate aversive feelings in the short-term, it often exacerbates these feelings over time⁴⁵.

Parenting style, specifically the use of psychological control over the child (i.e., attempting to manipulate the child's actions, thoughts, and emotions), was associated with both child depression and anxiety symptoms in the full models; this is the first study to show the relation between psychological control over child and mental health status among children with OW/OB. On the other hand, firm control over child was only associated with depression symptoms, and only at the zero-order level. Parents who employ psychological control express resentment and shame towards their child, which can consequently negate the child's self-worth, whereas parents who employ firm control set stringent rules and use harsh forms of discipline, which does not directly impair the child's sense of intrinsic value⁴⁶. Although firm control may be perceived as an undesirable form of parenting, results from this study are consistent with previous findings that psychological control is a more robust predictor of depression and anxiety symptoms⁴⁷ among the general population of children. A parenting style consisting of low psychological control and high acceptance may therefore be most beneficial to the child's mental health⁴⁷. Unlike parenting style, parent psychopathology was not associated with child depression or anxiety symptoms in the regression models. Although previous studies^{2-4,6,18} showed an association between parent and child psychopathology among children with OW/OB, the majority of those reports^{3,4,6,18} used parent-reported measures of child psychopathology, which can create a reporter bias in terms of the parents' own level of psychopathology and their awareness of their child's symptoms^{9,10}. Findings from the current study, and the use of disorder-specific child self-report measures, indicate that parent psychopathology may be more weakly related to depression and anxiety symptoms among this population of children than previously thought.

As far as social/peer-level factors, the current study is the first to show an association between lower subjective social status and higher depression symptomatology among any subgroup of pre-adolescent youth. Diminished subjective social status can prompt negative thoughts about oneself (e.g., "no one likes me"), which can act as a precursor to further depression symptoms⁴⁸. Higher social problems, on the other hand, were associated with

depression and anxiety symptomatology only at the zero-order level, suggesting that social standing may be a more powerful predictor than social problems. Moreover, children self-reported their subjective social status whereas level of social problems was reported by their parent, which may have impacted findings.

Lastly, though some of the community-level factors were significant at zero-order, none of them remained significant in the full models of depression or anxiety symptoms. This might be related to the community-level factors being the most distal ones, from the child, within the SEM. As such, these factors may have weaker associations beyond that of the more immediate factors in a child's daily life (e.g., parents and peers). The current study is the first to examine community-level factors among this population of children. Therefore, future research is encouraged to examine these relations in other clinical samples of children with OW/OB.

Based on our findings, almost 40% of FBT-seeking youth begin treatment screening positive for clinically-significant depression and/or anxiety symptoms. Providers of FBT and other pediatric weight-loss treatments are therefore encouraged to screen children for psychopathology (and its associated factors) and refer children to mental health specialists if they exhibit high levels of psychopathology. Screening protocols should be developed carefully, as the current study provides new insight as to which factors are most robustly associated with depression and anxiety symptomatology (i.e., global ED pathology, emotional eating, parent psychological control, and subjective social status). Clinicians should therefore consider including these factors (as opposed to other factors at the various SEM levels) as part of their screening protocols to provide more purposeful and targeted assessments of risk factors for depression and anxiety symptomatology. This will allow providers to assess risk profiles for mental health problems more efficiently, thus minimizing patient burden and optimizing clinic time.

Additionally, for those children who indicate low to moderate levels of psychopathology, it may be useful for the provider to monitor their symptoms during treatment (as these symptoms may vary in their natural course over time), modify/broaden treatment components, and/or add supplemental sessions, in order to address their mental health concerns and related risk factors. For example, self-monitoring is an important behavioral skill taught in FBT -- children are asked to keep a record of their food and activity behaviors, which they review with their parents and interventionists on an ongoing basis. Recording emotional distress (e.g., journaling) has been shown to significantly improve depression and anxiety symptoms⁴⁹; thus, it might be beneficial to broaden the self-monitoring component of FBT to also include negative affect. Additionally, although the SMFQ and SCARED have not previously been used in an FBT-seeking sample, the scales' ease of administration and user-friendliness make them good tools for periodically monitoring psychopathology symptoms throughout treatment (e.g., every 2 weeks). For those struggling with depression and/or anxiety symptoms and emotional eating, the intervention approach could be adapted to address the negative emotions (e.g., frustration and sadness) underlying current eating behaviors as well as to teach healthy strategies for coping with these emotions. Similarly, screening for parent-level variables, such as parenting style, may reveal parents who are high in psychological control. Parenting is already a major

