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The Nosological Status of Loss of Control over Eating in Children

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by

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ABSTRACT OF THE DISSERTATION

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Professor Denise Wilfley, Chair

A significant subset of overweight children report loss of control (LOC) over eating (i.e., feeling unable to stop eating), a correlate of poorer psychosocial functioning and obesity. Another obesogenic appetitive trait, high food reinforcement, is characterized by a strong drive to obtain palatable food. LOC and high food reinforcement both predict increased energy intake and excessive weight gain, although the association between LOC and high food reinforcement has not been examined in youth. Additionally, the impact of LOC or high food reinforcement on pediatric weight loss treatment response remains unclear, including whether children with fewer alternate (non-snack food) reinforcers available in their environment are particularly at risk for poor outcomes. Overweight children (N = 241), each with one parent, were assessed at baseline and following 4-month family-based behavioral weight loss treatment. Children who reported ≥1 LOC episode in the past 3 months were categorized as LOC (n = 62, 25.7%) and compared against children reporting no recent LOC (No LOC). As hypothesized, LOC children were more likely to demonstrate high food reinforcement, as well as self-reported higher emotional eating, depressive and anxiety symptoms, and poorer quality of life than No LOC children, although LOC groups did not differ on corresponding parent-report on child variables. Moreover, LOC and food reinforcement interacted with child gender and reinforcers in the environment, respectively—boys with LOC, and children with low food reinforcement and higher alternate reinforcers, achieved the best weight outcomes. Although child-parent associations were not observed for LOC, relations between child and parent food reinforcement and between parent food reinforcement and alcohol

reinforcement indicate high food reinforcement's potential heritability and lack of domain-specificity. Overall, pediatric LOC eating appears associated with higher food reinforcement and poorer perceived quality of life, but may not hinder short-term family-based treatment success. Future longitudinal studies are needed to assess improvement in LOC severity over time and its potential impact on both short- and long-term treatment response. Findings additionally underscore the importance of targeting the provision of alternate reinforcers to high energy-dense foods as a means of enhancing treatment response within pediatric weight control programs.

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INTRODUCTION

Childhood obesity is a significant problem worldwide that has increased dramatically in recent decades (Ogden et al., 2006; Ogden, Flegal, Carroll, & Johnson, 2002). In addition to physical health sequelae, being overweight during childhood is associated with a myriad of psychosocial problems (Strauss & Pollack, 2003). Overweight children report greater eating pathology than their normal weight peers (Goldschmidt, Aspen, Sinton, Tanofsky-Kraff, & Wilfley, 2008), including loss of control (LOC) eating episodes, which are characterized by the sense that one cannot control what or how much one is eating (American Psychiatric Association, 2000). LOC eating episodes are associated with excess weight gain and obesity in children (Field et al., 2003; Tanofsky-Kraff et al., 2006; Tanofsky-Kraff, Yanovski, et al., 2009), in addition to deficits in psychosocial functioning (Goldschmidt & Wilfley, 2009; Morgan et al., 2002). Given that a significant subset (i.e., 20-35%) of overweight treatment-seeking children report LOC eating (Goossens, Braet, & Decaluwe, 2007; Tanofsky-Kraff, Faden, Yanovski, Wilfley, & Yanovski, 2005), enhancing the understanding of issues that may impact the classification of pediatric LOC eating could inform treatment and prevention program development, in an effort to hamper the development of chronic medical and psychological difficulties in these youth.

More research is needed regarding the profile of behaviors characterizing children with LOC. In particular, children who report LOC eating may be experiencing a higher level of food reinforcement than children who do not report LOC eating. A high level of food reinforcement is a behavioral marker of increased motivation to obtain palatable food, which is cross-sectionally associated with obesity (Epstein, Temple, et al., 2007; Saelens & Epstein, 1996) and increased food consumption in the laboratory (Epstein, Temple, et al., 2007; Epstein et al., 2004) in adults, as well as excessive weight gain over time (Hill, Saxton, Webber, Blundell, & Wardle, 2009) in children. Similar to individuals with LOC eating, individuals who experience a greater level of food reinforcement appear to be at a higher risk for the development and maintenance of obesity (Epstein, Leddy, Temple, & Faith, 2007; Hill et al., 2009), and this pattern may be especially strong among individuals with few alternate reinforcers available in the surrounding environment

(Ashcroft, Semmler, Carnell, van Jaarsveld, & Wardle, 2008; Poston & Foreyt, 1999; Timperio, Salmon, Telford, & Crawford, 2005). It also is not entirely clear whether overweight adults with high food reinforcement also experience a generally higher drive to obtain other rewards, such as alcohol, or whether this motivation to work for pleasurable reinforcers is domain-specific to palatable food (Volkow & Wise, 2005).

Of particular relevance to the present study is the possibility that experiencing either LOC eating or high food reinforcement could potentially impede success in weight loss treatment. Indeed, successful weight control is already difficult for most individuals to achieve (Jeffery et al., 2000; Wilfley, Stein, et al., 2007a), and efforts might be complicated by the presence of LOC and associated features. Thus, identifying individuals at particularly high risk for obesity and excessive weight gain based on these behavioral indicators could aid in enhancing and personalizing treatment and targeted prevention interventions to maximize sustained weight loss.

To explore these questions, the present study's aims were to: 1) examine the association between LOC eating and high food reinforcement in children; 2) augment existing data regarding the association between pediatric LOC eating and other related appetitive traits (e.g., poorer satiety responsiveness, greater emotional eating), increased internalizing symptoms, and decreased quality of life; 3) examine LOC as a predictor of pediatric weight loss treatment outcome; 4) examine the relation between child and parent food reinforcement; 5) explore the extent to which the level of non-snack food reinforcers in children's home and neighborhood environment moderates the effect of high food reinforcement on pediatric weight loss treatment outcome; and 6) explore the association between high alcohol reinforcement in parents and high food reinforcement in children and parents. To address these questions, a large sample of families (i.e., parent-child dyads) was assessed before and after participating in a 4-month standard family-based weight loss treatment.

BACKGROUND

To establish the need for the present study, this background section will first define loss of control (LOC) and binge eating and describe disorders involving binge eating in adults, followed by a discussion of the significance of loss of control and binge eating in youth, as well as the assessment and diagnosis of loss of control eating behaviors in children. Finally, general and domain-specific reward sensitivity will be discussed, with the examples of alcohol and palatable foods. Specifically, the concept of food reinforcement—also referred to as the relative reinforcing value of food—will be defined and discussed, including existing adult and pediatric literature. Non-snack food reinforcers available in children's home and neighborhood environment (e.g., physical activity equipment) may impact the relation between food reinforcement and successful weight control by providing alternative sources of reinforcement for overweight children. Throughout, it will be highlighted how relevant findings could inform the profile of characteristics exhibited by children who experience loss of control over eating.

Definition of Loss of Control (LOC) and Binge Eating

Loss of control over eating (LOC) is defined as the experience of not being able to control what or how much one is eating (American Psychiatric Association, 2000). Binge eating episodes are characterized both by LOC and the consumption of, "in a discrete period of time (e.g., within any 2-hr period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances" (American Psychiatric Association, 2000).

By combining or separating these constructs (LOC and an *unambiguously large* amount of food), aberrant eating episodes fall into three distinct categories. Eating episodes that meet both of the above criteria (i.e., LOC and an unambiguously large amount of food) are classified as objective binge episodes (OBEs), whereas those episodes with LOC but without an unambiguously large amount of food are deemed subjective binge episodes (SBEs). Finally, unambiguously large eating episodes not accompanied by a sense of LOC are categorized as

objective overeating episodes (OOs) (Fairburn & Cooper, 1993). Normal eating episodes are those that fail to meet any of the above criteria.

Deciding what qualifies as an unambiguously large amount of food is often difficult, especially among children (see below, “Assessment of Loss of Control Eating in Youth”). Specifically, evaluating children’s episode size is influenced by considering children's developmental stage and increasing caloric needs over time (Goldschmidt, Doyle, & Wilfley, 2007). Also of note, self-report of energy intake includes some measurement error, and heavier children may provide less accurate reports of their energy intake compared to normal weight youth (Bandini, Schoeller, Cyr, & Dietz, 1990). Finally, young children (i.e., aged 12 years and younger) often do not have access to the unambiguously large amount of food necessary for their eating episodes to qualify as objective binge eating (Goossens et al., 2007). As such, assessment of aberrant eating episodes in adults (Fairburn & Cooper, 1993) and children (Bryant-Waugh, Cooper, Taylor, & Lask, 1996) requires conservative coding of episode size, often minimizing the distinction between LOC eating episodes with and without an “unambiguously large amount of food” in children—that is, binge eating versus more broadly defined LOC eating (Tanofsky-Kraff, 2009).

LOC eating episodes will be used herein to refer to all eating episodes in which LOC is experienced, regardless of the amount of food, whereas *binge eating episodes* refer only to those LOC episodes which are deemed by the assessor to be unambiguously large. LOC eating episodes can be of any size provided they are viewed as excessive by the respondent.

Ultimately, LOC episodes reported by youth—regardless of whether they qualify as unambiguously large binge episodes of sufficient frequency to meet diagnostic criteria—are thought to reflect an overall diet containing excess energy intake (Theim et al., 2007). Intervening with children at an early age to form healthy eating habits and stem the development of binge eating is crucial, considering that even a small surplus of energy intake leads to excess weight gain over time; for example, an excess consumption of 120 calories per day, or the equivalent of one regular soda, could result in a weight gain of over 100 pounds over 10 years (Ebbeling,

Pawlak, & Ludwig, 2002). Existing research regarding binge eating in adults is discussed below, which set the stage for the present investigation of LOC eating in children.

Binge Eating Disorders in Adults

Recurrent binge eating is the hallmark of both bulimia nervosa and binge eating disorder (BED), eating disorders characterized by significant physical and psychosocial impairment (Hudson, Hiripi, Pope, & Kessler, 2007). BED—the eating disorder most recently recommended for formal inclusion in DSM-5—is a stable syndrome and an eating disorder of clinical significance, yet distinct from anorexia nervosa and bulimia nervosa (Pope et al., 2006; Wilfley, Bishop, Wilson, & Agras, 2007; Wilfley, Wilson, & Agras, 2003). In particular, BED confers significant risk for the development and maintenance of obesity (Yanovski, Nelson, Dubbert, & Spitzer, 1993) and has a demographic profile different from the other eating disorders, such as the fact that it affects more males than other eating disorders and has a later age of onset (American Psychiatric Association, 2000; Spitzer et al., 1993).

Emerging research continues to illuminate the appropriate classification and treatment of BED in adults (Theim & Wilfley, 2009; Wilfley, Bishop, et al., 2007). For example, many adults who experience LOC eating may not meet the diagnostic threshold for BED—often due to insufficient binge eating frequency (i.e., fewer than two episodes per week), despite the presence of frequent LOC. However, these cases of "subthreshold BED" tend to confer similar levels of psychiatric distress, obesity, and associated eating pathology when compared to adults with sufficiently frequent binge eating (Crow, Stewart Agras, Halmi, Mitchell, & Kraemer, 2002; Striegel-Moore et al., 2000). Additionally, some evidence suggests that, in addition to the importance of an unambiguously large episode size, the experience of LOC may be the feature of binge eating that best predicts psychosocial distress and impairment (Colles, Dixon, & O'Brien, 2008; Pratt, Niego, & Agras, 1998). That is, in adults, overall eating pathology (Niego, Pratt, & Agras, 1997) and psychological markers of distress (Colles et al., 2008) in BED are more closely tied to the presence of LOC than to the presence of an unambiguously large amount of food. A

more detailed discussion of these findings as they pertain to pediatric binge eating is included below.

Significance of LOC and Binge Eating in Youth

Despite significant advances in adult BED diagnostic research, similar research in children and adolescents is emerging but is still less developed, and less is known about the clinical utility and predictive validity of eating disorders involving LOC in young children (i.e., aged 12 years and younger). Although few children meet full criteria for BED, youth commonly report LOC eating (Field, Colditz, & Peterson, 1997; Johnson, Rohan, & Kirk, 2002; Neumark-Sztainer & Hannan, 2000). In particular, a significant proportion (i.e., approximately 20-35%) of overweight children and adolescents report LOC eating (Glasofer et al., 2007; Morgan et al., 2002; Neumark-Sztainer, Story, Hannan, Perry, & Irving, 2002).

Association with Excess Weight Gain and Obesity

Children with LOC eating are more likely to be overweight or obese, and LOC eating predicts weight and fat mass gain over time (Field et al., 2003; Tanofsky-Kraff et al., 2006; Tanofsky-Kraff, Yanovski, et al., 2009). A potential mechanism by which LOC contributes to excess adiposity is excess energy intake; when children are interviewed regarding their LOC eating episodes, they report a higher consumption of energy-dense foods (e.g., snacks, desserts, and lower protein content) than in episodes reported by children with no LOC eating (Theim et al., 2007). These findings have been replicated by studies of children's eating in the laboratory setting (Tanofsky-Kraff, McDuffie, et al., 2009) as well as using ecological momentary assessment (Hilbert, Rief, Tuschen-Caffier, de Zwaan, & Czaja, 2009). Studies have also suggested that children with LOC eating experience a briefer satiety duration following meals compared to children without LOC (Mirch et al., 2006). Altogether, these findings may reflect an overall diet with an excess energy balance in children with LOC eating, thus promoting and/or maintaining adiposity.

Alternatively, it is possible that LOC eating is simply a correlate of obesity that has already developed in children or adults, considering that many adults with BED retrospectively report being overweight as children prior to the onset of their binge eating (Reas & Grilo, 2007). Of note, however, many individuals also report a concurrent onset of binge eating and overweight during childhood (Reas & Grilo, 2007), and a substantial proportion of adults with BED report binge eating onset before their first attempt at dieting (Grilo & Masheb, 2000; Manwaring et al., 2006), which may suggest that binge eating preceded overweight (Mussell et al., 1995).

In sum, data suggest that binge eating is a reliable predictor of obesity onset in previously normal weight youth (Stice, Presnell, & Spangler, 2002). Further, LOC eating in general (i.e., with or without an unambiguously large amount of food) is not only cross-sectionally associated with increased adiposity when compared to children with overeating without LOC (Tanofsky-Kraff et al., 2004), but also prospectively predicts excess relative body weight gain (Tanofsky-Kraff, Yanovski, et al., 2009) and fat mass gain (Tanofsky-Kraff et al., 2006) over time.

Psychosocial Correlates

In addition to the physical consequences of LOC and binge eating, psychosocial correlates of LOC eating in children have been identified. Studies of treatment-seeking overweight children and adolescents have found that those who report LOC eating episodes tend to also have higher depressive symptoms and associated disordered eating attitudes (Berkowitz, Stunkard, & Stallings, 1993; Eddy et al., 2007; Isnard et al., 2003). Furthermore, youth with LOC accompanied by unambiguously large amounts of food (i.e., objective binge episodes) may be a particularly pathological group with regard to associated disordered eating, depressive symptoms, and anxiety (Goossens et al., 2007; Goossens, Braet, Van Vlierberghe, & Mels, 2009a). Data from overweight non-treatment-seeking children have yielded similar findings (Tanofsky-Kraff, Faden, et al., 2005; Tanofsky-Kraff et al., 2004).

Furthermore, data from adults have indicated that BED is associated with impairments in quality of life (De Zwaan et al., 2002; Rieger, Wilfley, Stein, Marino, & Crow, 2005). However, few similar studies have been conducted with youth. Among adolescents, data from at least two

studies suggest that adolescent boys and girls with elevated disordered eating behaviors and cognitions (e.g., eating concern, weight/shape concern, LOC, compensatory behaviors) report decreased health-related quality of life (Doyle, le Grange, Goldschmidt, & Wilfley, 2007; Herpertz-Dahlmann, Wille, Holling, Vloet, & Ravens-Sieberer, 2008). Of note, these studies were conducted in adolescents above age 11 years and did not measure the singular association between LOC eating and quality of life. Thus, data are needed regarding the specific influence of LOC eating on young children's self-reported and parent-reported quality of life to further explore its association with clinically significant impairment.

Impact of LOC Eating on Weight Loss Treatment Outcome

Given the association between LOC eating and excess weight and fat gain over time, as well as between LOC eating and psychosocial deficits and distress, one might expect that individuals with LOC would have greater difficulty losing weight within behavioral obesity treatment. Findings in adults, however, have been mixed. Adult studies have compared individuals with and without binge eating, including some with participants who meet full BED criteria. Whereas some data suggest that binge eating status may not adversely impact weight loss treatment outcome among adults (Teixeira, Going, Sardinha, & Lohman, 2005; Wadden, Foster, & Letizia, 1992; Wonderlich, de Zwaan, Mitchell, Peterson, & Crow, 2003), in other studies adults who report binge eating have greater weight loss treatment attrition (Sherwood, Jeffery, & Wing, 1999; Yanovski, 1993), less weight loss within treatment (Blaine & Rodman, 2007; Pagoto et al., 2007), and greater regain following treatment cessation (Agras, Telch, Arnow, Eldredge, & Marnell, 1997; Sherwood et al., 1999; Yanovski, Gormally, Leser, Gwirtsman, & Yanovski, 1994). A small study of obese women with subthreshold binge eating or BED participating in a very-low-calorie diet program found that subjects with BED were more likely to regain at least 50% of their weight loss at 3-month follow-up and to have a poor weight loss outcome at 1-year follow-up (Yanovski et al., 1994). In a study of 444 obese women participating in weight loss treatment, those with binge eating problems were more likely to drop out of treatment (Sherwood et al., 1999). Furthermore, findings from a meta-analysis of weight loss

programs suggested that binge eating negatively affects treatment outcome; although obese adults with and without BED achieved comparable improvements in depressive symptoms, adults with BED lost significantly less weight than non-BED adults (i.e., an average weight loss of 1.3 kg vs. 10.5 kg, respectively) after controlling for baseline weight (Blaine & Rodman, 2007).

Despite the potential for binge eating to affect weight control success, few studies have examined this question in pediatric samples. In a study of obese children in weight loss treatment by Levine and colleagues, baseline eating pathology (i.e., binge eating) did not impact weight outcomes (Levine, Ringham, Kalarchian, Wisniewski, & Marcus, 2006). However, the total sample size was small (n = 27), including only 4 children reporting LOC eating. Interestingly, attrition was higher among children reporting LOC (2 out of 4, or 50%, compared to 30% of children without LOC), although this difference was not statistically significant, likely due to the small sample size.

To follow-up on these preliminary data, Wildes and colleagues found that within a weight loss trial for obese children, youth with binge eating exhibited poorer weight loss outcomes within treatment (Wildes et al., 2010). Although differences were not observed at long-term follow-up—which may have been due to weight regain in both groups following the end of the intervention—these findings merit replication, given the importance of short-term weight loss success in long-term outcome (Goldschmidt et al., in press). Of note, however, this study used a brief questionnaire measure of binge eating (a single item from the Children's Eating Attitude Test), and categorized children as "binge eating" according to the measure's scoring guidelines for frequency of "often" and higher, which excludes children who report binge eating "rarely" or "sometimes." In addition, preliminary data from a study of adolescents receiving a combination pharmacological (Orlistat) and lifestyle weight loss treatment found that youth who reported LOC eating episodes had poorer weight loss outcomes (Ranzenhofer et al., 2008). Lastly, one study investigated the impact of subjective binge episodes (SBEs) on treatment completion and outcome among children and adolescents (aged 8-18 years) undergoing 10-month inpatient treatment (Goossens, Braet, Van Vlierberghe, & Mels, 2009b). A gold-standard interview was

used to assess LOC eating episodes in this study; presence of LOC episodes (SBEs or OBEs) did not impact weight loss outcomes, although children who reported SBEs (subjectively large LOC episodes) had a lower rate of attrition from the program. The authors posit that their treatment program may have fulfilled a perceived need for these children, who may have been distressed by their LOC and thus been motivated to engage in treatment.

Overall, data are mixed regarding whether young children with LOC exhibit different weight loss treatment outcomes than those without LOC. Of note, sample sizes in some studies have been small, and a gold-standard interview technique has often not been used to assess binge eating. Further investigation is needed to clarify the association between LOC eating and weight loss treatment outcome.

Assessment of LOC Eating in Youth

The measurement of eating behavior in youth poses special difficulties. In particular, assessing the construct of LOC in young children is particularly challenging. Disordered eating behaviors are often just beginning to emerge in young children, who thus may find it difficult to report on relatively new behaviors (Tanofsky-Kraff et al., 2003). For example, although the link between LOC eating and eating in response to emotional states has been established (Tanofsky-Kraff, Theim, et al., 2007), many young children may not be able to adequately recognize and name their emotions, nor may they be aware of the potential impact of their emotions on their eating behavior (Tanofsky-Kraff et al., 2003). Furthermore, making clinical judgments regarding the amount of food sufficient to qualify as unambiguously large is often particularly difficult in children, as mentioned above (Goldschmidt et al., 2007). Lastly, children may interpret what is meant by *loss of control* in a variety of ways, without additional explanation.

Considering the general difficulty in accurately assessing young children (Sattler, 1990), researchers and clinicians often administer questionnaires to parents to collect data on their children's eating behavior. However, despite the wealth of information that can be gathered from parents regarding their young children, several studies have revealed generally low agreement

between children's self-report and parent-reports on children's LOC eating episodes (Steinberg et al., 2004; Tanofsky-Kraff, Yanovski, & Yanovski, 2005). Parent-child agreement may be especially poor for elementary-aged children (Braet et al., 2007). It is unclear whose report (child self-report or parent-report on child) is more accurate. It may be that parents are less accurate or more biased when reporting on the eating behavior of children in this young age group, especially if the child is overweight (Braet et al., 2007). Altogether, studies have suggested that parents may be best able to report on their child's eating-related distress (Tanofsky-Kraff, Yanovski, et al., 2005) and on the absence of eating pathology (Johnson, Grieve, Adams, & Sandy, 1999), but that they may not be able to provide an accurate account of the presence of LOC or emotional eating—behaviors that are often secretive and not observable, given that they rely on individuals' internal feelings.