component of FBT (e.g., encouraging parents to offer praise and positive reinforcement for healthy energy-balance behaviors). Although FBT is particularly beneficial (compared to standard care) for poorly functioning families⁵⁰, treatment could be tailored, when needed, to also educate parents on the importance of empathy, promoting child autonomy, and avoiding emotionally-manipulative strategies for controlling their child's behavior. Finally, although weight-control programs have been developed that focus on the social/peer aspects of food and activity behaviors²⁵, this content could be expanded to also focus on ways to improve children's subjective social status.

The current study has limitations worth noting. First, the direction of causality cannot be definitively determined by our analyses, and there are plausible reasons to assume that some of the associations found in the present analyses may go in both directions (e.g., the relation between emotional eating and negative affect). Second, the present assessments of psychopathology (i.e., SMFQ and SCARED) are not diagnostic measures and do not necessarily indicate a diagnosis of depression or anxiety; future research in this age-group might include diagnostic interviews as part of their assessments, like one study did in a sample of primarily adolescent youth with OW/OB⁵. Third, the present study is a secondary analysis, such that the variables chosen to be examined were limited to the measures administered in the main study. Thus, there are other potential variables accounted for by the SEM that were not included in the analyses but may play a role in mental health concerns among the study population. Finally, although the current sample appears to be fairly representative of FBT-seeking children, with similar demographics as in other studies^{2,7} that assessed self-reported depression and anxiety symptomatology, the results may be specific to FBT-seeking youth, rather than all children with OW/OB. Despite these limitations, the study presents several strengths such as using simple self-report measures of child psychopathology (rather than parent-report) in a much larger clinical sample, assessing for depression and anxiety separately, and the novel use of the SEM framework as a guide for examining a broader and more comprehensive set of factors associated with psychopathology among this population.

In summary, given that only some variables were associated with depression and anxiety symptomatology in the full models, FBT providers should consider developing screening protocols that focus on assessing for these factors, as opposed to the ones at various SEM levels that were not significantly associated with depression and anxiety symptomatology. This will ultimately create a more effective and efficient way to measure psychopathology profiles and risk-potential among children seeking treatment for OW/OB. Furthermore, since the current study found higher rates of depression symptomatology, and somewhat higher rates of anxiety symptomatology, compared to the two previous studies^{2,7}, it may be more essential than previously understood to adapt and broaden the scope of pediatric weight-loss treatments in order to better address depression and anxiety symptoms, as well as the modifiable individual-, family/parental-, and social/peer-level factors associated with these symptoms. Confronting mental health problems during pediatric weight-loss treatment has the potential to improve quality of life and overall health status. Further research is needed to test the feasibility of such treatment modifications, as well as different screening protocols, and whether they reduce children's mental health concerns and/or contribute to greater weight-loss.

Acknowledgements:

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Funding Source:

This work was supported by several National Institutes of Health (NIH) Grants: 5R01HD036904 (National Institute of Child Health and Human Development), 5K24MH070446 (National Institute of Mental Health), KL2RR024994 (National Center for Research Resources), 1F31DK113700 (National Institute of Diabetes and Digestive and Kidney Diseases) and 5T32HL007456 (National Heart, Lung, and Blood Institute). This work was also made possible by NIH Grant UL1 RR024992 (National Center for Research Resources).

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Table 1.

Zero-order associations between child psychopathology and continuous SEM-level factors

| Continuous Variables | Depression Symptoms (SMFQ) | Anxiety Symptoms (SCARED) |
|--------------------------------------------------------------|----------------------------|---------------------------|
| Continuous Variables | Correlations | |
| Individual-Level Factors | | |
| Child age | 0.035 | -0.050 |
| Child percent overweight | 0.008 | -0.018 |
| Global eating disorder pathology (YEDE-Q) | 0.533 ^{***} | 0.565 ^{***} |
| Emotional eating (EES-C) | 0.457 ^{***} | 0.466 ^{***} |
| Family/Parental-Level Factors | | |
| Family SES | -0.028 | -0.111 |
| Parent psychopathology (BSI) | 0.130 [*] | 0.068 |
| Parent acceptance (CRPBI) | -0.126 | -0.042 |
| Parent firm control (CRPBI) | 0.209 ^{***} | 0.126 |
| Parent psychological control (CRPBI) | 0.302 ^{***} | 0.312 ^{***} |
| Social/Peer-Level Factors | | |
| Social problems (CBCL) | 0.255 ^{***} | 0.219 ^{***} |
| Subjective social status | -0.237 ^{***} | -0.078 |
| Community-Level Factors | | |
| Median household income ^a | -0.120 | -0.134 [*] |
| Percent of adults who are HS graduate or higher ^a | -0.072 | -0.117 |
| Perceived crime incidence (NEWS) | 0.019 | 0.078 |
| Perceived outdoor safety (NEWS) | -0.161 [*] | -0.199 ^{**} |

Note: All significance levels are 2-tailed. All variables are from baseline assessments.

Abbreviations: SEM, Social Ecological Model; SMFQ, Short Mood and Feelings Questionnaire; SCARED, Screen for Child Anxiety Related Disorders; YEDE-Q, Youth Eating Disorder Examination Questionnaire; EES-C, Emotional Eating Scale for Children and Adolescents; SES, socioeconomic status; BSI, Brief Symptom Inventory; CRPBI, Children's Report of Parental Behavior Inventory; CBCL, Child Behavior Checklist; HS, high school; NEWS, Neighborhood Environment Walkability Scale

* P <.05,

** P <.01,

*** P <.001

^aFor the family's zip code, based on 2010 U.S. Census data

Table 2.

Zero-order associations between child psychopathology and dichotomous SEM-level factors

| Individual-Level Factors | | Depression Symptoms (SMFQ) | | | Anxiety Symptoms (SCARED) | |
|--------------------------|----------------------|----------------------------|--------------------|-----------------------------|---------------------------|-----------------------------|
| | | <i>N</i> | Mean (<i>SD</i>) | <i>T</i> (<i>df</i> = 239) | Mean (<i>SD</i>) | <i>T</i> (<i>df</i> = 239) |
| Child Sex | Male | 90 | 5.9 (5.4) | 0.39 | 17.6 (13.1) | 2.04 * |
| | Female | 151 | 6.1 (5.7) | | 21.5 (14.9) | |
| Child Race/ Ethnicity | Non-Hispanic White | 156 | 6.3 (5.9) | 0.91 | 20.7 (14.3) | 0.54 |
| | Other race/ethnicity | 85 | 5.6 (4.8) | | 19.7 (14.4) | |
| LOC status ^a | LOC | 82 | 8.2 (6.3) | 4.22 *** | 26.2 (15.5) | 4.70 *** |
| | No LOC | 159 | 4.9 (4.8) | | 16.9 (12.6) | |

Note: All significance levels are 2-tailed. All variables are from baseline assessments.

Abbreviations: SEM, Social Ecological Model; SMFQ, Short Mood and Feelings Questionnaire; SCARED, Screen for Child Anxiety Related Disorders; LOC, Loss of control

* $P < .05$,

*** $P < .001$

^a Any LOC eating during the past 3 months, based on the Child Eating Disorder Examination

Table 3.