Within an interview setting, probes to explain the concept of LOC may be included (Tanofsky-Kraff, 2009)—a method that is likely particularly helpful for children, who may have difficulty accurately reporting LOC on a questionnaire without assistance. The Child Eating Disorder Examination (ChEDE) (Bryant-Waugh et al., 1996) is a widely used gold-standard diagnostic interview for the assessment of eating behavior in youth. It was adapted from the Eating Disorder Examination (Fairburn, 2008; Fairburn & Cooper, 1993), an assessment of eating disorder behaviors and cognitions that has demonstrated good validity and reliability in adult clinical samples (Cooper, Cooper, & Fairburn, 1989; Grilo, Masheb, Lozano-Blanco, & Barry, 2004; Rosen, Vara, Wendt, & Leitenberg, 1990).

To date, studies that have examined parent-report on child LOC have used the Questionnaire on Eating and Weight Patterns, which does not assess subjectively large binge eating episodes (SBEs; LOC without an unambiguously large amount of food). This is a particularly important limitation of this questionnaire when younger children are studied, as the emergence of objectively large episodes may not have occurred yet in this age group, coupled with a potentially lower rate of free access to objectively large amounts of food in young children. Also of note, the predictive validity of parent-report on child LOC is unclear (i.e., with regard to

excessive weight gain or the development of future eating disorder behaviors), in contrast to the validity data available for the ChEDE (Tanofsky-Kraff et al., 2011; Tanofsky-Kraff, Yanovski, et al., 2009).

Taken together, previous studies suggest that perhaps the ideal method for assessing child LOC is both child and parent interview, so that key concepts may be explained and parallel measures used. However, to minimize respondent burden, an acceptable alternative may be a child interview (ChEDE) along with a parent questionnaire that includes a thorough assessment of the number and recency of both types of LOC eating episodes (objectively large and subjectively large).

Diagnostic Classification of LOC Eating Pathology in Youth

In the development of DSM-5, recommendations have been made regarding eating disorder classification, including attempts to define more accurately the appropriate threshold of clinically significant symptom severity (e.g., binge eating 1 day/week vs. 2 days/week) and duration (e.g., 6 months vs. 3 months) in adults (Wilfley, Bishop, et al., 2007). As mentioned above, research with adolescents suggests that adult BED criteria are useful but that symptoms comprising subthreshold BED also confer distress (Glasofer et al., 2007; Goldschmidt, Jones, et al., 2008). In addition, even infrequent recent episodes of LOC, including those that are not objectively large (i.e., SBEs), are associated with increased general psychopathology, eating pathology, and adiposity in children (Morgan et al., 2002; Shomaker et al., 2010; Tanofsky-Kraff et al., 2004). As LOC eating behaviors are often just beginning to form in young children, even one recent LOC eating episode can confer heightened risk for psychosocial impairment and excessive weight gain compared to children with no reported LOC (Morgan et al., 2002; Tanofsky-Kraff et al., 2004). Furthermore, children who report having ever experienced LOC over eating are at five-fold increased risk for developing partial or full-syndrome BED at long-term follow-up (Tanofsky-Kraff et al., 2011). As such, it is appropriate to study children reporting a range of LOC eating behavior on a continuum (i.e., rather than only using strict BED criteria) so

that a particular threshold and profile of behavioral indicators that confer elevated risk for impairment may be evaluated.

Regarding the size of LOC episodes, pediatric studies have found few differences in impairment between youth reporting LOC eating episodes with or without unambiguously large amounts of food (Glasofer et al., 2007; Goldschmidt, Jones, et al., 2008), similar to findings in adults. In a study of overweight adolescents seeking weight loss treatment, those who met full BED criteria reported a similar level of associated eating pathology and depressive symptoms compared to those with less frequent, recurrent LOC with or without overeating (i.e., "subclinical binge eating") (Goldschmidt, Jones, et al., 2008). As a result of their findings, Goldschmidt, Jones, et al. noted a need for more information regarding how youth with binge eating at a clinical vs. subclinical level differ on other measures of pathology, such as anxiety or self-esteem. Data from another investigation with overweight treatment-seeking adolescents suggested that youth with BED and youth who report recent episodes of binge eating but who do not meet BED criteria report similar levels of disturbed eating cognitions and anxiety, which were elevated compared to youth with no history of LOC episodes (Glasofer et al., 2007). Heightened eating disorder and general psychopathology in youth reporting recent LOC and in those reporting "remote" history of LOC (i.e., not in the past three months) in this previous study highlights the potential importance of recency in the clinical significance of past LOC episodes.

Altogether, the classification of BED in children has proven more difficult than in adults, which may be due in part to different behavioral features and clinically significant LOC episode frequencies in children as compared to adults (Tanofsky-Kraff, Goossens, et al., 2007). Very few children meet full criteria for BED (American Psychiatric Association, 2000), and emerging research suggests that the behavioral characteristics of young children (i.e., aged 12 years and younger) who report LOC eating episodes may differ from those in adolescents and adults. A qualitative multi-site investigation of LOC eating episodes in children aged 12 years and younger was conducted by Tanofsky-Kraff and colleagues (Tanofsky-Kraff, Marcus, Yanovski, & Yanovski, 2008) to refine the proposed pediatric BED criteria, originally developed by Marcus and

Kalarchian (Marcus & Kalarchian, 2003). The revised criteria (see Table 1) reflect features found to describe LOC episodes in children within the multi-site study (Tanofsky-Kraff, Goossens, et al., 2007): eating in response to negative affect, secrecy, feelings of numbness (lack of awareness), eating more than others, and negative affect following eating.

However, more data are needed regarding the behavioral profile characterizing children with LOC. For example, it is possible that children who report periodically engaging in LOC eating episodes experience an overall higher motivation to eat than their non-LOC counterparts, which could impact response to standard weight loss treatments. That is, children with LOC may find food more reinforcing, leading to a stronger urge to seek and consume food than non-LOC children. The concept of sensitivity to reward is discussed below, followed by a discussion of food reinforcement and its relation with obesity in children and adults.

Sensitivity to Reward

Within the literature on reward sensitivity and the reinforcing value of different objects, substances, or experiences, it is important to note the difference between liking and wanting. *Liking* typically refers to one's reaction to the hedonic properties of a stimulus and is thought to be regulated by opiods. A related concept, *wanting*, is used to describe motivation to engage in a rewarding behavior (Berridge, 1996).

Researchers have debated the precise role of dopamine in the experience of feeling an urge for a reward and thus being willing to work to obtain that reward. Essentially, hedonic processes and motivational processes with regard to reward are thought to be distinct systems. The primary focus within the present study was motivational processes (e.g., wanting, willingness to work for a reward, reinforcement), with an understanding that the hedonic properties of a reward are important as well. For example, the use of drugs and alcohol affects individuals differently with regard to the subjective pleasure derived from these substances, and this liking is related to yet distinct from the propensity of some individuals to become addicted. Another

Table 1

Provisional Criteria for Loss of Control Eating Disorder (LOC-ED) in Children Aged 12 Years and Younger (Tanofsky-Kraff et al., 2008)

A.	Recurrent episodes of LOC eating. An episode of LOC eating is characterized by both of the following:
	1. A sense of lack of control over eating.
	2. Food seeking in the absence of hunger or after satiation.
B.	The LOC eating episodes are associated with three or more of the following:
	1. Eating in response to negative affect.
	2. Secrecy regarding the episode.
	3. Feelings of numbness (lack of awareness) while eating.
	4. Eating more, or the perception of eating more, than others.
	5. Negative affect following eating (e.g., shame/guilt).
C.	The LOC eating episodes occur, on average, at least twice a month for three months.
D.	Eating is not associated with the regular use of inappropriate compensatory behaviors and does not occur exclusively during the course of anorexia nervosa, bulimia nervosa, or binge eating disorder.

example, as discussed in more detail below, is palatable food, which tends to be universally pleasurable to humans whereas disparities in food reinforcement emerge independent of differences in liking.

These and other factors come in to play when individuals are faced with choices throughout the day, including choices that influence consumption of rewarding substances such as drugs or food (Epstein, Leddy, et al., 2007). A relatively parsimonious yet highly useful framework used to conceptualize individuals' choices of this type is behavioral economics—the application of economic principles (e.g., weighing the costs and expected benefits of a reward) to human behavior (Bickel, DeGrandpre, & Higgins, 1993). When constraints are placed on access to a reinforcer (e.g., lack of availability, greater work required to obtain it), individuals weigh the value of the reinforcer along with their consequent motivation to obtain that reinforcer and choose a behavior accordingly (e.g., seek out the reinforcer or seek out an alternative item or activity). Generally speaking, a reinforcer is defined as a stimulus that increases the rate of a preceding behavior; the *reinforcing value* of an item reflects how hard an individual is willing to work to obtain that desired item (Epstein, Leddy, et al., 2007). Most commonly, the absolute reinforcing value of a reward (i.e., rather than its value relative to an alternative) is measured by manipulating the schedule of responses required to obtain that reward. In the example of self-administration of drugs, human and animal research has demonstrated that as the unit price of an item increases (i.e., the behavioral cost, or response requirement, needed to obtain a unit of a rewarding substance), self-administration typically decreases (Bickel et al., 1993).

Interestingly, it is thought that a disruption in the underlying neurobiological processes involved in reward, such as decreased dopamine receptor levels (Wang, Volkow, Thanos, & Fowler, 2004), are common to many forms of drug addiction (Hetherington, 2007). Two examples of reinforcers that humans commonly seek out and consume are alcohol and food. As neither alcohol nor high-fat snack foods are required for nutritional purposes, they are thought to represent more freely-made choices rather than necessities in individuals' daily lives (i.e., required for survival).

Two Examples of Reward Sensitivity: Alcohol and Palatable Food

Common brain mechanisms are thought to at least partially regulate the reinforcing effects of both addictive drugs and palatable foods, due to the influence of dopamine activation in the experience of reward (Di Chiara et al., 2004; Risinger, Freeman, Rubinstein, Low, & Grandy, 2000; Volkow & Wise, 2005). Given overlapping or common causes to an increase in motivation to obtain a range of reinforcers, it is possible that individuals who experience high reinforcement for one stimulus in their environment (e.g., alcohol) may also experience a higher motivation to work for multiple pleasurable rewards. That is, it has been noted that the behavioral loss of control observed in drug-addicted individuals (Bickel, Madden, & Petry, 1998) shares similarities with the loss of control seen in compulsive overeating (Volkow & Wise, 2005; Wang et al., 2004). Alternatively, it has been proposed that addictive drugs and palatable foods compete for the same neurologic reward sites, which may at least partially explain the lower rates of alcohol and marijuana use among obese individuals as compared to the general population, for example (Kleiner et al., 2004; Warren, Frost-Pineda, & Gold, 2005).

As such, in identifying individuals at high risk for developing problematic behaviors with regard to a rewarding substance (e.g., drug addiction), it is important to understand the interplay between high reinforcement for various stimuli in the environment. These reinforcers could include alcohol and addictive drugs—as well as palatable foods, which often have high energy density and promote excess weight gain over time. Indeed, a range of addictive behaviors such as drug and alcohol abuse have been compared to chronic overeating and binge eating (Corwin & Hajnal, 2005; Davis, Strachan, & Berkson, 2004; Wang et al., 2004). Future studies are needed to elucidate whether high reinforcement generally influences drive to obtain a variety of rewards (e.g., both alcohol and food) or whether, at least for a subset of individuals, the reinforcing value of high energy-dense palatable foods is a distinct behavioral phenotype. In addressing this question, alcohol would be a fitting candidate for exploration given its prevalence of use, compared to illegal drugs of abuse (Grant et al., 2004).

There is an extensive empirical literature on food as a powerful reinforcer in animals (Berridge, 1996; Booth, 1980; Herrnstein & Loveland, 1974). In human studies, it appears that overweight and normal weight individuals do not differ on food liking—that is, measures of the subjective hedonics of common palatable foods tend to be high among normal weight and overweight adults alike (Epstein, Temple, et al., 2007; Temple, 2009). However, some evidence appears to support the theory that a hypersensitivity to reward confers risk for obesity because some individuals are more motivated to work to obtain pleasurable rewards (wanting), such as palatable foods (Davis et al., 2004; Stice, Spoor, Ng, & Zald, 2009).

More specifically, this physiologic susceptibility to a high drive to obtain food as a reward may influence obesity risk indirectly through the promotion of certain eating behaviors, such as high susceptibility to external food cues (Davis et al., 2007). In a study of adult women, a measure of sensitivity to reward (i.e., a scale reflecting one's pleasure derived from and motivation to engage in physically rewarding behaviors) was significantly associated with emotional eating in response to depressive emotions, and both variables were associated with obesity (Davis et al., 2004).

Further exploration is warranted regarding whether a subset of individuals possesses high reinforcement for a range of rewards, given the potential clinical implications for treatment for multiple addictive behaviors. In the context of weight loss treatment, it may be important to know whether an individual evidences a high motivation to seek out and consume rewards—most importantly, high energy-dense foods.

Food Reinforcement: The Relative Reinforcing Value (RRV) of Food

With regard to the specific domain of eating behavior, individuals appear to differ by how reinforcing they find food relative to other commodities. An individual's choice to eat is embedded among a number of possible choices, such as physical or sedentary activity. Thus, the *relative* reinforcing value (RRV) of food has been assessed in recent years as a way to measure how heavily individuals weigh various reward options, such as palatable snack foods (e.g., chips,

cookies), healthy foods (e.g., fruits, vegetables), or non-food reinforcers such as sedentary activity (e.g., reading or television-watching time) or money. More specifically, assessment of the RRV of food often employs palatable foods such as high-fat snack foods, which are thought to provide a proxy estimation of potential real-life situations in which there is actually a *choice* to eat, as snack foods are typically not required for nutritional purposes (Saelens & Epstein, 1996). These snack foods are then compared to any of the other reinforcers listed above. High energy-dense, palatable snack foods are an appropriate food reinforcer to test in the context obesity as they are highly reinforcing for most people, comprise a large portion of individuals' dietary intake (Block, 2004), and are related to increased body weight cross-sectionally (McCrory et al., 1999).

To assess an individual's RRV of snack food, for example, two options are typically presented to an individual that are equally weighted at first, in that they require equal cost or an equal amount of work to obtain. Then, the cost of the target item (i.e., palatable food) is progressively increased while the cost required to obtain the alternate reinforcer is held constant. To conduct this paradigm, assessment of the RRV of food has previously involved a computer-generated concurrent schedules task, in which participants can earn points for the food or a non-food reinforcer, and the number of points required to earn food increases while the cost of the non-food reinforcer remains constant (Lappalainen & Epstein, 1990). A computer game has been used for various reasons, including ease of data collection, as well as participant engagement. In various iterations of this paradigm, the food reward offered within the task is either given to the participant throughout the task or delivered at the end. The outcome variables obtained from this paradigm could include the total number of points obtained for a food reward (i.e., where the participant can chose to work for the target food or for a non-food reinforcer), or the *switch point*, that is, the point at which a participant switches over to preferring the non-food reinforcer when the cost of the target food reinforcer becomes too high. For example, an individual may choose food when the cost of the food and of an alternate reinforcer are equal, but when the cost of the food item becomes high enough that it is not perceived as worthwhile to expend the work to obtain it, he or she then indicates a preference for the alternate reinforcer.

Studies in adults have demonstrated that the assessment of the RRV of food demonstrates good temporal stability and validity with regard to actual energy intake and weight status. For example, level of food reinforcement predicts actual energy intake better than food hedonics—that is, wanting, rather than mere liking (Epstein, Temple, et al., 2007), and that food deprivation increases the reinforcing value of food (Epstein, Truesdale, Wojcik, Paluch, & Raynor, 2003; Goldfield, Epstein, Davidson, & Saad, 2005; Raynor & Epstein, 2003). With regard to test-retest reliability, Epstein and colleagues found a significant correlation (r = .80) between food reinforcement (i.e., the switch point on the RRV of Food Task) among a small sample of adults who completed the task on two visits separated by up to one week (Epstein, Temple, et al., 2007).

To decrease participant burden, a questionnaire (paper-and-pencil task) version of the RRV of Food Task was developed and validated against the computer task (Goldfield et al., 2005). Using a paper-and-pencil assessment also decreases assessor burden, enabling a larger sample size to be measured while still providing a valid assessment of food reinforcement. This questionnaire has also shown acceptability and predictive validity regarding excessive weight gain in children as young as age 7 years (Epstein, Dearing, Temple, & Cavanaugh, 2008; Hill et al., 2009). During the RRV of Food Task, social desirability plays a role when individuals are assessed immediately prior to weight loss treatment. In addition, providing high-fat foods to participants before or after weight loss treatment within such a task can complicate the therapist-patient relationship and further impact patients' willingness to respond honestly. As such, hypothetical rewards were used in the RRV of Food Task, which was not expected to significantly bias participants' responses, based on prior piloting of the measure, and on the fact that previous behavioral economics studies have demonstrated that individuals tend to discount real rewards similarly to hypothetical rewards (Baker, Johnson, & Bickel, 2003; Johnson & Bickel, 2002; Kirby & Marakovic, 1996; Lagorio & Madden, 2005; Madden, Begotka, Raiff, & Kastern, 2003).

As food reinforcement has grown in interest as a focus of research concomitant to the rising prevalence of obesity, valid and reliable assessment tools have become available for use in

the community and in clinical samples. Existing knowledge concerning food reinforcement in adults and children is discussed below.

Food Reinforcement in Adults

Research has indicated that although obese adults do not necessarily show higher food hedonics than normal weight adults (liking), they appear to find food more reinforcing (wanting) than non-obese individuals (Saelens & Epstein, 1996). Specifically, a small study (*N* = 16) in college-aged women found that obese individuals found palatable food to be more reinforcing relative to sedentary behavior than did non-obese individuals (Saelens & Epstein, 1996). In other words, obese women were less responsive to the effects of increasing the cost to obtain food relative to the sedentary behavior reward compared to non-obese women, indicating a greater willingness to work to obtain snack foods within this computer task paradigm.

Building upon these findings, Epstein and colleagues have conducted multiple studies further validating the construct of food reinforcement in adults. Additional studies have replicated the early finding that obese adults demonstrate a higher level of food reinforcement than non-obese adults (Epstein, Leddy, et al., 2007; Epstein, Temple, et al., 2007). Additionally, when the level of food reinforcement increases (i.e., when subjects are more willing to work to obtain a palatable food reinforcer), the amount of food that subjects consume and their energy intake during a separate ad-libitum eating task also increases (Epstein, Temple, et al., 2007; Epstein et al., 2004), further implicating high food reinforcement in the development and maintenance of obesity. As would be expected, deprivation has a powerful effect on the RRV of food as compared to non-food reinforcers (Epstein et al., 2003; Lappalainen & Epstein, 1990; Raynor & Epstein, 2003). Specifically, participants who completed the computerized food reinforcement task were willing to exert more work to obtain a food reward after a period of fasting (i.e., at least 4 hr post-prandial) compared to subjects who were provided a meal prior to testing, despite equivalent hedonic ratings for food (Epstein et al., 2003).

Considering the association between high food reinforcement and obesity, and the fact that obesity treatments commonly involve some type of dietary restriction, studies have also

examined the relation between dietary restraint and the RRV of food. More specifically, dietary restraint may moderate the influence of deprivation on food reinforcement. In an experimental paradigm illustrating this trend, Raynor and Epstein found that short-term deprivation was associated with high food reinforcement, but that food reinforcement was highest among participants in the condition in which they experienced deprivation in combination with short-term food restriction—that is, exposure to palatable foods which they were not permitted to eat (Raynor & Epstein, 2003). Another study with college students found that body mass index (BMI) moderated the relation between dietary restraint and food reinforcement in response to snack food. Among heavier participants, high dietary restraint was associated with high food reinforcement, whereas among participants with a low BMI the reverse was shown—relatively low restraint was associated with higher food reinforcement (Goldfield & Lumb, 2009). Interestingly, this model only emerged as significant among females and not males, suggesting that overweight dieting women may experience a particularly high level of food reinforcement. Another study involving 30 non-obese college women found that dietary restraint did not independently predict the RRV of snack food, but rather was moderated by anxiety; for women low in dietary restraint, high anxiety was associated with lower food reinforcement, whereas there were no differences by anxiety among women high in dietary restraint (Goldfield & Legg, 2006). Of note, findings concerning the influence of dietary restraint on food reinforcement have been conducted predominantly in college students.

Overall, obese adults demonstrate a higher level of food reinforcement than non-obese adults. It follows, then, that individuals seeking weight loss treatment may represent a group more likely to exhibit high food reinforcement—a trait that may have important clinical implications given that dietary restraint may heighten some individuals' motivation to eat. Emerging research has begun to examine these questions in children as well.

Food Reinforcement in Children

Although comparatively less data are available in children, findings from studies of the RRV of food in youth are largely concordant with adult findings. In particular, it appears that

overweight children find food more reinforcing than normal weight children. Temple and colleagues (Temple, Legierski, Giacomelli, Salvy, & Epstein, 2008) conducted two experiments using the computer-generated reinforcement schedule paradigm (Lappalainen & Epstein, 1990) following a preload (one granola bar). In Experiment 1, children earned points toward either pizza or their preferred nonfood alternative (of video games, coloring, drawing, or magazines); reinforcers used in Experiment 2 were children's most preferred snack food (of potato chips, Skittles candy, or chocolate candies) or a sedentary activity (during separate visits, either video games, word searches, magazines, and maze completions). Across both experiments, overweight children demonstrated a higher rate of responding for the food reinforcer than the normal weight children as the reinforcement schedule progressed. Further, this motivation to work for food—rather than mere liking of the food, as all foods were generally liked—was correlated with children's relative body weight and energy intake during the experiment (Temple, Legierski, et al., 2008). Another study of 7-10 year-old children found that although food reinforcement was not cross-sectionally associated with adiposity, higher child baseline food reinforcement predicted excess weight and fat mass gain over one-year follow-up (Hill et al., 2009). Findings suggested that, as in the case of LOC, high food reinforcement may be a key appetitive trait contributing to high risk for obesity among a subset of children.

As obesity tends to run in families (Whitaker, Wright, Pepe, Seidel, & Dietz, 1997), identifying behavioral phenotypes shared by children and their parents may help explain, in part, this heritability. Similarly, child and parent response to weight loss treatment is strongly associated (Golan, Weizman, Apter, & Fainaru, 1998; Wrotniak, Epstein, Paluch, & Roemmich, 2004, 2005). One study has examined the relation between child and parent food reinforcement, in a sample of 50 families (overweight children aged 8-12 years and their parents) prior to family-based weight control treatment (Epstein et al., 2008). Level of food reinforcement (defined as the total number of food reinforcers chosen during the task) was significantly correlated between children and parents. These findings suggest that the RRV of food is a factor related to obesity

that is shared between children and their parents. Future investigations are warranted to replicate this finding in a larger sample of overweight treatment-seeking families.

Existing research suggests that high food reinforcement in children is predictive of excess weight and body fat gain—a similar finding to that seen in the literature on pediatric LOC. However, no studies have specifically examined whether LOC eating in children is characterized by an elevated RRV of food. Children who experience a higher drive to obtain and consume food may also be experiencing LOC eating episodes–a marker for the development of obesity and further disordered eating behaviors and cognitions. Data regarding whether LOC eating episodes in children are associated with a higher RRV of food would inform the clinical significance of LOC in children. Furthermore, future investigation of the relation between child and parent food reinforcement may help inform the parent-child concordance that is typically observed in weight loss treatment response (Golan et al., 1998; Wrotniak et al., 2004, 2005).

Food Reinforcement and LOC Eating

Little data are available regarding the association between food reinforcement and LOC or binge eating. A study conducted by Goldfield et al. (Goldfield, Adamo, Rutherford, & Legg, 2008) categorized 40 college women using the Binge Eating Scale (yielding 22 “binge eaters” based on elevated scores), measured changes in perceived stress following a stress-induction (i.e., speech anticipation) session, and administered the computerized RRV of Food Task. Psychological stress has been well established as a risk factor for binge eating, weight gain, and obesity in children and adults (Greeno & Wing, 1994; Polivy & Herman, 1993; Stice et al., 2002). In this study, stress and binge eating status interacted such that only binge eaters who were highly reactive to stress also demonstrated a higher RRV of snack food in that stress-inducing condition (Goldfield et al., 2008). There has also been one study in 10 adult female smokers, 4 of whom had bulimia nervosa, a disorder marked by binge eating alternating with high dietary restraint. In contrast to control women who demonstrated the expected increase in food reinforcement following an 18-hr fast, women with bulimia nervosa showed the opposite pattern, expending less work for the food reinforcers despite high hunger (Bulik & Brinded, 1994). Taken

together, these two studies suggest that in adult women with binge eating, high dietary restraint (as in bulimia nervosa) may lead to decreased food reinforcement whereas and stress may increase food reinforcement.

Finally, one additional small study examined hunger and food reinforcement in 12 adults without BED as compared to 6 obese adults with BED (Nasser, Evans, Geliebter, Pi-Sunyer, & Foltin, 2008). Results indicated that hunger may interact with binge eating status to promote higher food reinforcement in adults with BED, but only after consuming a preload to the point of fullness. In the absence of a preload (the "fasted" condition), individuals with and without BED did not differ on food reinforcement. However, the non-BED group was a mixed sample of obese and non-obese adults, and the small sample size precludes definitive conclusions about the relation between binge eating and food reinforcement.

It remains to be seen whether individuals who experience LOC eating but who do not have an eating disorder (i.e., anorexia nervosa, bulimia nervosa, or BED) experience a higher level of food reinforcement. Specifically, the relation between RRV of food and LOC or binge eating has not been examined in children. Additional findings from adult studies of reward sensitivity in BED support further examination of these questions. Specifically, obese adults with and without BED report greater reward sensitivity than normal weight controls, but only among those who also possess an obesity susceptibility genetic marker—the Taq1A A1+ allele (Davis et al., 2008). Of relation to the present study, prior research indicates that individuals with high food reinforcement exhibit greater energy intake in the laboratory, but this pattern is especially strong among individuals with both high food reinforcement and the Taq1A A1+ allele (Epstein, Temple, et al., 2007; Epstein et al., 2004). Findings highlight a potential complex relation between genetic markers associated with increased energy intake and high food reinforcement, environment, and weight trajectory, which merits investigation in children as well.

In sum, preliminary findings from adult studies suggest that the presence of binge eating may impact responding for food within RRV of Food tasks, although it remains to be seen

whether the same association exists in treatment-seeking, non-eating disordered overweight children.

Food Reinforcement and Other Reinforcers in the Environment

As discussed above, high food reinforcement (i.e., the RRV of palatable snack foods) is cross-sectionally associated with degree of overweight and with excess weight and fat gain prospectively in children (Hill et al., 2009). However, the influence of other reinforcers available in the environment, such as healthy foods or non-food reinforcers (e.g., electronic or physical activity equipment) remains largely unclear. That is, children's lack of access to reinforcers other than high energy-dense snack foods may negatively impact their success within weight loss treatment.

Behavioral weight loss treatment typically involves some sort of dietary restriction, which includes an overall negative energy balance and often reducing intake of high energy-dense foods, such as palatable snack foods (e.g., chips, cookies). As discussed above, overweight individuals tend to demonstrate a higher rate of responding or willingness to work for snack foods. Individuals undergoing weight loss treatment are typically also encouraged to decrease the availability of these snack foods in the home as well as their consumption. Ironically, this deprivation could create a tension whereby obese individuals then experience even stronger food reinforcement over time as a result of deprivation (Epstein, Leddy, et al., 2007). This elevated food reinforcement may then promote LOC and excess weight gain, creating a problematic cycle for this vulnerable subset of individuals.

To lose weight successfully, individuals may seek out substitutable rewarding stimuli in their environment, which could include healthier food options or non-food reinforcers. Indeed, a key construct within behavioral economic theory is that an individual's decision to choose one reinforcer (e.g., a negative health behavior) partly depends on access to alternative sources of reinforcement (Audrain-McGovern et al., 2009; Audrain-McGovern et al., 2004). In accordance with this concept, many family-based behavioral weight loss treatments encourage parents to increase the availability of healthy food in the home and to enhance opportunities for physical

activity (e.g., providing access to sports equipment or accessing resources for physical activity in the neighborhood, such as parks) to make these healthful choices easier for their children. Recognizing this need to enhance the quality of the home and neighborhood environment, pediatric weight control programs have begun incorporating a focus on providing alternate reinforcers to children that can compete with high energy-dense foods (Epstein, Roemmich, Stein, Paluch, & Kilanowski, 2005; Wilfley, Van Buren, et al., 2010; Wilfley, Vannucci, & White, 2010a).

Without these reinforcers available to replace the rewarding value an individual may often get from palatable snack foods, initiating and maintaining healthy weight control behavior changes (e.g., reducing intake of these high energy-dense foods) may be even more difficult. As such, children who have greater difficulty utilizing non-food reinforcers in their home and neighborhood environment may then find weight loss more challenging. Access to non-snack-food reinforcers may be part of this problem, considering data from a large epidemiological study that linked the quality of a child's home environment with the prevalence and development of obesity. This study prospectively followed nearly 3,000 normal weight young children over 6 years and found that children in homes with less cognitive stimulation (e.g., relatively fewer books and music in the home) were more likely to become obese over the 6-year follow-up (Strauss & Knight, 1999). These effects remained significant after controlling for a range of demographic variables and highlight the potential importance of having an environment that is enriched with non-food reinforcers in the prevention of weight control problems.

LOC eating episodes are prevalent among overweight youth, who are at an increased risk for developing both obesity and eating pathology in adolescence and adulthood. Altogether, a rapidly growing body of research indicates that LOC eating and high food reinforcement are behavioral phenotypes that are each independently associated with overweight and excess body weight and fat gain over time in children. However, no studies have specifically examined the potential link between pediatric LOC eating and high food reinforcement. Similarly, evidence is

mixed regarding the impact of LOC eating on weight loss treatment response, and little is known about the interplay between these factors and other potential reinforcers in the child's environment.

Aims and Hypotheses

As discussed above, further research is needed concerning the nosological status of LOC eating in children—namely, the behavioral and psychological characteristics associated with LOC, as well as the predictive validity of LOC with regard to weight loss treatment outcome. In particular, the overlap between pediatric LOC and the behavioral phenotype of high food reinforcement should be examined, as well as the relation between child and parent LOC eating and food reinforcement. Food reinforcement (i.e., the RRV of snack foods) should also be examined within a framework that includes other reinforcers in the environment, such as healthy foods, non-food reinforcers, and alcohol. To address these issues, the present study addressed the aims outlined below. Hypotheses were generated based upon findings from previous relevant studies, as well as exploratory analyses conducted with a prior sample of overweight children and their parents undergoing weight loss treatment (Wilfley, Stein, et al., 2007b).

Overweight children aged 7-11 years, each with one participating parent or caregiver, were recruited to participate in a 4-month family-based behavioral weight loss treatment (FBT). Relevant variables were assessed at baseline, including measures of child and parent LOC, child and parent food reinforcement (i.e., the RRV of food as compared to a small monetary reinforcer), and child appetitive traits, internalizing symptoms, and quality of life. Child relative body weight was reassessed post-treatment.

Specific Aim 1: Examine the association between LOC and high food reinforcement in children

Hypothesis 1: Children with recent reported LOC eating episodes (i.e., at least 1 LOC episode in the past 3 months) will demonstrate a higher level of food reinforcement than will children without LOC.

Specific Aim 2: Examine the association between LOC and related appetitive traits, internalizing symptoms, and quality of life, as assessed via child self-report (emotional eating, depressive and anxiety symptoms, and quality of life) and parent-report on child (satiety responsiveness, food responsiveness and enjoyment, internalizing symptoms, and quality of life)

Hypothesis 2: Children with recent reported LOC eating episodes will demonstrate greater emotional eating, less satiety responsiveness, greater food responsiveness and enjoyment, greater internalizing symptoms, and poorer quality of life than children reporting no LOC.

Specific Aim 3: Examine LOC as a predictor of attrition, attendance, and child weight outcomes during treatment

Hypothesis 3: Children with recent reported LOC eating episodes will have a higher rate of attrition and attend fewer treatment sessions than children without reported LOC during 4-month family-based weight control treatment. Children with recent reported LOC will also achieve poorer relative body weight loss outcomes (i.e., a smaller decrease in percent overweight) than will children reporting no LOC.

Specific Aim 4: Examine the association between children and their parents regarding the prevalence of LOC eating episodes and high food reinforcement

Hypothesis 4: Children of parents reporting recent LOC will be more likely to report recent LOC eating episodes, and children's and their parents' level of food reinforcement will be positively associated.

Specific Aim 5: Examine the level of non-snack food reinforcers available in children's home and neighborhood environment as a moderator of the effect of food reinforcement on child treatment outcome

Hypothesis 5: Level of non-snack food reinforcers available in children's home/neighborhood environment will moderate the effect of food reinforcement on treatment outcome, in that children demonstrating high food reinforcement and a low level of non-snack food reinforcers in their environment will have the poorest weight

outcomes at post-treatment. That is, the interaction of food reinforcement and level of non-snack food reinforcers in the environment will account for a significant proportion of the variance in child percent overweight change during FBT.

Specific Aim 6: Explore the association between alcohol reinforcement and food reinforcement in parents, and the association between parent alcohol reinforcement and child food reinforcement

Hypothesis 6: Parents' level of food reinforcement and alcohol reinforcement will be positively associated. Parents' alcohol reinforcement will be positively associated with children's food reinforcement.

Significance of Proposed Research

An emerging body of research has begun to illuminate the behavioral profile that characterizes pediatric LOC eating. However, many potentially relevant features of LOC eating episodes in children remain unclear. Although previous research has demonstrated that measures of general psychopathology and specific eating disorder pathology discriminate between children who do and do not have LOC, the present study augments existing findings to simultaneously include both parent- and child-reported quality of life, as well as associated features of LOC eating (e.g., emotional eating, disturbances in satiety responsiveness). Further research also is needed regarding the predictive validity of LOC in relation to clinical outcomes. Specifically, binge eating appears to negatively impact weight loss treatment retention and long-term weight outcomes in adults. However, comparable data in youth are limited; results have been mixed and often found in small sample sizes, and a gold-standard interview technique has not always been used to assess LOC eating behavior.

An important next step in defining the classification of pediatric LOC eating would be to investigate the association between LOC eating episodes and other relevant aspects of a child's eating attitudes and behaviors. For example, it is possible that children with LOC also experience a higher motivation to eat than children without LOC. The presence of either of these behaviors (LOC or high food reinforcement) potentially could complicate weight loss treatment for a subset

of overweight youth—perhaps especially for those who have few other reinforcers available in their home and neighborhood environment. Results could help enhance future treatment and prevention programs for this subset of individuals who may be particularly susceptible to the development and maintenance of obesity. The present study also is designed to provide preliminary evidence to support the generality or domain-specificity of high food reinforcement and alcohol reinforcement in overweight parents.

Findings regarding the interplay of these factors could elucidate the etiology of LOC in children and inform the development of individualized family-based weight loss programs.

METHODS

The present study was part of a large randomized controlled trial (RCT) investigating the efficacy of family-based weight maintenance interventions (2 R01 HD036904-06A2, "Childhood Obesity Treatment: A Maintenance Approach, PI: Denise Wilfley). Participants were recruited and assessed at two clinical sites: Washington University School of Medicine, St. Louis (PI: Denise Wilfley) and the University of Washington, Seattle (PI: Brian Saelens).

Participants

Participants were 7- to 11-year-old overweight children (*N* = 241), who each had at least one overweight parent, assessed prior to entering family-based behavioral weight loss treatment (FBT, described below). The weight criterion for children was a body mass index (BMI) above the 85th percentile for their age and gender, as provided in CDC 2000 growth curves (Kuczmarski et al., 2000). Overweight in parents was defined as a BMI ≥ 25 kg/m^2. Each child participated with one parent or caregiver, yielding a total sample of 241 children and 241 parents at baseline. Baseline sample characteristics are presented in Table 2.

For families in which only one parent was overweight, the overweight parent was encouraged to participate; if both parents were overweight, the family chose one to be the participating parent or caregiver. At baseline, 97.5% of participating parents (*n* = 235) were

Table 2

Baseline Characteristics of Study Participants

Variable	LOC (n = 62)	No LOC (n = 179)	Entire Sample (N = 241)
Child			
Age, years	9.9 (1.3)	9.9 (1.3)	9.9 (1.3)
Gender, % Female (n)	71.0 (44)	59.8 (107)	62.7 (151)
Race/ethnicity, % (n)			
White (non-Hispanic)	69.4 (43)	63.1 (113)	64.7 (156)
Black/African-American	14.5 (9)	15.6 (28)	15.4 (37)
Hispanic	9.7 (6)	10.6 (19)	10.4 (25)
Other	6.5 (4)	10.6 (19)	9.5 (23)
Percent overweight	64.0 (23.6)	66.6 (26.9)	66.0 (26.1)
BMI percentile	97.9 (2.4)	97.9 (2.5)	97.9 (2.5)
Parent			
Age, years	43.5 (6.8)	41.7 (6.2)	42.1 (6.4)
Gender, % Female (n)	85.5 (53)	83.2 (149)	83.8 (202)
BMI (kg/m^2)	37.5 (9.4)	38.5 (9.3)	38.3 (9.3)
Socioeconomic status*	43.4 (9.1)	43.0 (10.8)	43.1 (10.4)

Note. For all variables, *mean (SD)* is presented unless otherwise specified. LOC and No LOC groups (i.e., children who did or did not self-report LOC) did not differ on any of the above characteristics (ps > .05). *Socioeconomic status was assessed using the Barratt Simplified Measure of Social Status, which provides a proxy measure for socioeconomic status.

overweight or obese. Only the overweight child and the participating parent were required to attend treatment sessions, although all adult members of the household were encouraged to support healthy changes in the family's lifestyle. For some families, both parents attended treatment sessions and received program materials, but only the identified participating parent provided data.

Exclusion Criteria

Families were excluded if there was: a) a thought disorder, suicidal ideation, bipolar disorder, or drug or alcohol dependence in either the participating parent or the participating child; b) an inability of the child or participating parent to comprehend English at a 1st-grade level; c) a physical disability or illness in either the participating parent or the child that precluded physical activity at a level equivalent to a brisk walk or that required severe dietary restriction; or d) a medication regimen for either the child or the participating parent that affected his or her weight. Exclusion criteria were selected because they may interfere with treatment implementation, and families with these problems could add variability to treatment effects, thus decreasing statistical power for the main RCT.

In addition, since parental eating disturbance has been linked to an increased risk of child eating disturbances (Leon, Keel, Klump, & Fulkerson, 1997; Pike & Rodin, 1991; Stein, Woolley, Cooper, & Fairburn, 1994), parents (participating and nonparticipating) and children were excluded if they were diagnosed with an eating disorder (i.e., anorexia nervosa, bulimia nervosa, binge eating disorder) or had sub-clinical levels of eating disturbance that the investigators felt would interfere with participation in the weight control treatment (e.g., frequent binge eating or compensatory behaviors that failed to meet diagnostic criteria).

Recruitment

Families were recruited from the St. Louis and Seattle metropolitan areas, through local media outlets (i.e., television, newspaper, Internet, and radio), schools and organizations, referrals from pediatrician offices, and clinics treating weight problems.

As prevalence rates for overweight are similar for male (36.5%) and female (38%) children in this age group (Ogden et al., 2006), male and female children were sought equally for recruitment. As obesity is a significant problem among racially/ethnically diverse populations (Kumanyika, 1994; The National Task Force of Prevention and Treatment of Obesity, 1994), strong efforts were made to obtain an ethnically representative sample.

Procedure

This study was approved by the Washington University School of Medicine Human Research Protection Office and the Seattle Children's Hospital Human Subjects Protection Program. Consent was obtained from all participating parents and assent from children.

Families were recruited for a larger RCT designed to test the effects of a socially based weight maintenance intervention to be delivered following FBT. However, only baseline and post-FBT assessments were examined within the present study. Thus, all families received identical assessments and treatment programs. Potential participating families were screened by phone and then attended orientation sessions, during which they received information about the treatment program and completed a portion of the questionnaire assessments. Interested families then scheduled two additional baseline assessment visits, during which they completed the measures included in the present study. Families typically completed baseline assessments within the two months prior to beginning FBT.

Baseline assessments were administered prior to the beginning of FBT by trained research assistants who were at least bachelor's level (see Table 3). Assessments were delivered in interview and questionnaire format; children were given questionnaires to complete without assistance, although questionnaires were read aloud to children as needed based on the child's ability to complete the entire assessment battery without assistance.

Following baseline assessments, families participated in the 4-month FBT—an extensively studied intervention that has been shown to produce child relative body weight loss (Epstein, Myers, Raynor, & Saelens, 1998; Kalarchian et al., 2009; Wilfley, Tibbs, et al., 2007).

Table 3

Schedule of Assessments

Domain	Measure	Respondent	Time point	
			Baseline	Post-FBT
Relative Body Weight	Height	C, P	X	X
	Weight	C, P	X	X
Demographics	Age/Date of Birth	P, P_C	X	
	Race/Ethnicity	P, P_C	X	
	Barratt Simplified Measure of Social Status (SES)	P	X	
Loss of Control (LOC) Eating	ChEDE	C	X	
	EDE-Q, EDE-Q-Pc	P, P_C	X	
Food Reinforcement	Hunger and Food Hedonics Questionnaire	C, P	X	
	RRV of Food Task	C, P	X	
	FPQ	C, P	X	
Other Reinforcers in the Environment	Environmental Questionnaire	P	X	
	NEWS	P	X	
Alcohol Reinforcement	ARQ	P	X	
Associated Features of Eating Behavior	CEBQ	P_C	X	
	EES-C	C	X	
Internalizing Symptoms	CBCL	P_C	X	
	SMFQ	C	X	
	SCARED	C	X	

Domain	Measure	Respondent	Time point	
			Baseline	Post-FBT
Quality of Life	PedsQL	C, P_C	X	
Treatment Attendance and Attrition		Family	(Throughout FBT)	

Note. C = child; P = parent; P_C = parent reporting on child; FBT = Family-based behavioral treatment; SES = Socioeconomic status; ChEDE = Child Eating Disorder Examination; EDE-Q = Eating Disorder Examination-Questionnaire; RRV = Relative reinforcing value; FPQ = Food Purchasing Questionnaire; NEWS = Neighborhood Environment Walkability Scale; ARQ = Alcohol Reinforcement Questionnaire; CEBQ = Child Eating Behavior Questionnaire; EES-C = Emotional Eating Scale – Adapted for Children; CBCL = Child Behavior Checklist; SMFQ = Short Mood and Feelings Questionnaire; SCARED = Screen for Child Anxiety Related Emotional Disorders; PedsQL = Pediatric Quality of Life Inventory.

Treatment included the following components: 1) diet (reducing energy intake and improving dietary quality); 2) physical activity promotion (a minimum goal of 90 min per day for children and 60 min per day for parents, at least 5 days per week); and 3) behavioral modification (e.g., stimulus control, self-regulatory strategies, and self-monitoring). Sessions were held weekly for 16 weeks and included a 30-min individual family meeting as well as concurrent separate 45-min child and parent groups that addressed similar concepts but were targeted towards each group's respective developmental level. Parent groups had an additional focus on parenting around eating and activity. Parents were encouraged to make the same behavioral changes for modeling purposes, as well as to make changes in the home environment to impact the health of the entire family.