Hierarchical regression analyses for associated factors of depression symptomatology (SMFQ)

| Variables | <i>B</i> | <i>SE B</i> | β | <i>p</i> | <i>R</i> ² | <i>R</i> ² | <i>p</i> | <i>R</i> ² |
|----------------------------------------------|----------|-------------|---------|----------|-----------------------|-----------------------|----------|-----------------------|
| <i>Step 1: Individual-Level Factors</i> | | | | | .391 | .391 | <.001 | |
| Global eating disorder pathology (YEDE-Q) | 1.80 | 0.28 | .37 | <.001 | | | | |
| Emotional eating (EES-C) | 2.09 | 0.42 | .28 | <.001 | | | | |
| Any LOC eating during past 3 months (ChEDE) | 0.57 | 0.63 | .05 | .366 | | | | |
| <i>Step 2: Family/Parental-Level Factors</i> | | | | | .416 | .025 | .027 | |
| Parent psychopathology (BSI) | 0.04 | 0.03 | .08 | .137 | | | | |
| Parent firm control (CRPBI) | 0.05 | 0.10 | .02 | .638 | | | | |
| Parent psychological control (CRPBI) | 0.14 | 0.07 | .11 | .038 | | | | |
| <i>Step 3: Social/Peer-Level Factors</i> | | | | | .471 | .055 | <.001 | |
| Social problems (CBCL) | 0.06 | 0.05 | .07 | .220 | | | | |
| Subjective social status | -0.56 | 0.13 | -.23 | <.001 | | | | |
| <i>Step 4: Community-Level Factors</i> | | | | | .473 | .002 | .321 | |
| Perceived outdoor safety (NEWS) | -0.25 | 0.25 | -.05 | .321 | | | | |

Note: *B* and *SE B* are the beta coefficients, and β is the standardized beta coefficient. Beta values are from the final model. All variables are from baseline assessments.

Abbreviations: SMFQ, Short Mood and Feelings Questionnaire; YEDE-Q, Youth Eating Disorder Examination Questionnaire; EES-C, Emotional Eating Scale for Children and Adolescents; LOC, loss of control eating; ChEDE, Child Eating Disorder Examination-abbreviated version; BSI, Brief Symptom Inventory; CRPBI, Children's Report of Parental Behavior Inventory; CBCL, Child Behavior Checklist; NEWS, Neighborhood Environment Walkability Scale

Table 4.

Hierarchical regression analyses for associated factors of anxiety symptomatology (SCARED)

| Variables | <i>B</i> | <i>SE B</i> | β | <i>p</i> | <i>R</i> ² | <i>R</i> ² | <i>p</i> | <i>R</i> ² |
|----------------------------------------------|----------|-------------|---------|----------|-----------------------|-----------------------|----------|-----------------------|
| <i>Step 1: Individual-Level Factors</i> | | | | | .436 | .436 | <.001 | |
| Child sex | 2.44 | 1.55 | .08 | .118 | | | | |
| Global eating disorder pathology (YEDE-Q) | 5.51 | 0.75 | .42 | <.001 | | | | |
| Emotional eating (EES-C) | 4.77 | 1.14 | .24 | <.001 | | | | |
| Any LOC eating during past 3 months (ChEDE) | 2.03 | 1.70 | .07 | .234 | | | | |
| <i>Step 2: Family/Parental-Level Factors</i> | | | | | .452 | .016 | .013 | |
| Parent psychological control (CRPBI) | 0.44 | 0.17 | .13 | .013 | | | | |
| <i>Step 3: Social/Peer-Level Factors</i> | | | | | .462 | .010 | .043 | |
| Social problems (CBCL) | 0.22 | 0.12 | .09 | .074 | | | | |
| <i>Step 4: Community-Level Factors</i> | | | | | .469 | .007 | .268 | |
| Median household income ^a | 0.00 | 0.00 | .04 | .439 | | | | |
| Perceived outdoor safety (NEWS) | -0.96 | 0.65 | -.08 | .138 | | | | |

Note: *B* and *SE B* are the beta coefficients, and β is the standardized beta coefficient. Beta values are from the final model. All variables are from baseline assessments.

Abbreviations: SCARED, Screen for Child Anxiety Related Disorders; YEDE-Q, Youth Eating Disorder Examination Questionnaire; EES-C, Emotional Eating Scale for Children and Adolescents; LOC, loss of control; ChEDE, Child Eating Disorder Examination-abbreviated version; CRPBI, Children's Report of Parental Behavior Inventory; CBCL, Child Behavior Checklist; NEWS, Neighborhood Environment Walkability Scale

^aFor the family's zip code, based on 2010 U.S. Census data