Child and parent post-FBT weight and (for children) height were measured at the end of FBT (week 16). Families who had dropped out of treatment prior to the end of FBT were not actively sought out for post-FBT assessments (see Figure 1 for the participant flow).

Measures

Relative Body Weight

Child and parent height was measured with shoes removed using a stadiometer, calibrated in 0.1 cm intervals. Child and parent weight was measured with shoes removed and in light clothing to the nearest 0.1 kg, on a calibrated electronic scale. Staff were trained to accurately measure height and weight. On the basis of the height and weight data, measures of relative weight were calculated. For children, percent overweight was used, defined as the degree to which the child's actual BMI is above the median BMI for the child's age and sex as provided in CDC 2000 growth curves (Kuczmarski et al., 2000). For parents, BMI (kg/m^2) was calculated.

Demographics

Parents completed a brief demographics questionnaire (i.e., child and parent race/ethnicity, age, and gender). The child's parents' and grandparents' occupation and level of education were used to calculate the Barratt Simplified Measure of Social Status—a measure

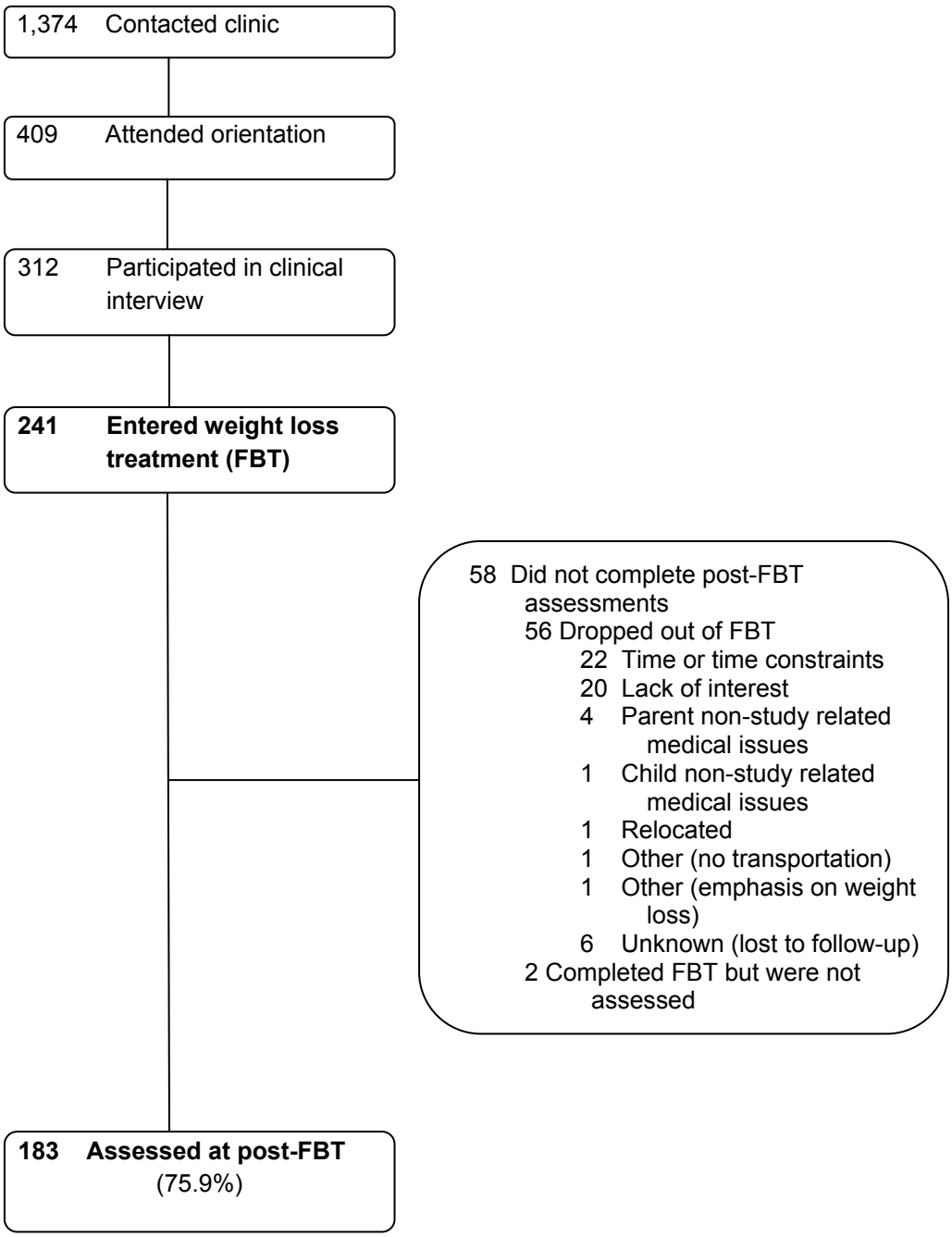

Figure 1. Study participant flow. FBT = Family-based behavioral treatment.

adapted from Hollingshead (Hollingshead, 1975), designed to be a proxy for socioeconomic status (SES).

Loss of Control (LOC) Eating

Child Eating Disorder Examination (ChEDE)

An abbreviated version of the Child Eating Disorder Examination (ChEDE) (Bryant-Waugh et al., 1996), a widely-used gold-standard diagnostic interview for the assessment of eating disorder behaviors and cognitions in youth, was administered to assess the presence of child LOC in the past three months. Specifically, to reduce participant burden, only the section assessing overeating and LOC eating episodes was administered. This portion of the interview prompts children to describe episodes in the previous 28 days and 3 months (with the assistance of a calendar of events) during which they felt that they overate. The interviewer additionally probes for episodes in which the child experienced LOC in the previous 28 days and 3 months. The ChEDE yields the number of each type of aberrant eating episode (LOC episodes with and without a large amount of food [OBEs and SBEs] and large amounts without LOC [OOs]) and the number of days on which each type of episode occurred. Data obtained from the ChEDE were used to determine the presence of recent LOC (yes/no) and the number of recent LOC episodes (OBEs and SBEs combined). Additional brief qualitative questions were developed for the present study to probe about the nature of typical LOC eating episodes.

Eating Disorder Examination Questionnaire (EDE-Q)

The Eating Disorder Examination Questionnaire (EDE-Q) (Fairburn & Beglin, 1994) assessed the presence of parent LOC. The EDE-Q is a widely used questionnaire version of the gold-standard interview assessment of eating pathology, the Eating Disorder Examination (Fairburn & Cooper, 1993). The EDE-Q assesses the full range of eating disorder attitudes and behaviors, all of which appear to have adequate internal consistency and test-retest reliability (Luce & Crowther, 1999; Mond, Hay, Rodgers, Owen, & Beumont, 2004). The EDE-Q shows good agreement with the Eating Disorder Examination (Binford, Le Grange, & Jellar, 2005; Black & Wilson, 1996; Fairburn & Beglin, 1994; Grilo, Masheb, & Wilson, 2001) and has a low rate of

false negatives (Goldschmidt et al., 2007). An instructions page providing definitions of “loss of control” and “an unusually large amount of food” was provided, including example vignettes of various types of eating episodes (e.g., what constitutes an unusually large episode with loss of control). Of note, the version of the EDE-Q used in the present study only assesses for aberrant eating episodes (i.e., LOC) in the past month, in contrast to the past 3 months assessed on the ChEDE and parent-report EDE-Q (described below). Thus, parents were categorized as having LOC if LOC was reported in the past month.

Eating Disorder Examination Questionnaire–Parent Report on Child (EDE-Q-Pc)

A brief parent-report version of the EDE-Q was created for the present study on which parents are asked to report the number of LOC episodes (unambiguously large and not large) their child has experienced in the past month and the past 3 months. Instructions ask respondents to provide their best estimate if unsure. As in the EDE-Q, definitions of key terms and example vignettes are provided.

Food Reinforcement

Hunger and Food Hedonics Questionnaire

Prior to administration of the food reinforcement task, children and parents answered questions regarding their level of hunger, fullness, desire to eat, and liking of each of the test food reinforcers (chocolate chip cookies, potato chips, Doritos cheese-flavored chips, M&Ms chocolate candies, Skittles fruit-flavored candies, and Kit Kat chocolate bars) on a 10-point Likert-type scale. Hunger and desire to eat were averaged to obtain a combined pre-test hunger score. Participants also reported the time at which they last consumed food or beverages (other than water), from which the time since last food/beverage consumption was calculated. These variables were assessed as part of the food reinforcement measure (described below) to determine their impact on food reinforcement, given that hunger (i.e., extended deprivation) has been shown to increase adults' level of food reinforcement (Raynor & Epstein, 2003).

Relative Reinforcing Value (RRV) of Food Task

The Relative Reinforcing Value (RRV) of Food Task was administered to assess child and parent food reinforcement. This assessment has been validated against the computer-generated concurrent schedules paradigm assessing the RRV of food in adults (Goldfield et al., 2005) and it has been successfully used in children as young as age 7 years (Epstein et al., 2008) including data to support its predictive validity regarding excessive weight gain over time (Hill et al., 2009). On the RRV of Food Task, participants are asked to indicate their preference for completing work to obtain either a food or non-food (monetary) reinforcer. For the food reinforcer in the present study, participants selected their most preferred snack food from 6 possible choices (those listed above in the description of the food hedonics questionnaire). The food item indicated as most highly liked by each participant was selected for the RRV Task; in the event of a tie between two or more items, the participant was then asked, “Hypothetically, if you could eat one of these right now, which would you choose?” The selected food was then clearly displayed on the table (along with the monetary reinforcer) for task administration. The non-food reinforcer consisted of one quarter ($0.25), which was also displayed. Participants were asked what they might do with the money if it were received, and then were asked to practice using the handheld tally counter by performing 20 presses at the beginning of the task.

In the RRV of Food Task, the hypothetical amount of work required to obtain either reinforcer consists of clicking a handheld tally counter a prescribed number of times. The task begins with an equal amount of work required to obtain either reinforcer (i.e., 20 presses). With each subsequent item, the number of clicker presses required to obtain the food reinforcer increases on a fixed ratio progressive schedule of reinforcement of 20 presses per question (up to 240 presses within the total 12 items), while the work required to obtain the monetary reward is held constant (20 presses). The point just before the participant switches from choosing food to choosing money (i.e., two consecutive times) is referred to as the *switch point*. Although neither reinforcer actually is given to the participant following the task, instructions were carefully administered to indicate that study staff are interested in getting information about “how people

respond to a variety of foods" and what "factors affect people's preferences and choices," and participants were encouraged to ask questions as they arise.

To help reduce the likelihood that participants were very hungry during the task, the RRV of Food Task was administered first in the assessment battery. Although deprivation is known to influence the relative reinforcing value of food (Lappalainen & Epstein, 1990; Raynor & Epstein, 2003), a preload was not used during the study visit, considering the possibility that consumption of a preload—particularly one that is palatable—could serve as a priming stimulus for overweight children (Temple, Legierski, et al., 2008), perhaps disproportionately for children who are more responsive to environmental food cues or who experience disinhibition following the consumption of palatable foods. Participants' level of hunger and fullness was assessed immediately before the RRV of Food Task.

The RRV of Food Task was administered within a three-part RRV assessment for the larger RCT, in which two additional tasks assessed the RRV of the participant's favorite fruit/vegetable and favorite physical activity with a peer. The order of these three tasks was counterbalanced (i.e., ABC, ACB, BAC, BCA, CAB, or CBA), such that the snack food versus money comparison in the proposed study (Task A) was sometimes delivered after one or both additional tasks (Tasks B and C). A random counterbalance order was selected by rolling a standard 6-sided die.

The primary outcome variable obtained from the RRV of Food Task is the switch point—that is, the item number at which the individual switches from choosing the food reinforcer to choosing the monetary reinforcer (ranging from 0 [if the participant never chose food] to 240 button presses). Child and parent food reinforcement measured continuously on the RRV of Food Task (the switch point, from 0 to 240, recoded as 0 to 12) was highly positively skewed, with many 0 and 1 values, although it did not fit a Poisson distribution. In consultation with the measure's author (Dr. Len Epstein) and the statistician for the larger RCT (Dr. Ken Schechtman), child and parent food reinforcement was dichotomized into high and low. Participants were categorized as high food reinforcement if they responded as willing to work more for the food

reinforcer (i.e., responses yielded a switch point of 2 or greater) or low food reinforcement if they did not respond that they would work more for the food reinforcer as compared to the monetary reinforcer (i.e., a switch point of 0 or 1—never responding for the food reinforcer, or responding for the food reinforcer only when work amounts were equal, respectively).

Food Purchasing Questionnaire (FPQ)

In measuring food reinforcement, it was anticipated that the RRV of Food Task may present a social desirability bias. Specifically, it was thought that participants may be hesitant to indicate a strong desire for high-fat snack foods when in the presence of the interviewer, prior to entering a weight-loss treatment program.

For this reason, an additional assessment of food reinforcement was included, which was presumed to be less affected by social desirability. The Food Purchasing Questionnaire (FPQ) (Epstein, Dearing, & Roba, 2010) was completed by the child and parent. The FPQ was developed by Epstein and colleagues using similar methodology as the previously developed Cigarette Purchase Task (Bickel & Madden, 1999) and validated against the computerized assessment of food reinforcement described above (Epstein et al., 2010). Instructions for the FPQ are as follows:

> Imagine a TYPICAL DAY during which you eat snack foods. The following questions ask how many portions of snack food you would consume if they cost various amounts of money. The available snack food is _____ (*preferred snack food*). Assume you have the same income/savings that you have now and NO ACCESS to any snack food other than the snack food offered at these prices. In addition, assume that you would consume the snack food that you request on that day; that is you cannot save or stockpile snack food for a later date. Please respond to the questions honestly.

Participants then are asked: "How many portions of _____ (*preferred snack food*) would you consume if they were ____ each at the following 19 prices?: Zero (free), $0.01, $0.05, $0.13, $0.25, $0.50, $1, $2, $3, $4, $5, $6, $11, $35, $70, $140, $280, $560, $1,120." The prices are presented in ascending order. Instructions were slightly modified for readability by young children, and piloted to ensure comprehension. Additionally, a standardized protocol for verbally explaining the instructions to children was written by KRT for the present study to enhance children's comprehension, and the FPQ was read aloud to all children using this protocol.

Similar to the RRV of Food Task, the primary outcome variable obtained from the FPQ was the switch point (i.e., the last price at which consumption was greater than zero), which was square-root transformed to more closely approximate a normal distribution. The counterbalancing of the questionnaire order was also similar to the RRV of Food Task, in that the same question is asked regarding the participant's favorite fruit/vegetable, which was randomly counterbalanced in an AB or BA fashion.

Other Reinforcers in the Environment

Environmental Questionnaire

The Environmental Questionnaire was administered to parents to determine the presence of food and non-food reinforcers available to the child, with a focus on the home environment. This measure was used previously by Saelens and colleagues (2009) and was modified slightly for the purposes of the present study. Questions concerning food ask about a range of 22 different types of healthy (e.g., fresh fruit, non-fat dairy, lean meats) and unhealthy (e.g., cakes, cookies, and sweetened breakfast cereal) foods. Parents are asked to report the presence of each food in the home, whether or not the child can immediately eat the food, and the general amount of the food present (i.e., "a little," "some," or "a lot"). Questions concerning non-food reinforcers assess the availability of recreational electronic equipment (e.g., number of TVs, computers, radios or music players, and video game players in each room in the home), other items that may contribute to the child's cognitive stimulation such as books, magazines, and musical instruments (Strauss & Knight, 1999), and the availability of physical activity items (e.g., a bike, sports equipment, or a play/recreation room) in the home. Subscale scores were calculated for fruit/vegetable availability, electronics availability, physical activity equipment availability, and cognitive enrichment item availability. The cognitive enrichment subscale was taken from the HOME measure, which has been found to predict obesity onset in children (Strauss & Knight, 1999), whereas others were taken from a previously used environmental questionnaire by Dr. Saelens and colleagues. The electronics and physical activity subscales previously have demonstrated good test-retest reliability and construct validity, including a positive association

between physical activity equipment availability and reported physical activity (Rosenberg et al., 2010), whereas the present study added the fruit/vegetable subscale to the measure.

Neighborhood Environment Walkability Scale

The Land Use Mix – Diversity subscale from the Neighborhood Environment Walkability Scale (Cerin, Saelens, Sallis, & Frank, 2006; Saelens, Sallis, Black, & Chen, 2003) was used to assess the child's neighborhood environment. Items ask parents to estimate the time it would take to walk to local facilities, such as the nearest park or playground, recreation center, or library, and the total number of locations within a 20-minute walk are summed. Higher scores indicate greater proximity of local facilities to the child's home.

The above subscales (pertaining to non-snack food reinforcers in the home environment and availability of resources in the neighborhood environment) were then summed to obtain a global index of non-snack food reinforcers available in the child's environment.

Alcohol Use and Reinforcement

Alcohol Reinforcement Questionnaire (ARQ)

Parent alcohol reinforcement was measured by the Alcohol Reinforcement Questionnaire (ARQ), which was created for the present study and modeled from previously developed measures of alcohol and nicotine reinforcement (MacKillop et al., 2008; Schmitz, Sayre, Hokanson, & Spiga, 2003), including MacKillop and colleagues' Alcohol Purchase Task (Mackillop et al., 2009). On this questionnaire, parents first are asked a forced-choice (yes/no) question to assess alcohol use: "Do you ever drink alcohol (including beer or wine)?" Parents are then asked to imagine the following hypothetical scenario:

> Imagine that you are at a social event where alcohol is available for purchase, and you are considering drinking. How many drinks do you think you would buy for yourself if each drink was priced at each of the following amounts? Please note that for this questionnaire, "one drink" would refer to: a standard size beer (12 oz.), a glass of wine (5 oz.), a shot of hard liquor (1.5 oz.), or a mixed drink containing one shot of liquor. If you would not plan on purchasing any drinks at any price, please indicate "0."

Response options were identical to the FPQ, described above (Epstein et al., 2010). Similar to the FPQ, the primary outcome variable obtained from the ARQ is the switch point (i.e., the

highest price for which the reported purchase/consumption is greater than zero), which was square-root transformed to more closely approximate a normal distribution. As such, the ARQ is designed to assess how much money an individual may be willing to spend on alcohol.

Associated Features of Eating Behavior

Child Eating Behavior Questionnaire (CEBQ)

Parents completed the Child Eating Behavior Questionnaire (CEBQ) (Carnell & Wardle, 2007; Wardle, Guthrie, Sanderson, & Rapoport, 2001) to report on their children's appetitive traits. The CEBQ is a 35-item instrument, from which 3 subscales were used: responsiveness to food (e.g., "My child is always asking for food," "Even if my child is full s/he finds room to eat his/her favorite food"); enjoyment of food (e.g., "My child loves food," "My child looks forward to mealtimes"); and satiety responsiveness (e.g., "My child leaves food on his/her plate at the end of a meal," "My child cannot eat a meal if s/he has just had a snack before"). These three subscales were chosen because they are most relevant to the present study's aims and have been shown to be associated with food intake in a laboratory setting (Carnell & Wardle, 2007; Wardle et al., 2001). The CEBQ has good internal validity and test-retest reliability among parents of young children (Ashcroft et al., 2008; Carnell & Wardle, 2007; Wardle et al., 2001).

Emotional Eating Scale – Adapted for Children

The Emotional Eating Scale – Adapted for Children (EES-C) (Tanofsky-Kraff, Theim, et al., 2007) is a child self-report measure of emotional eating (i.e., eating in response to affect). The EES-C asks children to indicate their level of desire to eat (ranging from "I have no desire to eat" to "I have a very strong desire to eat") in response to a list of 26 emotions (e.g., "down," "stressed out," "nervous"). Previous use in children and adolescents established the EES-C's adequate factor structure, internal consistency, test-retest reliability, and convergent validity with self-reported LOC (Tanofsky-Kraff, Theim, et al., 2007). Although most items describe negative emotions, the emotion "happy" was also included, as was done previously (Tanofsky-Kraff, Theim, et al., 2007). As needed, assessors were provided with a standardized list of prompts with

which to explain each emotion word for children. For the purposes of the present study, the global score of the EES-C was used.

Internalizing Symptoms

Child Behavior Checklist (CBCL)

The Child Behavior Checklist-Parent Version (CBCL) (Achenbach, 1991; Achenbach & Elderbrock, 1991) was completed by parents to assess a broad range of child psychological functioning, including child externalizing, internalizing, and social problems. The CBCL is a widely used measure of general psychopathology in youth aged 6-18 years and has demonstrated good reliability and validity (Achenbach, 1991; Achenbach & Elderbrock, 1991). The internalizing problems T-score (standardized by child age and sex) was used as a measure of internalizing symptoms.

Short Mood and Feelings Questionnaire (SMFQ)

Children self-reported their internalizing symptoms on two questionnaires, including the Short Mood and Feelings Questionnaire (SMFQ) (Angold et al., 1995). The SMFQ is a brief child self-report measure of depression symptoms that has been demonstrated to be a reliable measure of depression in youth (Daviss et al., 2006; Messer et al., 1995).

Screen for Child Anxiety Related Emotional Disorders (SCARED)

Children also completed the Screen for Child Anxiety Related Emotional Disorders (SCARED) (Birmaher et al., 1999; Birmaher et al., 1997). The SCARED assesses anxiety symptoms and has been demonstrated to be a reliable and valid screening measure of anxiety in children and adolescents (Birmaher et al., 1999; Birmaher et al., 1997).

Quality of Life

The Pediatric Quality of Life (PedsQL) Inventory (Varni, Burwinkle, Katz, Meeske, & Dickinson, 2002; Varni, Seid, & Kurtin, 2001) assesses health-related quality of life in children in the areas of physical, emotional, social, and school functioning. The PedsQL has good reliability and validity (Varni et al., 2001). Children completed the self-report and parents completed the parent-report on child version of the 23-item generic core measure of the PedsQL, which provide

both a child self-report and parent report of children's health-related quality of life. The psychosocial health summary score of each version was used.

Treatment Attendance and Attrition

Attendance was monitored during each week of FBT. Attendance was counted positively for each family for a given session provided that either member of the parent-child dyad was present (e.g., even if the participating parent came without the child, or an alternate parent or caregiver transported the child to that treatment session). Make-up sessions were provided as needed, which counted towards FBT attendance if the session occurred in-person within the same week as the missed session.

Families with poor attendance were contacted regularly by their individual interventionist and the study manager, as needed. Families who could not be contacted by phone or email after several weeks were mailed a letter encouraging them to contact the study team. Families who expressed a desire to leave treatment or who ceased attending and were unable to be contacted were considered FBT dropouts.

Assessor Training

As part of the RCT's study training for the full RCT in December, 2009, a cross-site assessor training was conducted by KRT, including standardized administration of the ChEDE (Bryant-Waugh et al., 1996), and the RRV of Food Task (Goldfield et al., 2005; Hill et al., 2009). Assessment training sessions were recorded for study staff members who were unable to attend trainings. Regular cross-site assessment conference calls were scheduled throughout the course of the study to maintain standardized assessment delivery and troubleshoot any problems in assessment administration and/or scoring. To further aid in administration standardization, ample instructions were provided within each assessment packet.

To ensure adequate standardized ChEDE delivery, assessors at both sites were required to code at least three example tapes and to conduct at least one practice recording, and received feedback and certification approval from KRT, with supervision from Dr. Wilfley. Following

certification, KRT listened to audiotaped ChEDE interviews to ensure accurate coding, with a minimum of two tapes per assessor. Training on the RRV of Food Task was supplemented by providing all assessors with a recording of proper RRV Task administration. These training and certification procedures were approved by the Data Coordinating Center for the larger RCT.

Statistical Analyses

Analyses were conducted using IBM SPSS v19.0. All tests were two-tailed. Statistical significance for tests was set at $p < .05$, rather than adopting a study-wide stricter alpha level. Further, although multiple aims and hypotheses were tested within the present study, each hypothesis was considered independent (i.e., conclusions could be drawn from significant results in each) rather than requiring joint hypotheses (Veazie, 2006). In the case of Hypothesis 2, for which MANOVA was used, univariate effects were only interpreted in the event that the omnibus test for the full model was significant ($p < .05$). Further, an alpha of $p < .05$ was considered significant for all secondary analyses, given their exploratory nature.

Primary analyses involving post-FBT relative body weight only included families with post-FBT data. Secondary analyses used an intent-to-treat approach, carrying forward baseline relative body weight for children missing post-FBT data (see below).

Preliminary Analyses

The primary dependent variables include both categorical (the presence or absence of LOC or high food reinforcement in children and parents) and continuous (child percent overweight change) variables. To determine other variables that might be included in each model, associations were examined between potential predictors (child baseline relative body weight, age, gender, race/ethnicity, and SES) and children's LOC status and food reinforcement.

Child self-reported LOC status (LOC vs. No LOC) was determined by the ChEDE, and parent LOC status (LOC vs. No LOC) was determined by the EDE-Q. Children and parents who reported at least one LOC episode in the past three months (or past month, for parents, based on the EDE-Q) were categorized as LOC. Previous similar studies have found that children in this

age range typically report a very small number of recent LOC episodes (e.g., 1-10 episodes), with a mode of 1 episode in the past 3 months among children with LOC (Goldschmidt, Tanofsky-Kraff, et al., 2008; Tanofsky-Kraff et al., 2004; Wilfley, Stein, et al., 2007a). As such, the distribution of data yields many zero values, and is highly positively skewed (as was in the case in the present study). Thus, children were dichotomized by LOC or No LOC; however, post-hoc exploratory analyses examined other ways of categorizing children (e.g., those who reported only 1 recent LOC episode versus those who reported >1 LOC episode), in addition to conducting analyses only among the subset of children with LOC, to examine the continuous number of LOC episodes reported (see below).

Primary Analyses

Hypothesis 1: Children with LOC will demonstrate a higher level of food reinforcement than will children without LOC. Binary logistic regression was used to examine whether LOC groups (LOC vs. No LOC) differed on food reinforcement (high vs. low), after including other relevant predictors and their interactions in the model. Specifically, main effects were entered, followed by all two-way interactions, all three-way interactions, and the four-way interaction. Non-significant interaction terms were then removed from the final model.

Hypothesis 2: Children with LOC will demonstrate greater emotional eating, less satiety responsiveness, greater food responsiveness and enjoyment, greater internalizing symptoms, and decreased quality of life. MANOVA was used, with LOC status (LOC vs. No LOC) as the between-subjects factor and the following dependent variables: EES-C global score, CEBQ subscales (satiety responsiveness, food responsiveness, and food enjoyment), SMFQ total score, SCARED total score, CBCL internalizing problems T-score, and PedsQL (parent-report and child-report) psychosocial health summary score.

Hypothesis 3: Children with LOC will have a higher rate of attrition and poorer treatment attendance than will children without reported LOC. Children with LOC will also achieve poorer relative body weight loss outcomes than children without LOC. A chi-square test statistic was calculated to compare LOC status groups (LOC vs. No LOC) on dropout status (completed FBT

vs. dropout, as defined above). T-test was used to compare LOC status groups on session attendance (number of FBT sessions attended out of a total 16, a continuous variable). ANCOVA was used to compare children's weight outcomes, with child percent overweight change from baseline to post-FBT as the dependent variable and the following between-subjects factors: child gender, LOC status (LOC vs. No LOC), and their two-way interaction (child gender x LOC status).

Hypothesis 4: Children of parents with LOC will be more likely to report LOC, and children's and their parents' level of food reinforcement will be positively associated. Binary logistic regression was used to predict child LOC using the factors of parent gender, parent LOC status (LOC vs. No LOC), and their two-way interaction (parent gender x parent LOC status). A chi-square test statistic was calculated to compare child and parent food reinforcement (high vs. low).

Hypothesis 5: Level of non-snack food reinforcers available in the child's home/neighborhood environment will moderate the effect of food reinforcement on treatment outcome. Multiple linear regression was used to examine level of food reinforcement and level of non-snack food reinforcers in the environment as predictors of child percent overweight change from baseline to post-FBT. Main effects were entered, followed by interactions. Specifically, the following steps were entered into the model: child gender, child food reinforcement (high vs. low), and the global index of non-snack food reinforcers in the environment (step 1), all two-way interactions (step 2), and the three-way interaction (step 3). Non-significant interaction terms were then removed from the final model.

Hypothesis 6: Parents' level of food reinforcement and alcohol reinforcement will be positively associated; parent alcohol reinforcement will be positively associated with child food reinforcement. Independent samples t-tests were used to compare children and parents with high vs. low food reinforcement on parent alcohol reinforcement as a continuous variable. A second analysis reexamined these associations only among the subset of parents who reported that they drink alcohol.

Post-Hoc Secondary Analyses

To explore further the relation between children's LOC and the above constructs, several sets of additional analyses were conducted. In general, secondary analyses involved using different measures to assess key variables (LOC and food reinforcement) or different ways of categorizing children with LOC, although statistical approaches remained identical or similar.

First, child LOC analyses were repeated re-categorizing children (LOC vs. No LOC) in three additional ways. Children were categorized based on recency (whether LOC was present in the past 3 months, vs. present ever but not in the past 3 months) and frequency (whether >1 LOC episode was reported). Differences were also examined based on binge size by categorizing children as reporting: 1) objective binge eating (OBEs), 2) subjective binge eating only (SBEs), 3) objectively large episodes without LOC (OOs) and no history of LOC, or 4) no recent aberrant eating episodes and no history of LOC. Lastly, child LOC was examined using the parent-report on child LOC measure (the EDE-Q-Pc).

Further, exploratory analyses were conducted only among the subset of children reporting LOC eating episodes (n = 62), using the number of LOC episodes reported in the previous three months as a continuous variable. First, number of LOC episodes was square-root transformed to more closely approximate a normal distribution. Then, a t-test examined the association between food reinforcement and number of LOC episodes, and Pearson product-moment correlations examined the association between number of LOC episodes and eating behaviors, internalizing symptoms, quality of life, and relative body weight change from baseline to post-FBT.

Lastly, rather than using the RRV of Food Task to assess child and parent food reinforcement, secondary analyses used the switch point from the Food Purchasing Questionnaire (FPQ; described above) to measure food reinforcement. FPQ data were analyzed continuously (using t-tests or Spearman's ρ correlations), as a dichotomy (high vs. low) was not appropriate given the distribution of the data (i.e., only 2 children and 3 parents indicated that they would not purchase any portions of snack food).

RESULTS

Preliminary Analyses

Missing Baseline Data

In the event of missing interview or questionnaire data at baseline, those families with missing data was excluded from the relevant analyses. The rate of complete data collection for each measure was very high (i.e., 97-100%). Families with missing questionnaire or interview data are described below.

Child self-reported LOC was successfully assessed in the full sample (N = 241), although EDE-Q LOC status was missing for 6 parents and EDE-Q-Pc (parent-report on child LOC) was missing from 1 parent due to invalid or missing questionnaire data.

Food reinforcement (RRV of Food Task) data were available from 240 children (1 missing due to assessor error) and 240 parents (1 missing due to parent refusal to select one of the 6 snack food options).

Data on the FPQ were missing from 3 children and 3 parents due to either assessor error (e.g., participant inadvertently being permitted to choose a different food than that on their RRV of Food Task), or a change in participating parent, in 1 case. For an additional 17 children, the switch point on the FPQ was greater than $35, suggesting that the children may not have been able to understand the instructions; that is, children who indicated that they would pay more than $35 for a single portion of snack food (i.e., the next available response options were $70 or greater) were presumed to not fully understand the meaning of the purchase price of food as indicated on the questionnaire (L. H. Epstein, personal communication, April, 2011). FPQ data from these 17 were excluded from analyses of child FPQ data. Alcohol reinforcement (ARQ) data were missing from 3 parents due to incorrect administration.

Regarding other questionnaires, the index of non-snack food reinforcers available in the environment was missing from 6 parents due to failure to collect the Environmental Questionnaire. Socioeconomic status could not be calculated for 8 families due to incomplete

data. Lastly, 5 families were excluded from the MANOVA to test Hypothesis 2 due to incomplete data on the EES-C (n = 1) or CEBQ (n = 4).

Missing Post-FBT Data

Analyses involving post-FBT child percent overweight were conducted in two ways: 1) using a completers analysis, only including children with post-FBT relative body weight data (n = 183), and 2) using an intent-to-treat approach, with the full sample (N = 241), whereby baseline percent overweight data were carried forward for children missing post-FBT relative body weight data (n = 58).

Although post-FBT relative body weight data were missing from 64 children, 6 of those 64 children had recent height and weight data from which a percent overweight could be calculated (i.e., height from weeks 9-15, and weight from weeks 12-15, out of a total 16 weeks of FBT) and carried forward to post-FBT.

When families included in analyses of post-FBT child relative body weight data (n = 183) were compared against those with missing data (n = 58), the only difference that emerged was parent age. Families in which the parent was older (42.7 vs. 40.4 years) were more likely to have child post-FBT data, $t(239) = -2.36$, $p = .019$, $d = .36$.

Checking for Other Relevant Predictors to Include in Analyses

No differences were found between LOC and No LOC children in child baseline percent overweight, age, gender, race/ethnicity, or SES (see Table 2; ps > 0.13). Regarding parent LOC, female parents were more likely to report LOC than male parents (53.5% of female parents versus 35.1% of male parents), $\chi^2(1, N = 235) = 4.22$, $p = .049$, OR = 2.13. Thus, all further analyses involving parent LOC tested parent gender as a main effect and within all interactions.

No associations were found between children's food reinforcement and their baseline relative body weight, age, SES, gender, or race (ps > .07). However children with high food reinforcement had: a greater liking of the test food, $t(238) = -2.85$, $p = .005$, $d = .37$, and greater pre-test hunger, $t(238) = -2.67$, $p = .008$, $d = .35$. In addition, the counterbalance order of RRV Task presentation significantly impacted child food reinforcement responses: children who were

presented with the snack food RRV Task first (n = 84) were more likely to have high food reinforcement than children who were administered the snack food RRV Task second or third in the order, $\chi^2(1, N = 240) = 8.58$, $p = .004$, OR = 2.23. Thus, analyses for Hypothesis 1 (comparing LOC and No LOC children on food reinforcement) included these three variables in the model, as main effects and within all interactions (i.e., all two-way interactions were entered, followed by all three-way, and the four-way interaction). Non-significant interaction terms were then removed from the final model.

Although child gender was not associated with child self-reported LOC, gender was significantly associated with child relative body weight loss from baseline to post-FBT; boys achieved greater decreases in percent overweight than did girls (-15.36 versus -11.87, respectively), $t(181) = -2.88$, $p = .005$, $d = .43$. Thus, child gender was included in models predicting child change in percent overweight, both as a main effect and in all interactions.

Frequency of LOC Eating Episodes

Based on the ChEDE, 62 children (25.7%) were categorized as having LOC (≥ 1 LOC episode in the past 3 months). Of the 62 children who reported LOC, 25 (40.3%) reported only 1 episode in the past 3 months (median = 2, $M = 4.1 \pm 6.9$, range = 1 – 41 episodes). In exploratory analyses, children were categorized more broadly based on whether they reported ever experiencing an LOC eating episode. An additional 25 children (for a total of 87, or 38.7% of the total sample; data missing from 16) reported that they have experienced LOC eating in the past, but not in the past 3 months.

Based on the EDE-Q, 119 parents (49.6%) were categorized as having LOC (at least 1 reported LOC eating episode in the past month). Of those 119 parents, 23 (19.3%) reported only 1 episode in the past month (median = 3 episodes, $M = 5.7 \pm 7.0$, range = 1 - 49).

Primary Analyses

Hypothesis 1

Children with LOC will demonstrate a higher level of food reinforcement than will children without LOC. In the final model, the main effect of LOC was significant, $\chi^2(1, N = 240) = 4.76$, $p = .029$, OR = 2.03, indicating that children who reported LOC were more likely to have high food reinforcement than were No LOC children (see Figure 2). The only significant interaction that emerged was the two-way interaction between counterbalanced task order and children's liking of the test food, $\chi^2(1, N = 240) = 6.65$, $p = .010$, OR = 1.53. Specifically, children who reported a higher liking of the test food (i.e., their selected preferred snack food) and who received the snack food reinforcement task (food vs. money) first in the order, rather than second or third, were more likely to have high food reinforcement. All other two-way interactions, three-way interactions, and the four-way interaction were not statistically significant (*p*s > .18). For example, the two-way interactions between LOC and task order, $\chi^2(1, N = 240) = 1.76$, $p = .185$, OR = 0.36; LOC and liking of the test food, $\chi^2(1, N = 240) < .01$, $p = .993$, OR = 1.00; and between LOC and pre-test hunger, $\chi^2(1, N = 240) = 0.01$, $p = .920$, OR = 0.99 were all non-significant. Similarly, the above two-way interaction between liking of the test food and task order did not differ by child LOC, in that this 3-way interaction was not significant, $\chi^2(1, N = 240) = 0.62$, $p = .431$, OR = 1.35.

Hypothesis 2

Children with LOC will demonstrate greater emotional eating, less satiety responsiveness, greater food responsiveness and enjoyment, greater internalizing symptoms, and decreased quality of life. The full MANOVA model was significant, $F(9, 226) = 4.08$, $p < .001$ (see Table 4). Child self-reported variables significantly differed between LOC and No LOC children; children who reported LOC also reported significantly higher emotional eating ($p < .001$), depressive symptoms ($p = .008$), and anxiety symptoms ($p < .001$), and poorer quality of life ($p = .03$). However, no differences were seen between groups in parent-reported variables (i.e., parents' report of their children's satiety responsiveness, food responsiveness and enjoyment, internalizing symptoms, and quality of life).

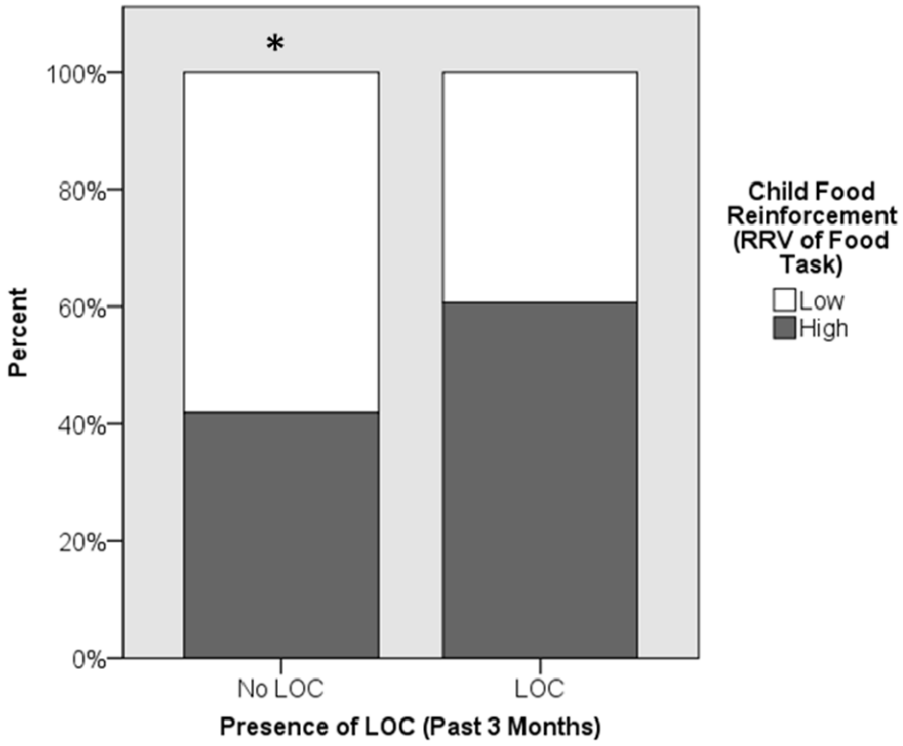

Figure 2. Child food reinforcement by the presence of child self-reported LOC. RRV = Relative reinforcing value.

* $p < .05$

Table 4

Characteristics of Children with and without LOC

Variable	LOC (n = 62)	No LOC (n = 179)	η^2	F-values
Full MANOVA model	---	---	.14	$F(9, 226) = 4.08$***
Child Self-report				
EES-C Emotional Eating	1.2 (0.8)	0.6 (0.6)	.12	$F(1, 235) = 32.37$***
SMFQ Depressive Symptoms	7.6 (6.4)	5.5 (5.1)	.03	$F(1, 235) = 7.09$**
SCARED Anxiety Symptoms	25.8 (16.5)	18.3 (13.1)	.05	$F(1, 235) = 12.63$***
PedsQL Quality of Life	66.1 (17.9)	71.6 (16.6)	.02	$F(1, 235) = 4.79$*
Parent-report on Child				
CEBQ Satiety Responsiveness	2.3 (0.6)	2.2 (0.6)	.01	$F(1, 235) = 1.75$
CEBQ Food Responsiveness	3.7 (0.9)	3.7 (0.8)	<.01	$F(1, 235) = 0.04$
CEBQ Food Enjoyment	4.3 (0.8)	4.3 (0.6)	<.01	$F(1, 235) = 0.03$
CBCL Internalizing Symptoms	54.6 (10.5)	54.3 (10.4)	<.01	$F(1, 235) = 0.03$
PedsQL Quality of Life	77.4 (16.0)	78.3 (14.4)	<.01	$F(1, 235) = 0.14$

Note. For all variables, *Mean* (*SD*) are presented. Child self-reported LOC eating was used to categorize children. LOC = At least 1 loss of control eating episode in the past 3 months; No LOC = No loss of control eating in the past 3 months; EES-C = Emotional Eating Scale – Adapted for Children; SMFQ = Short Mood and Feelings Questionnaire; SCARED = Screen for Child Anxiety Related Emotional Disorders; PedsQL = Pediatric Quality of Life Inventory; CEBQ = Child Eating Behavior Questionnaire; CBCL = Child Behavior Checklist.

*$p < .05$. **$p < .01$. ***$p < .001$.

Hypothesis 3

Children with LOC will have a higher rate of attrition and poorer treatment attendance than will children without reported LOC. LOC and No LOC children did not differ in their likelihood of dropping out of treatment, $\chi^2(1, N = 241) = 0.71$, $p = .486$, OR = .74, or in the number of sessions they attended (11.6 versus 11.0 sessions, respectively), $t(239) = -0.91$, $p = .363$, $d = -.14$. The lack of difference in number of treatment sessions attended remained the same when only FBT completers were analyzed, $t(183) = -0.66$, $p = .508$, $d = -.11$.

Children with LOC will achieve poorer relative body weight loss than children without LOC. Although the main effect of LOC status (LOC vs. No LOC) was not significant, $F(3, 182) = 1.58$, $p = .211$, $\eta^2 = .01$, there was a significant interaction between LOC and child gender, $F(3, 182) = 5.22$, $p = .024$, $\eta^2 = .03$ (see Figure 3). Specifically, male children who reported LOC experienced better weight outcomes (i.e., a greater average decrease in percent overweight from baseline to post-FBT) than male children without LOC, $t(68) = 2.05$, $p = .045$, $d = .57$, whereas girls with and without LOC experienced similar changes in percent overweight, $t(111) = -0.91$, $p = .366$, $d = -.19$. This pattern remained identical in the ITT analysis, $F(3, 240) = 10.21$, $p = .002$, $\eta^2 = .04$.

Hypothesis 4

Children of parents with LOC will be more likely to report LOC, and children's and their parents' level of food reinforcement will be positively associated. The model predicting child self-reported LOC using parent gender, parent LOC, and their two-way interaction was not significant, $\chi^2(3, N = 235) = 1.17$, $p = .761$. No association was observed between child and parent food reinforcement, $\chi^2(1, N = 239) = 1.50$, $p = .242$, OR = .73.

Hypothesis 5

Level of non-snack food reinforcers available in the child's home/neighborhood environment will moderate the effect of food reinforcement on treatment outcome. The results of the full regression model are shown in Table 5 ($p = .009$). In the final model, with non-significant interaction terms removed, the main effects of child food reinforcement ($p = .093$) and non-snack

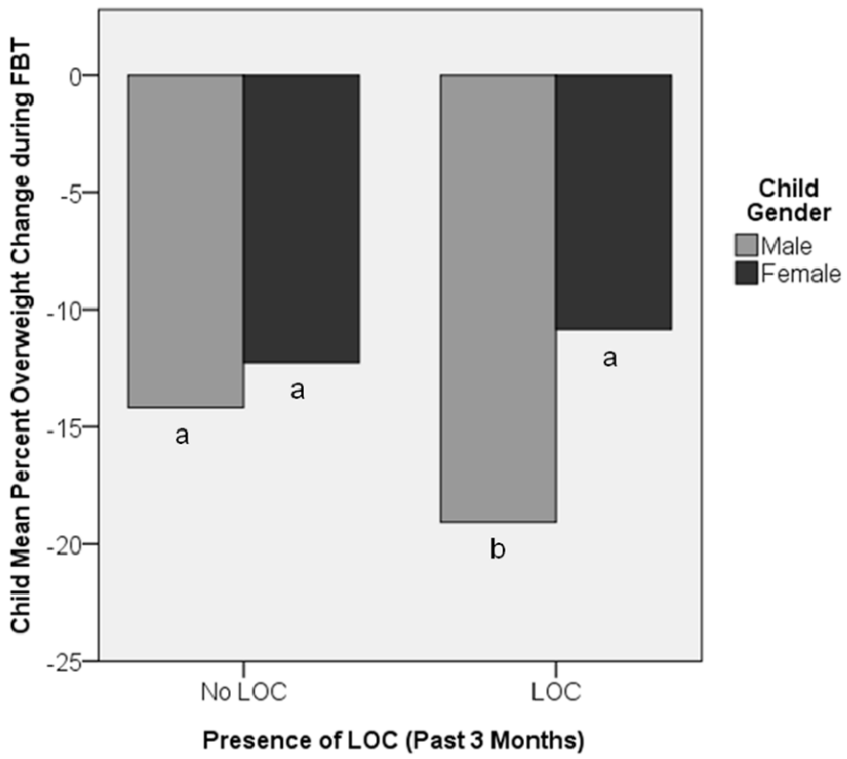

Figure 3. Interaction between child gender and child self-reported LOC as a predictor of child percent overweight change. Bars with different lettering significantly differ, $p < .05$. Interaction term $p = .024$.

Table 5

Hierarchical Regression Model Predicting Child Percent Overweight Change during FBT

Variable	*B*	*SEB*	*β*	*p*	R^2	ΔR^2	$p\Delta R^2$
Step 1: Child Baseline Variables					.050		.03
Gender	3.35	1.21	.20	.01			
Food Reinforcement	1.34	1.18	.08	.26			
Non-snack Food Reinforcers in the Environment	-.03	.04	-.05	.49			
Step 2: Two-way interactions					.102	.05	.02
Gender x Food Reinforcement	4.02	2.40	.23	.10			
Gender x Non-snack Food Reinforcers in the Environment	-.15	.08	-.70	.07			
Food Reinforcement x Non-snack Food Reinforcers in the Environment	.15	.07	.72	.04			
Step 3: Three-way interaction							
Gender x Food Reinforcement x Non-snack Food Reinforcers in the Environment	-.01	.16	-.03	.96	.102	.00	.96

Note. *B* and *SEB* are the Beta coefficients and *β* is the standardized *β* coefficient.

food reinforcers in the environment (p = .062) were not significant, but there was a significant two-way interaction between food reinforcement and non-snack food reinforcers in the environment (p = .048). Specifically, children with low food reinforcement who also had more non-snack food reinforcers in the environment tended to achieve greater decreases in percent overweight (see Figure 4). Post-hoc analyses, although not statistically significant, suggested that among children low in food reinforcement, a higher level of alternate reinforcers in the environment was correlated with a decrease in percent overweight, $r(94) = -.17$, p = .096. Among children high in food reinforcement, alternate reinforcers in the environment and percent overweight change were not associated, $r(81) = .08$, p = .489. In the ITT analysis, the full model remained significant (p = .043), although the two-way interaction between food reinforcement and non-snack food reinforcers in the environment failed to reach significance (p = .056).

As the global index of non-snack food reinforcers in the environment included a variety of items (e.g., healthy foods, neighborhood resources), confirmatory analyses were run only using the index of physical activity items in the child's home environment. The pattern of findings was similar. The overall ANOVA was significant (p = .012), as was the interaction between food reinforcement and reinforcers in the environment (p = .039). The ITT model was similar although not statistically significant (p = .107).

Hypothesis 6

Parents' level of food reinforcement and alcohol reinforcement will be positively associated; parent alcohol reinforcement will be positively associated with child food reinforcement. Parents with high food reinforcement did not differ on alcohol reinforcement from those with low food reinforcement, either among the full sample, $t(235) = -1.81$, p = .072, d = .24, or within only the subset of parents who reported that they drink alcohol, $t(173) = -1.51$, p = .132, d = .23. Child food reinforcement was not associated with parent alcohol reinforcement when analyzed among the full sample, $t(235) = .50$, p = .615, d = -.07, or among only the subset of parents who reported that they drink alcohol, $t(172) = .50$, p = .618, d = -.08.

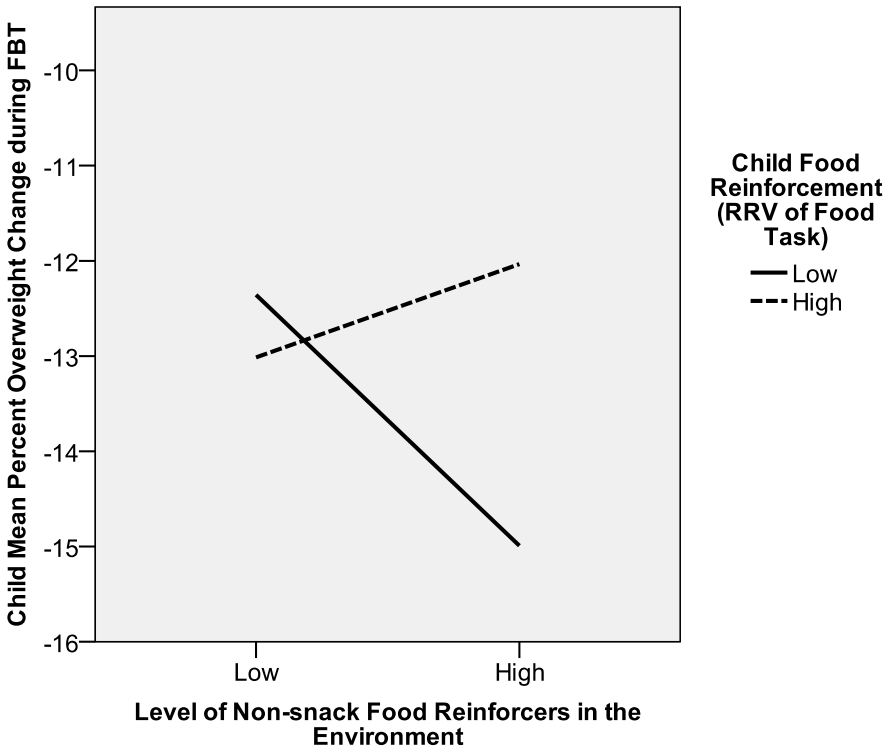

Figure 4. Interaction between child food reinforcement and level of non-snack food reinforcers in the environment in the final model. Level of non-snack food reinforcers in the environment was analyzed as a continuous variable, but is presented as low and high using a median split, for illustration purposes. Observed percent overweight change values are presented. RRV = Relative reinforcing value.

Interaction term $p = .048$.

Post-Hoc Secondary Analyses

Categorizing Children by Recency and Frequency of LOC

For these analyses, children were categorized based on whether they reported having ever experienced LOC, whether LOC episodes occurred recently (i.e., in the past 3 months), and whether frequent LOC (i.e., more than one episode) was reported. Sixteen children were unable to be categorized in this way due to missing data on the *LOC Ever* question, due to its addition to the interview after recruitment began and assessors failing to collect prior to the beginning of FBT. This categorization yielded the following groups: 1) LOC never, n = 138 (61.3%); 2) LOC ever but not recent, n = 25 (11.1%); 3) LOC recent but only once, n = 25 (11.1%); and 4) LOC recent and more than once, n = 37 (16.4%).

Hypothesis 1: Child LOC and Food Reinforcement. A pattern emerged whereby children appeared more likely to have high food reinforcement as LOC recency and frequency increased, $\chi^2(1, N = 224) = 12.30$, $p = .006$. The logistic regression model, which also included task order, children's liking of the test food, and pre-test hunger, was significant, $\chi^2(7, N = 224) = 25.38$, $p < .001$; however, the only significant difference was between the LOC Never group and all other LOC groups, in that any LOC (LOC Ever, LOC recent but only once, and LOC recent and more than once) conferred greater likelihood of having high food reinforcement, $\chi^2(1, N = 224) = 8.80$, $p = .003$, OR = 2.49 (see Figure 5). The two-way interaction between pre-test hunger and food liking was also significant, $\chi^2(1, N = 224) = 5.93$, $p = .015$, OR = 1.51.

Hypothesis 2: Differences between LOC Groups on Appetitive Traits, Internalizing Symptoms, and Quality of Life. The full MANOVA model was significant, $F(9, 210) = 4.45$, $p < .001$, $\eta^2 = .16$. Findings evidenced a similar pattern as in the primary analyses, in that differences were seen for child self-reported variables (see Figure 6) but not parent-reported variables (data not shown). Specifically, among the LOC categories (LOC never, LOC ever but not recent, LOC recent but only once, and LOC recent and more than once), children in any of the three LOC categories tended to report higher emotional eating, higher depressive symptoms, higher anxiety symptoms, and poorer quality of life, with the exception that differences were not always seen

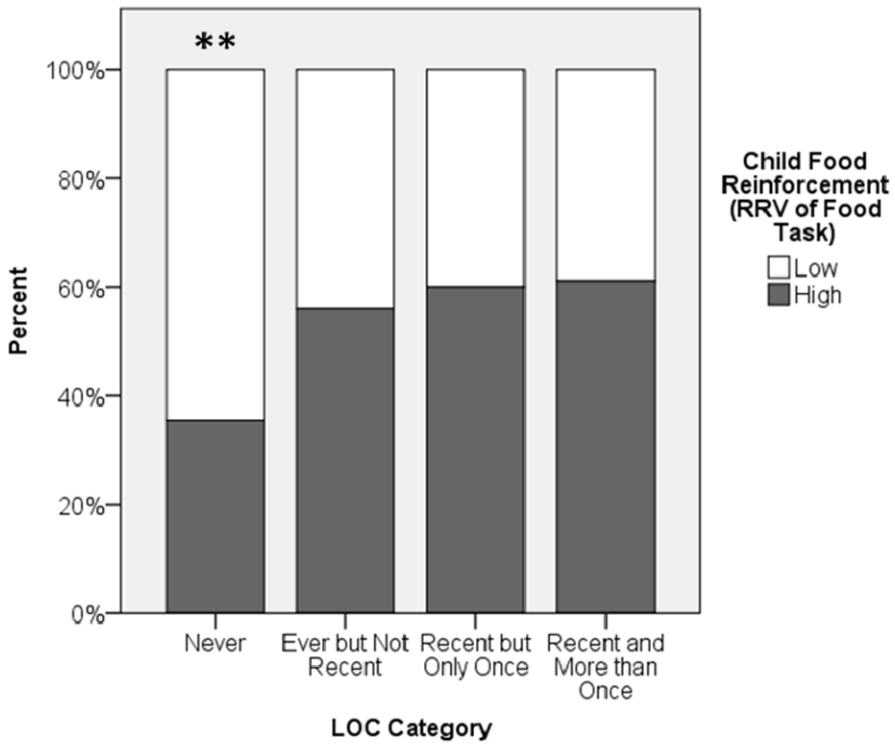

Figure 5. Child food reinforcement by child self-reported LOC recency and frequency. RRV = Relative reinforcing value.

** $p < .01$.

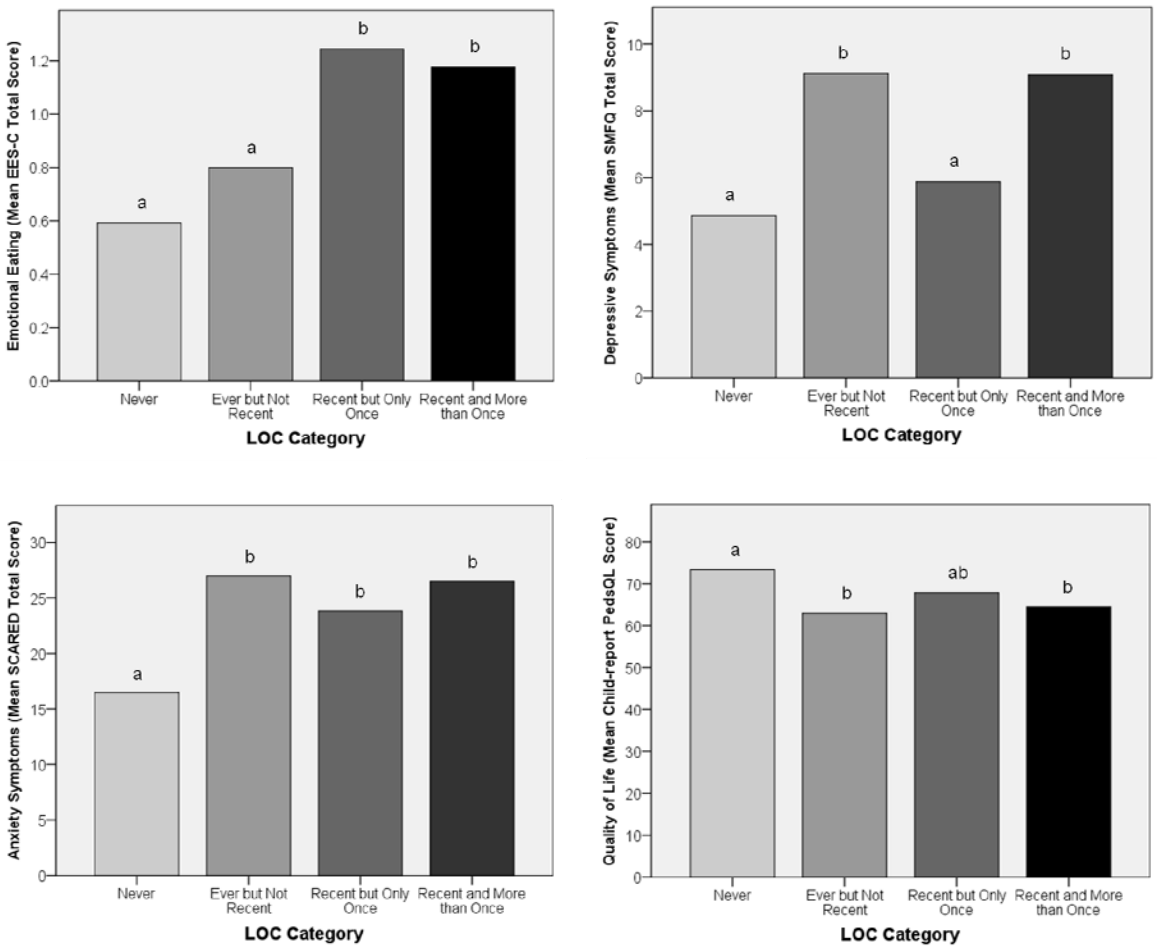

Figure 6. Differences between child self-reported LOC categories (recency and frequency) on child self-reported emotional eating, depressive symptoms, anxiety symptoms, and quality of life. EES-C = Emotional Eating Scale – Adapted for Children; SMFQ = Short Mood and Feelings Questionnaire; SCARED = Screen for Child Anxiety Related Emotional Disorders; PedsQL = Pediatric Quality of Life Inventory. Bars with different lettering significantly differ, $p < .05$.

between the Never and Ever but not recent and between the Never and Recent but only once groups. The Recent and more than once LOC group consistently differed from the Never group (see Figure 6).

Hypothesis 3: Differences between Groups on Attendance, Attrition, and Relative Body Weight Loss. Similar to primary analyses, LOC groups did not differ in their likelihood of dropping out of treatment, $\chi^2(3, N = 225) = 0.43$, $p = .935$, or in the number of sessions they attended, $F(3, 224) = 0.18$, $p = .910$, $\eta^2 < .01$.

Results were similar to the primary analyses, in that LOC group (e.g., LOC Ever versus Never, $F(1, 172) = .22$, $p = .642$, $\eta^2 < .01$) did not predict child percent overweight change, but the two-way interaction between child gender and LOC Ever status was significant, in that boys who reported ever having experienced LOC had the best weight outcomes, $F(1, 172) = 4.96$, $p = .027$, $\eta^2 = .03$. To more closely parallel the study by Wildes et al. (2010) which compared children who reported binge eating "often," the "recent and more than once" LOC group was compared against all other groups combined. Results were similar to the primary analysis; although the interaction between LOC and child gender was not significant in the completers analysis, $F(1, 182) = 2.79$, $p = .097$, $\eta^2 = .02$, it was statistically significant in the ITT analysis, $F(1, 240) = 5.87$, $p = .016$, $\eta^2 = .02$. Specifically, boys with recent and frequent LOC achieved greater decreases in percent overweight than boys without LOC, $t(88) = 2.49$, $p = .015$, $d = -.72$, whereas girls' percent overweight change did not differ between LOC and No LOC groups, $t(149) = -.40$, $p = .694$, $d = .09$.

Categorizing Children by LOC Size (Objective Binge Episodes)

For this exploratory analysis, 200 children were able to be categorized into the following groups, based on history of LOC and presence of recent objectively large binge eating episodes: OBEs ($n = 23$, 11.5%), SBEs only ($n = 39$, 19.5%), OOs and no history of LOC ($n = 18$, 9.0%), and no recent aberrant eating episodes and no history of LOC ($n = 120$, 60.0%). The remaining 41 children were excluded from this analysis due to either missing data on the LOC Ever variable

(*n* = 16), or inability to fit into any remaining groups (e.g., due to the presence of LOC in the past, but not recently.

Hypothesis 1: Child LOC and Food Reinforcement. The final regression model was significant, $\chi^2(6, N = 199) = 22.48$, $p = .001$, and included only main effects, as no interaction terms were statistically significant (*p*s > .11). Similar to the primary analyses, children in the SBE group were most likely to have high food reinforcement, $\chi^2(1, N = 199) = 7.36$, $p = .007$, OR = 2.95, whereas other groups did not differ significantly (*p*s > .24; see Figure 7).

Hypothesis 2: Differences between LOC Groups on Appetitive Traits, Internalizing Symptoms, and Quality of Life. The full MANOVA model was significant, $F(9, 183) = 1.81$, $p = .008$, $\eta^2 = .18$. Findings evidenced a similar pattern as in the primary analyses, in that differences were seen for child self-reported variables (see Figure 8) but not parent-reported variables (data not shown). Specifically, children in the LOC groups (OBE or SBE) reported higher depressive symptoms, higher anxiety symptoms, and poorer quality of life as compared to the None group (*p*s < .05), whereas the OO group's scores were intermediate between the None and LOC groups. Emotional eating was the only variable to differ from this pattern, in that the LOC groups (OBE or SBE) scored significantly higher as compared to both the OO and None group (*p*s < .05; see Figure 8).

Hypothesis 3: Differences between Groups on Attendance, Attrition, and Relative Body Weight Loss. Similar to primary analyses, LOC groups did not differ in their likelihood of dropping out of treatment, $\chi^2(3, N = 200) = 0.96$, $p = .811$, or in the number of sessions they attended, $F(3, 199) = 0.14$, $p = .937$, $\eta^2 < .01$.

After including the main effects of child gender and LOC group status and their interaction in the model, results were similar to the primary analyses in that the main effect of LOC group status was not a significant predictor of child change in percent overweight from baseline to post-FBT, $F(3, 153) = 1.60$, $p = .192$, $\eta^2 = .03$, but the interaction between LOC group status and child gender was significant, $F(3, 153) = 3.20$, $p = .025$, $\eta^2 = .05$. Findings were in the same direction as in the primary analyses, with the addition that boys in the OBE group

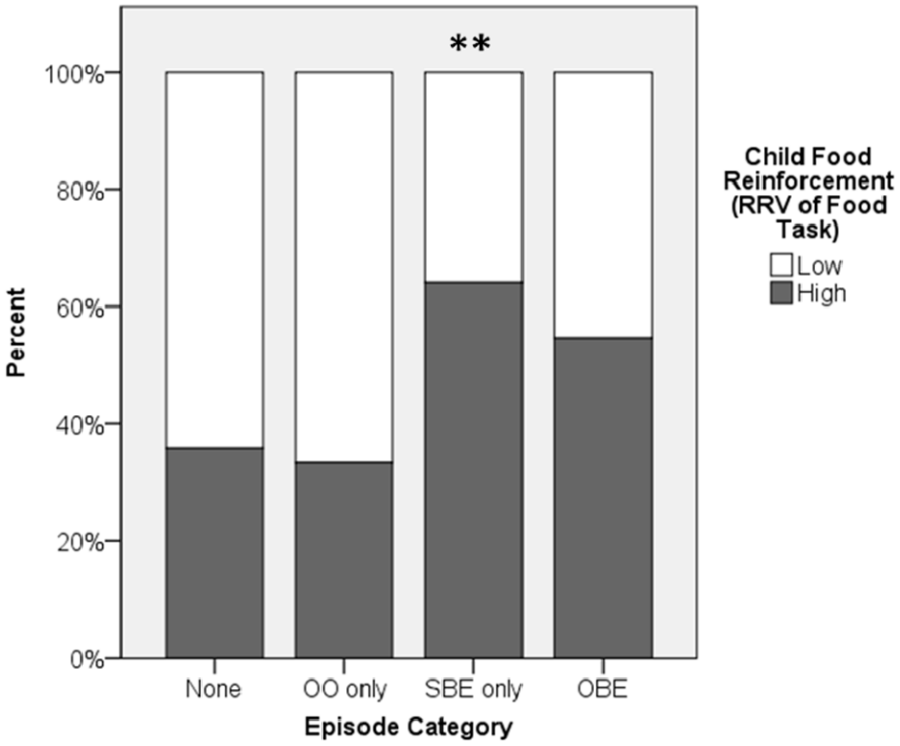

Figure 7. Child food reinforcement by child self-reported LOC and episode size. RRV = Relative reinforcing value; OO = Objective overeating episodes; SBE = Subjective binge eating episodes; OBE = Objective binge eating episodes.

** $p < .01$.

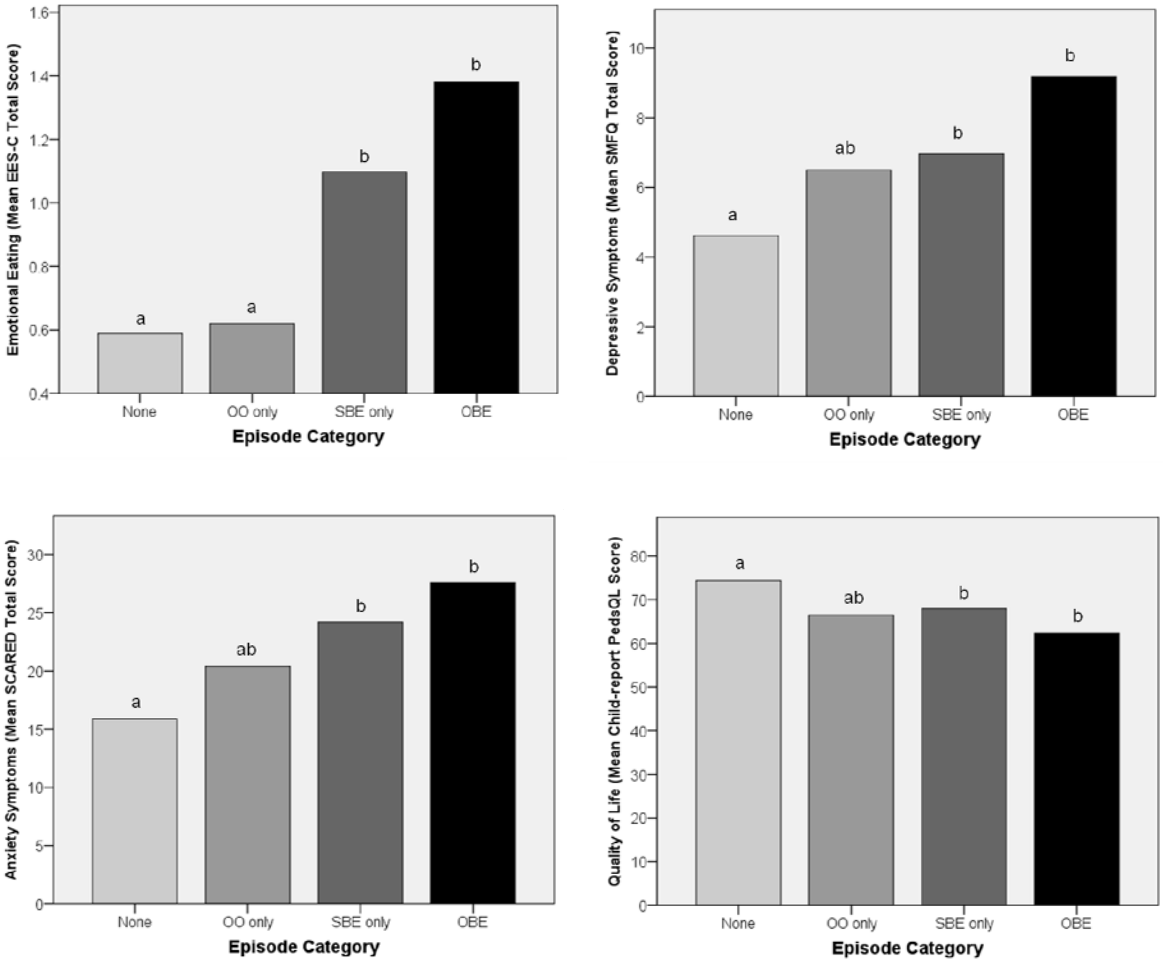

Figure 8. Differences between child self-reported LOC size categories on child self-reported emotional eating, depressive symptoms, anxiety symptoms, and quality of life. EES-C = Emotional Eating Scale – Adapted for Children; SMFQ = Short Mood and Feelings Questionnaire; SCARED = Screen for Child Anxiety Related Emotional Disorders; PedsQL = Pediatric Quality of Life Inventory. Bars with different lettering significantly differ, $p < .05$.

experienced the best weight outcomes. Again, findings were identical when using an ITT analysis, $F(3, 199) = 5.47$, $p = .001$, $\eta^2 = .07$. Of note, only 5 out of the 23 children in the OBE group (22%) were boys.

Categorizing Children with LOC based on Parent Report

For these analyses, a child was categorized as LOC if the parent reported, via questionnaire (EDE-Q-Pc), that his/her child had at least 1 LOC eating episode in the past 3 months. Child self-reported LOC and parent-report on child LOC were not in agreement, $\chi^2(1, N = 240) = 0.01$, $p = 1.00$, OR = 1.03. This lack of association remained when examined among only those parents who self-reported LOC, $\chi^2(1, N = 118) = <.01$, $p = 1.00$, OR = 1.00, or among those who did not self-report LOC, $\chi^2(1, N = 116) = 0.01$, $p = 1.00$, OR = 1.06. That is, 57 children (23.8%) were categorized as having LOC using parent-report, and 62 children self-reported LOC (25.7%), but there was an overlap of only 15 (6.2%) children for whom both the parent and child reported the presence of child LOC.

Hypothesis 1: Child LOC and Food Reinforcement. For the sake of parsimony in this exploratory analysis, only main effects and all two-way interactions were included in the model. No main effects (i.e., pre-test hunger, task order, food liking, or parent-report on child LOC) were significant predictors of child high food reinforcement (*p*s > .13), but two significant two-way interactions emerged: LOC x task order, $\chi^2(1, N = 239) = 4.24$, $p = .039$, OR = .25, and food liking x task order, $\chi^2(1, N = 239) = 5.41$, $p = .02$, OR = 1.47. As in the primary analyses, children were more likely to demonstrate high food reinforcement if they received the task first and reported greater liking of their selected snack food. In addition, children were most likely to have high food reinforcement if they received the task first and their parents reported they did *not* have LOC.

Hypothesis 2: Differences between LOC Groups on Appetitive Traits, Internalizing Symptoms, and Quality of Life. The full MANOVA model was significant, $F(9, 225) = 2.84$, $p = .004$, $\eta^2 = .10$. When assessed via parent-report, child LOC findings were the reverse of those seen in the primary analysis: child-report variables (i.e., child self-reported emotional eating,

internalizing symptoms, and quality of life) did not significantly differ between LOC and No LOC children (*p*s > .15). However, parent-reported LOC children differed on parent-reported variables, including higher internalizing symptoms ($p = .001$) and poorer quality of life ($p = .001$), although not satiety responsiveness ($p = .075$) or food responsiveness ($p = .096$).

To more closely parallel the one previous study examining parent-report on child LOC and child self-reported and parent-report on child internalizing symptoms (Steinberg et al., 2004)—which only measured parent-report on child *binge eating* (i.e., unambiguously large LOC episodes [OBEs])—children were categorized into parent-report on child OBE ($n = 38$) and No OBE ($n = 189$). The full MANOVA model was significant, $F(9, 217) = 4.16$, $p < .001$, $\eta^2 = .15$. Findings were similar to the model comparing parent-report on child LOC, in that parents who reported that their child experienced recent OBEs reported greater child internalizing symptoms ($p < .001$). In addition, children with parent-reported OBEs self-reported greater depressive symptoms ($p = .016$).

Hypothesis 3: Differences between Groups on Attendance, Attrition, and Relative Body Weight Loss. Parent-report on child LOC and No LOC groups did not differ in their likelihood of dropping out of treatment, $\chi^2(1, N = 240) = 0.22$, $p = .722$, OR = .84, or in the number of sessions they attended (11.4 versus 11.1 sessions, respectively), $t(238) = -0.37$, $p = .715$, $d = .05$. The lack of difference in number of treatment sessions attended remained the same when only FBT completers were analyzed ($p = .918$). After including child gender, LOC status (LOC vs. No LOC), and their two-way interaction in the model, neither parent-report on child LOC, $F(1, 181) = .19$, $p = .660$, $\eta^2 < .01$, nor the interaction term $F(1, 181) = .94$, $p = .333$, $\eta^2 = .01$, predicted child change in percent overweight from baseline to post-FBT.

Hypothesis 4: Association between Child and Parent LOC. In the model including parent gender, $\chi^2(1, N = 241) = .05$, $p = .818$, OR = .90, parents who self-reported that they experienced recent LOC were three times as likely to report that their children also had recent LOC episodes, $\chi^2(1, N = 234) = 10.63$, $p = .001$, OR = 3.00. The interaction between parent gender and parent LOC was not significant, $\chi^2(1, N = 241) = 1.65$, $p = .199$, OR = 3.23.

Subsample Analyses Only among Children with LOC

These exploratory analyses were conducted among only the subset of children reporting LOC eating episodes (n = 62), using the number of LOC episodes reported in the previous three months as a continuous variable (M = 4.1, range 1 - 41). Number of LOC episodes was square-root transformed for analyses to more closely approximate a normal distribution.

Hypothesis 1: Child LOC and Food Reinforcement. Within the 62 children with LOC, the 37 children (59.7%) who reported high food reinforcement did not differ from those with low food reinforcement on number of LOC episodes reported in the past 3 months, $t(59) = .54$, $p = .590$, $d = -.14$.

Hypothesis 2: Associations between Child LOC and Appetitive Traits, Internalizing Symptoms, and Quality of Life. A higher number of child-reported LOC episodes was significantly associated with child self-reported variables, including higher emotional eating, $r(59) = .28$, $p = .029$; higher depressive symptoms, $r(60) = .40$, $p = .001$; and higher anxiety symptoms, $r(60) = .40$, $p = .001$. The association between LOC episodes and quality of life failed to reach significance, $r(60) = -.25$, $p = .054$. There was no association between number of child self-reported LOC episodes and parent-report on child variables examined, including: satiety responsiveness, $r(59) = -.03$, $p = .823$; food responsiveness, $r(60) = .02$, $p = .897$; food enjoyment, $r(60) = .05$, $p = .703$; internalizing symptoms, $r(60) = .16$, $p = .223$; and quality of life, $r(60) = .01$, $p = .971$.

Hypothesis 3: Association between Child LOC and Attendance, Attrition, and Relative Body Weight Loss. There were no associations between child self-reported number of LOC episodes and FBT attendance, $r(60) = -.02$, $p = .910$; FBT dropout status, $t(60) = -.23$, $p = .821$, $d = .07$; or child relative body weight loss, $r(47) = .03$, $p = .832$.

Measuring Child and Parent Food Reinforcement via the Food Purchasing Questionnaire (FPQ)

Hypothesis 1: Child LOC and Food Reinforcement. Child pre-test hunger was correlated with child FPQ food reinforcement and thus was included as a main effect and in the two-way

interaction with LOC status. The interaction (LOC x pre-test hunger) was not significant, $F(13, 219) = 1.66$, $p = .074$, $\eta^2 = .09$, and was removed from the model. In the final model, the main effects of pre-test hunger, $F(18, 219) = 2.01$, $p = .011$, $\eta^2 = .15$, and child LOC status, $F(1, 219) = 6.69$, $p = .010$, $\eta^2 = .03$, were significant. Specifically, children who reported LOC demonstrated higher FPQ food reinforcement, as did children with a higher level of pre-test hunger.

Hypothesis 4: Association between Child and Parent Food Reinforcement. Child and parent FPQ food reinforcement were modestly positively correlated, Spearman's $\rho(218) = .14$, $p = .038$.

Hypothesis 6: Parent Alcohol Reinforcement and Food Reinforcement. Parent alcohol reinforcement and FPQ food reinforcement were not significantly correlated among the full sample, $\rho(235) = .11$, $p = .089$, although a significant correlation emerged within only the subset of parents who reported that they drink alcohol, $\rho(172) = .19$, $p = .014$. Child FPQ food reinforcement was not correlated with parent ARQ alcohol reinforcement when analyzed among the full sample, $\rho(216) = -.07$, $p = .319$, or among only the subset of parents who reported that they drink alcohol, $\rho(159) = -.06$, $p = .443$.

DISCUSSION

The current study examined relations between pediatric LOC eating and other obesogenic appetitive traits (e.g., food reinforcement), internalizing symptoms, quality of life, and weight loss treatment outcome and attendance. Child and parent food reinforcement also were examined in the context of other reinforcers available in the child's environment, as well as their association with parent alcohol reinforcement. Child self-reported LOC was associated with high food reinforcement, and child self-reported greater emotional eating, greater internalizing symptoms, and poorer quality of life. Additionally, LOC interacted with child gender in the prediction of child weight loss treatment response, in that boys who reported LOC achieved the best weight outcomes. Further, child food reinforcement impacted treatment response, in that children achieved the best weight outcomes when food reinforcement was low and level of

alternate reinforcers in the environment was high. Clinical implications of findings and future directions are discussed below.

Association between LOC and Food Reinforcement

The present study provides preliminary support for the relation between pediatric LOC (when assessed via child self-report interview) and high food reinforcement. This overlap between LOC and high food reinforcement was anticipated, given the association of each of these appetitive traits with excessive weight gain over time (Hill et al., 2009; Tanofsky-Kraff et al., 2006). Indeed, high food reinforcement (i.e., feeling a stronger motivation to eat palatable foods) may be one mechanism by which children feel a sense of loss of control over their eating, which then could lead to excess energy intake and greater obesity risk. Emerging research has focused on a cluster of obesogenic appetitive traits that share the feature of impaired ability to regulate energy intake, including LOC, high motivation to eat/food reinforcement, poor satiety responsiveness, and impulsivity (Wilfley, Vannucci, et al., 2010a).

Given this preliminary indication that the appetitive traits of LOC eating and high food reinforcement overlap among overweight treatment-seeking children—a sample in which both of these behaviors are more prevalent—replication is needed in non-treatment seeking samples, and adolescents and adults. Nasser et al. (2008) conducted a small (*N* =18 adults, only 6 of whom had BED) preliminary investigation of food reinforcement in adults, in which adults with BED demonstrated higher food reinforcement after consuming a preload versus when fasted, whereas non-BED subjects demonstrated the opposite pattern (higher food reinforcement when fasted). These previous data, coupled with the present study's finding that hunger and food reinforcement are positively related, suggest that future studies should specifically test the impact of a preload on food reinforcement in youth and adults with and without LOC. Children who reported LOC also reported greater hunger/desire to eat prior to the RRV of Food Task in the present study, but the hunger x LOC interaction was not significant, suggesting that the higher rate of high food reinforcement among children with LOC likely was not merely an artifact of

greater hunger in that group. Although future studies might consider using a preload to ensure that all kids feel physically full during the task, the disadvantages of this approach are noteworthy, including the potential inappropriateness during screening for a weight loss program, and the fact that a preload may disproportionately prime overweight kids to want to eat even more (Temple, Legierski, et al., 2008)—an effect that may be more pronounced in individuals with binge eating problems (Nasser et al., 2008).

The impact that RRV Task administration order had on children's food reinforcement was unexpected. Within the assessment battery, three RRV tasks were conducted, all involving a portion of the child's preferred snack food (i.e., as compared to money, in the present analyses, or as compared to fruits/vegetables or physical activity) to be displayed on the table in front of the child. Children were less likely to respond for the palatable snack food in the food's second or third presentation, as opposed to initially. Children may have been most reactive to the palatable snack food during its first presentation (i.e., whichever RRV Task was administered first), but then decreased in responding during subsequent trials as the snack food remained on the table, especially among children who reported the highest liking of the test food. This pattern may be explained in part by the concept of habituation, referring in this case to a reduction in behavioral responding over multiple presentations of a food (Epstein, Temple, Roemmich, & Bouton, 2009; Myers Ernst & Epstein, 2002; Temple, Giacomelli, Roemmich, & Epstein, 2008), although the present study design does not enable an examination of whether true habituation (as opposed to simple response fatigue) occurred, as only one food stimulus was presented throughout all RRV tasks. Of note, child LOC did not interact with any other predictor examined, including task order, liking of the test food, or pre-test hunger. Additionally, child self-reported LOC was assessed an average of 1.5-2 hr following the RRV of Food Task in the present assessment battery, which likely decreased bias in LOC reporting simply due to exposure to a highly preferred snack food in the food reinforcement task. Thus, although follow-up studies are warranted to replicate results and further explore the impact of potentially important covariates (e.g., hunger, food hedonics), children who report LOC appear more likely to demonstrate high food reinforcement. In studies of

the reinforcing value of food rewards, task administration order merits careful consideration as it may significantly affect results.

As discussed in greater detail below ("Association between LOC and Child Weight Loss Treatment Outcome"), the present study did not assess the potential impact of change over time in LOC, food reinforcement, or both. In particular, decreases in LOC or high food reinforcement during treatment may have positively impacted treatment response (i.e., weight loss) in some children.

Association between LOC and Internalizing Symptoms and Quality of Life

Consistent with previous literature (Goossens et al., 2007; Morgan et al., 2002; Shomaker et al., 2010), children who reported recent LOC also reported greater emotional eating and depressive and anxiety symptoms. Interestingly, children who self-reported LOC also reported poorer quality of life. This finding is in concert with previous studies in which adults with BED (De Zwaan et al., 2002; Rieger et al., 2005) and adolescents with elevated disordered eating behaviors and cognitions (Doyle et al., 2007; Herpertz-Dahlmann et al., 2008) reported a poorer quality of life. The present study augments this existing literature by studying the singular association between LOC and perceived quality of life assessed via self-report, in younger children. This finding that, within a sample of exclusively overweight children, children with who report LOC also report poorer quality of life is noteworthy as overweight children generally report poorer quality of life than their non-overweight peers (Schwimmer, Burwinkle, & Varni, 2003; Williams, Wake, Hesketh, Maher, & Waters, 2005). That is, the presence of even infrequent LOC appeared to impact perceived quality of life above and beyond overweight status. Coupled with the fact that child LOC was not associated with higher obesity severity, these data support the hypothesis that child self-reported LOC confers risk for poorer perceived quality of life among overweight children.

Differences between Child Self-reported LOC and Parent-report on Child LOC

As in previous studies showing poor agreement between child self-report and parent-report on child LOC and related eating behaviors (Braet et al., 2007; Johnson et al., 1999; Tanofsky-Kraff, Yanovski, et al., 2005), child self-report and parent-report on child LOC were unrelated in the present study. This disagreement between informants likely contributed to the different findings regarding the association between child LOC and related appetitive traits, internalizing symptoms, quality of life, and weight outcomes. For example, as discussed in greater detail below, child self-reported LOC was associated with better weight outcomes among boys, but there was no relation between parent-report on child LOC and child outcome. Likewise, no association was found between parent-reported child LOC and child self-reported emotional eating, internalizing symptoms, or quality of life. Altogether, children and their parents were in clear disagreement about the child's experience of LOC.

Although the present study appears to be the first to examine parent-report on child LOC with regard to weight loss treatment outcome or child self-reported quality of life, previous research has examined child self-report and parent-report on child binge eating and internalizing symptoms, with mixed results depending on the sample assessed (i.e., child versus adolescent, treatment-seeking versus non-treatment seeking). Two studies in overweight non-treatment seeking children found no relation between child self-reported LOC and parent-report on child internalizing symptoms (Morgan et al., 2002; Tanofsky-Kraff, Faden, et al., 2005), as in the present study. Among overweight treatment-seeking adolescents (*M* age = 14 years), youth self-reported binge eating was associated with greater internalizing symptoms both by youth self-report and parent-report on their adolescent (Glasofer et al., 2007). However, Glasofer and colleagues examined youth self-reported *binge eating*, rather than more broadly defined LOC. Similarly, a study of non-treatment seeking overweight children found that parent-reported child binge eating was associated with higher child self-reported internalizing symptoms (Steinberg et al., 2004), but again only assessed binge eating (OBEs)—a key limitation of the existing most widely used parent-report measure for child LOC, the Questionnaire of Eating and Weight

Patterns (Johnson et al., 1999). Secondary analyses in the present study revealed that children with parent-reported OBEs tended to self-report greater depressive and anxiety symptoms, which replicates data from Steinberg and colleagues (2004).

At first glance, the positive association between LOC and associated traits (i.e., obesogenic eating behaviors, internalizing symptoms) that differ by child self-report or parent-report on child could merely reflect a reporting bias, whereby individuals are reporting higher distress across all relevant measures, due to some other factor (e.g., severity of obesity, leading to greater concern or distress). That is, parents who were more concerned about their child's weight status may have consequently reported more pathological symptoms across all assessments that ask about their children. However, three points are worth considering: 1) measures in the current study were typically completed on separate days, likely making the relation between measures less apparent to participants (e.g., reporting an LOC episode, demonstrating willingness to work for a portion of snack food, and reporting internalizing symptoms); 2) there was no association between LOC (neither child self-report nor parent-report on child) and degree of overweight in the present study, suggesting that participants were not simply reporting more pathology to reflect children's greater obesity severity; and 3) it may be reasonably assumed that all parents, and at least the majority of children, were concerned about the child's weight status, as all families reported a commitment to join a year-long intensive weight control program.

Given that child self-reports and parents' reports on their children's LOC are often in disagreement (Braet et al., 2007; Johnson et al., 1999; Tanofsky-Kraff, Yanovski, et al., 2005), it becomes difficult for a clinician to determine which report is more accurate. An important limitation in the present study is the difference in assessment methodology between child self-report of LOC (gold-standard interview) and parent-report on child LOC (brief questionnaire). Ideally, LOC should be assessed using standardized interviews, although a lower participant and assessor burden can be achieved, while still maintaining adequate sensitivity and specificity, by using a combination of child interviews—enabling the explanation of difficult concepts for young

children—and parent questionnaires, which are quick and easy to administer. Presumably to reduce participant burden, parent interview about child LOC typically is not used, although it may be worthwhile to include in future studies and in clinical settings. It is likely that parents are perceiving clinically important and useful information about their young children, which merits assessment via standardized interview so that key concepts (e.g., what is meant by "loss of control") can be explained and explored.

In the event that a researcher or clinician only can assess one informant, interviewing the child may provide the most accurate data regarding the presence of LOC eating, given that LOC can be a secretive behavior and is an inherently subjective feeling (i.e., feeling unable to stop eating) that an outside observer would not be able to perceive as easily. Anecdotally, in the present study, several children with LOC appeared upset or embarrassed when being interviewed about their recent LOC episodes, occasionally explicitly reporting that they had not discussed these feelings with their parents. Further, young children may not be developmentally able to articulate these feelings (e.g., to their parents), as they may be relatively new and difficult to describe, and typically require explanation during the ChEDE interview. In support of these explanations, previous data have demonstrated that pediatric LOC episodes are often characterized by feeling emotionally "numb" while eating, eating alone, and feelings of secrecy (Tanofsky-Kraff, Goossens, et al., 2007). As a result, parents might be unable to provide an accurate account of their children's perceived sense of LOC and associated negative affect during meals and snacks. Future studies are needed to examine the predictive validity of assessments of parent-report on child LOC regarding long-term weight and eating behavior outcomes, as this has yet to be evaluated. In contrast, existing literature supports the concurrent and predictive validity of the child self-report interview in youth (Decaluwe & Braet, 2003; Eddy et al., 2007; Hilbert, Tuschen-Caffier, & Czaja, 2010; Tanofsky-Kraff et al., 2011; Tanofsky-Kraff, Yanovski, et al., 2009). As such, it has been recommended that, as in the present study, multiple informants be assessed whenever possible (Tanofsky-Kraff, 2009). Despite the relative lack of validity data for existing parent-report measures for child LOC, parental reports on children's

eating behavior presumably could contain clinically useful information and might serve as a tool to prompt further discussion with parents about how best to promote healthy weight control behaviors in their children.

Associations between Child and Parent LOC and Food Reinforcement

Contrary to hypotheses, child and parent LOC were not associated, either among the full sample or when analyzed separately among parents with LOC or without LOC. Of note, parents who self-reported LOC were more likely to report that their child also experienced recent LOC eating episodes. This concordance may reflect the fact that parents with LOC may more readily perceive their children to exhibit LOC. For instance, one previous study found that adults with binge eating disorder were more likely to report a history of binge eating in their family members (Fowler & Bulik, 1997). Likewise, parents who reported LOC may have been experiencing greater overall distress, and thus identified and reported greater pathology (e.g., LOC, internalizing symptoms, obesogenic appetitive traits, poorer quality of life) in their children.

In addition to differences by informant and type of assessment methodology used, results may have been influenced by the young age of the children in the present study, as reported LOC and binge eating were relatively infrequent. As children become older and as a subset of overweight youth develop more severe binge eating problems, stronger child-parent associations in binge eating and related obesogenic appetitive traits may emerge. Indeed, a body of research supports the heritability of BED, which aggregates in families when first-degree adult relatives are assessed (Hudson et al., 2006; Javaras et al., 2008).

The lack of association between child and parent food reinforcement as measured by the RRV of Food Task contradicts findings from the only previous study to date comparing child and parent food reinforcement (Epstein et al., 2008). The primary difference between Epstein and colleagues and the present study is a larger sample size in the present study (N = 241 families versus N = 50 families in Epstein et al.) In addition, although the same tool was used to measure food reinforcement (Goldfield et al., 2005), a slightly different administration protocol was used in

Epstein et al., whereby the task was administered multiple times with varying levels of work requirements to obtain either the food or monetary reinforcer, with the total number of responses made for food throughout all sessions as the outcome variable (Epstein et al., 2008). In contrast to the lack of association found using the RRV of Food Task, child and parent food reinforcement were positively correlated in the present study when child and parent were assessed with the Food Purchasing Questionnaire (FPQ). This difference in findings based on food reinforcement assessment method suggests that perhaps children, parents, or both are responding to the task and questionnaire assessment differently. In particular, the FPQ has not been previously validated in children, and it may not provide as accurate of a proxy for food reinforcement (i.e., willingness to *work* for a preferred snack food) in children. Indeed, responses from 17 children were considered invalid due to children reporting that they would spend a very high amount of money on their preferred snack food (i.e., at least $70 per portion). It appears that some children may not understand the FPQ instructions as currently written; future validation of a questionnaire assessment of food reinforcement in young children should consider additional modifications, while maintaining the verbal administration used in the present study to enhance comprehension. It is possible that the parent-child concordance in FPQ responses was influenced by another factor, such as similarity in how much value an individual places on *money*, rather than reflecting a true similarity in the relative reinforcing value of snack food. Alternatively, it may be that a lower social desirability bias in the questionnaire assessment affected results and promoted the emergence of a parent-child relationship in food reinforcement.

Follow-up studies are also needed to replicate findings using either food reinforcement assessment protocol, including the computer laboratory task assessment of food reinforcement. Future studies might also evaluate the impact of food type chosen by the child and parent, as Epstein and colleagues (2008) offered healthy food choices (e.g., fat-free yogurt, carrots) in addition to the standard high energy-dense snack foods used in the present study (e.g., cookies, chips). As in the case of LOC, a stronger relation between child and parent food reinforcement

may emerge as children become older, which then might be observed on the RRV of Food Task as well as a questionnaire assessment.

Association between LOC and Child Weight Loss Treatment Outcome

In the present study, child LOC—including either child self-report or parent-report on child—was not predictive of treatment attendance or attrition. LOC was hypothesized to negatively impact treatment attendance, although children with LOC also reported a poorer quality of life, and it is possible that children with LOC and a low perceived quality of life found FBT to be particularly helpful and engaging, given that it was associated with clinically significant weight loss but also that it incorporated fun, interactive groups and a supportive peer environment. In the case of parent-report, parent-report on child LOC also did not negatively affect attendance; parents who believed their children to experience LOC (whom they also indicated had a poorer quality of life) may have felt greater concern over their children's eating behaviors and felt even greater motivation to attend treatment, helping to equalize the weight loss of children with versus without LOC.

However, contrary to hypotheses, child gender interacted with child self-reported LOC status to predict weight outcomes among boys; the presence of reported LOC was not associated with differential weight outcomes in girls but was associated with better weight outcomes in boys. Findings suggest that not only does pre-treatment self-reported LOC not singularly preclude children from participating and succeeding in standard short-term weight loss treatment, but male children who report LOC may experience an even greater benefit from FBT than male children without LOC. This finding is contrary to the few previously published studies regarding LOC as a predictor of weight loss treatment outcome in children, discussed in greater detail below. As binge eating in adolescence is more common in females as compared to males (Croll, Neumark-Sztainer, Story, & Ireland, 2002; Decaluwe & Braet, 2003), one potential explanation is that LOC may have decreased over time in boys to a greater degree than in girls. Follow-up LOC data are needed to test this hypothesis, although data from two large community samples indicate that

girls are prospectively more likely than boys to develop binge eating (Haines, Neumark-Sztainer, Eisenberg, & Hannan, 2006) and binge eating tends to increase over time in girls but remain stable in boys (Field et al., 1999). This explanation would also be concordant with data from adolescents (Ranzenhofer, 2009) and adults with type 2 diabetes (Gorin et al., 2008) suggesting that individuals who report binge eating at pre-treatment but not at post-treatment achieve weight outcomes comparable to those who never reported binge eating, and better than those who continued to binge eat or began binge eating during treatment. That is, LOC may have been more persistent among girls, which may have been associated with less weight loss success relative to boys.

Children's LOC may have decreased with treatment as a result of effective weight loss treatment strategies, which would lend further support to previous data suggesting that youth's disordered eating attitudes decrease following lifestyle healthy weight control programs (Levine, Ringham, Kalarchian, Wisniewski, & Marcus, 2001; Stice, Marti, Spoor, Presnell, & Shaw, 2008). In particular, the intensive weight loss treatment offered could have conferred a large benefit to children via promotion of healthy dietary restraint. The strict restraint characteristic of disordered eating (e.g., total avoidance of certain foods, rigid dietary rules, fasting) is positively associated with binge eating in youth, both cross-sectionally (Goossens, Braet, & Bosmans, 2010) and longitudinally (Stice et al., 2002). In contrast, FBT promotes using more flexible dietary guidelines and ensuring sufficient dietary intake, while teaching healthy effective weight loss treatment strategies, such as planning for regular meals and snacks, employing volumetrics to make food eaten more satisfying, self-monitoring of dietary intake to promote awareness, and stimulus control to restructure the home environment to promote a healthier diet (Wilfley, Vannucci, & White, 2010b). Moreover, FBT targets improving support for children's efforts to make healthy behavior changes, including positive parenting (e.g., using specific praise, rewarding children for healthy changes). Children reporting LOC—who, as a result, are particularly at risk for excessive weight gain—may especially benefit from these strategies. Long-term follow-up data, including

both changes in percent overweight and LOC presence and severity, will likely help to clarify the interplay between child gender, LOC, and weight outcomes.

The finding that reported LOC was not associated with poorer treatment outcomes stands in contradiction to data from Wildes and colleagues (2010) in which children's binge eating predicted poorer short-term weight loss treatment outcome. However, this previous study assessed binge eating using a single questionnaire item (kids who reported binge eating at least "often"), whereas the present study used gold-standard interview. Also, the Wildes study excluded children who reported binge eating "rarely" or "sometimes" from the binge eating group (according to the questionnaire's scoring guidelines), whereas children with at least one LOC episode were included in the LOC group in the present study, given that even infrequent binge eating is associated with psychosocial impairment (Tanofsky-Kraff, Faden, et al., 2005). However results in the present study were identical when only children with more than one recent LOC episode were compared against the rest of the sample (i.e., boys with more frequent LOC achieved the best weight outcomes), to more closely parallel Wildes and colleagues' study. Another difference to consider between the present study and Wildes and colleagues' study is sample size—only half of the sample in the Wildes study received the FBT (97 families, as compared to 241 in the present study); moreover, only 22 children (out of the full sample of 192) reported binge eating, and it is unclear how many of those children received FBT. Lastly, children in Wildes and colleagues' study had a higher degree of obesity than children in the present study (*M* percent overweight = 91% versus 66%, respectively).

Although the presence of severe binge eating problems was an exclusionary criterion, almost no children and parents were excluded from the study for this reason, suggesting that the present study's sample was representative of the typical frequency and range of LOC episodes seen in treatment-seeking overweight children during middle childhood. Longitudinal follow-up in the present sample will clarify the relation between child LOC—both at baseline and change throughout treatment—and sustained weight control. Considering that children who persist in reporting LOC over time are at increased risk for the development of greater eating pathology and

depressive symptoms (Tanofsky-Kraff et al., 2011), sustained family-based weight control interventions may be effective in curtailing this pattern.

Impact of the Interplay between Food Reinforcement and Environment on Child Weight Loss Treatment Outcome

An interaction emerged whereby a higher level of available non-snack food reinforcers in the child's environment was associated with better weight outcomes among children who were low in food reinforcement. That is, children who had greater access to alternate reinforcers in their environment at baseline, along with a lower level of food reinforcement, demonstrated the best post-FBT weight outcomes.

This pattern is slightly different from the hypothesized effect, which was that poor environmental quality would disproportionately negatively impact weight outcomes among children with high food reinforcement. In the observed interaction, the level of environmental reinforcers did not appear to affect weight outcomes among children high in food reinforcement, but rather was perhaps able to confer benefit only for children low in food reinforcement. As discussed in greater detail below, findings suggest that future weight loss treatments should consider the interplay between children's appetitive traits—specifically high food reinforcement—and the degree to which their home and neighborhood environment fosters or hinders healthy weight regulation behaviors. The powerful influence of the home environment for all overweight children seeking to lose weight has become clear (Kral & Faith, 2009).

Data from the present study support previous research suggesting that a multi-level approach to pediatric obesity treatment is required, including a careful analysis and targeting of individual factors along with the home, family, peer network, and neighborhood environment, to promote sustained weight control (Wilfley, Van Buren, et al., 2010; Wilfley, Vannucci, et al., 2010b). For example, results from Wilfley and colleagues' previous trial comparing different intervention programs for weight control post-FBT, which found that the socially based weight loss maintenance program demonstrated superior effects to the no-treatment control condition in

the long-term (Wilfley, Stein, et al., 2007a). The significance of the interplay between the child's environment and high food reinforcement in the present study are in accordance with these previous results, which suggest that attention to the child's home environment (as well as other contexts that may provide alternate sources of reinforcement) is important for successful weight loss in children. For example, longitudinal analyses are needed to examine the potential positive influence of providing children with additional reinforcers—including those that are socially based, given the highly reinforcing nature of interpersonal relationships for children—on food reinforcement and, in turn, on weight control behaviors. In continuing to enhance and tailor childhood obesity interventions, it will be crucial to encourage parents to provide powerful reinforcers that can compete with the strong drive to eat that many children experience.

Comparison between Food Reinforcement and Alcohol Reinforcement

No relation was found between food reinforcement (as measured by the RRV of Food Task) and alcohol reinforcement when analyzed among parents who report that they drink alcohol. This lack of association suggests that the relative reinforcing value of food is domain-specific, rather than generalizable to all rewarding reinforcers. Although the only other rewarding substance tested in the present study was alcohol, this strategy was used to maximize the number of participants in the sample who at least occasionally used the substance of interest (in this case, alcohol). If the sample had been further limited to only those who use another substance (e.g., tobacco or other drugs), generalizability of results may have been limited, and failure to find an association with food reinforcement may have been due to insufficient power. By contrast, most parents in the present study (80%) reported that they currently drink alcohol.

Interestingly, findings differed when food reinforcement was assessed in a nearly identical way to the alcohol reinforcement questionnaire (ARQ), the FPQ. Exploratory analyses revealed that parent FPQ food reinforcement and ARQ alcohol reinforcement were positively correlated among parents who reported that they drink alcohol. Given these different findings based on the method by which food reinforcement was assessed, the similarity in the FPQ and

ARQ measures may have led to biases in both. That is, adults who would indicate a desire to purchase more items on one measure might be expected to indicate a desire to purchase more items on the other measure. In the present study, brief task and questionnaire assessments were used to minimize participant burden. Additionally, as mentioned above, the potential lower social desirability of the FPQ may have impacted findings. Future studies could replicate this finding using more ecologically valid laboratory paradigms. In addition, the study of adults who report that they *frequently* drink may provide a closer comparison to food, which is consumed daily.

LOC Episode Recency, Size, and Frequency

Comparisons between children with and without recent LOC yielded similar results when a more specific approach was used, taking into consideration the recency, frequency, and size of LOC episodes. This analysis compared children who reported never having experienced LOC, those who experienced LOC in the past but not recently (i.e., in the past three months), those who experienced LOC recently but only once, and those with multiple recent LOC eating episodes. Children with or without objectively large binge episodes (OBEs) were examined as well. One limitation of these secondary analyses is the somewhat restricted range within these variables, as relatively few children reported frequent LOC episodes or OBEs.

Increased LOC episode frequency (i.e., beyond reporting at least one episode) was not associated with level of food reinforcement, internalizing symptoms, or quality of life. These findings highlight the relevance of examining children reporting very few—even only one—recent LOC episode, as these children showed increased impairment relative to children who never reported having experienced LOC. Children at this young age typically have not developed full-blown disorders of binge eating, but rather may show the early indicators of developing pathology (e.g., a recent LOC episode). Furthermore, young children likely have difficulty recalling multiple LOC episodes, despite typically being able to report whether or not they felt a sense of LOC.

Few differences emerged between children reporting OBEs (the standard for defining binge eating) versus those reporting only subjectively large episodes (SBEs). The finding that

OBE and SBE children reported similar levels of emotional eating and depressive/anxious symptoms replicates previous findings in a large sample of non-treatment seeking children and adolescents, in which children reporting SBEs only did not differ from those reporting OBEs on emotional eating, anxiety, and depression (Shomaker et al., 2010). The general lack of significant differences between children reporting OBEs and those reporting only SBEs adds to previous literature suggesting that LOC is the defining feature of binge eating as it is the best predictor of clinical impairment (Colles et al., 2008; Niego et al., 1997; Pratt et al., 1998). Indeed, findings provide preliminary evidence that even children who only report SBEs may be at greater risk for high food reinforcement, further underscoring the clinical significance of SBEs. One might expect that the presence of OBEs would confer greater risk for poor weight loss treatment response, which was not observed. Contrary to expectations, boys reporting OBEs demonstrated even better weight outcomes than other groups, although the small number of children in this category (n = 5) warrants any conclusions preliminary.

Although OBEs may not necessarily contain more energy than SBEs, LOC eating episodes may contain a higher proportion of energy-dense foods such as desserts and snacks (Tanofsky-Kraff, McDuffie, et al., 2009; Theim et al., 2007) and even a small difference in energy intake (i.e., a small increase in energy content of OBEs compared to SBEs) could lead to weight gain over the course of several years. It is possible that the length of follow-up (four months) was not sufficient to observe this pattern. Alternatively, as discussed above, FBT's focus on creating a healthy environment to support behavior changes as well as healthy dietary restriction (e.g., guidelines rather than strict rules, focus on balanced nutrition rather than food avoidance) may have successfully led to decreases in children's overall energy intake regardless of baseline LOC status. In contrast, traditional weight loss programs or very-low calorie diet programs for adults lack this focus on environmental support and tend to encourage more rigid restraint, which may explain why binge eating tends to predict greater attrition (Sherwood et al., 1999; Yanovski, 1993) and poorer short- and long-term weight loss outcomes among adults within these treatments

(Agras et al., 1997; Blaine & Rodman, 2007; Pagoto et al., 2007; Sherwood et al., 1999; Yanovski et al., 1994).

Lastly, it is possible that the present study was underpowered to detect these exploratory differences between children reporting LOC episodes of varying recency, frequency, and size, as only 23 children (11.5%) reported recent OBEs, and most children who reported recent LOC reported only 1 or 2 LOC eating episodes. Additionally, children reporting only objectively large episodes (but no history of LOC) were similar to both LOC groups as well as children who reported no aberrant eating episodes. As only 18 children (9.0%) comprised this category, differences may have emerged within a larger sample size. However, this analysis is similar to that done by Goldschmidt and colleagues in treatment-seeking adolescents, with approximately equal category sample sizes, in which youth reporting only OO episodes reported depressive symptoms that fell in between children with SBEs or with no aberrant eating episodes (Goldschmidt, Jones, et al., 2008). Taken together, findings provide support that, in addition to LOC (with or without unambiguously large amounts of food), the consumption of unambiguously large amounts of food (with or without LOC) is associated with increased child self-reported distress relative to no aberrant eating.

Strengths and Limitations

Strengths of the present study include the large sample of ethnically diverse boys and girls, including a substantial minority (26%) who reported recent LOC. Further, child LOC was assessed via gold-standard semi-structured interview (ChEDE). Regarding child LOC, appetitive traits, internalizing symptoms, and quality of life, two informants were assessed—data were available from child self-report and parent-report on child. Additionally, child and parent food reinforcement was assessed in two ways, both using a validated task and an accompanying questionnaire (the latter of which may present a lower social desirability bias, given the weight loss treatment-seeking nature of the present sample). Lastly, the present study design enabled an examination of the association between LOC and standard weight loss treatment response—

in this case demonstrating that children who report LOC did not appear to fare worse in standard FBT, and that boys with LOC may even experience better weight outcomes.

However, the present study may have been limited by several factors. First, only short-term (4-month) treatment outcome was examined, and replication and extension of findings is needed in longitudinal studies, especially regarding the association between LOC and food reinforcement in children and the ability of these variables to predict, moderate, and mediate treatment outcomes. It is possible that long-term differences would emerge in weight trajectories of girls with or without LOC, for example, or that children with LOC are overall more vulnerable to weight regain following treatment cessation, when study staff contact and support ends. In addition, although FBT focused partially on improving the home environment for healthy eating and activity, future studies are needed to specifically address high food reinforcement and its potential impact on long-term weight control with treatment among children with impoverished environments. As such, longitudinal evaluations of weight loss maintenance programs should include assessments of sustained changes in the home environment and utilization of community resources to support healthy weight control behaviors.

Clinical Implications

Regarding the assessment and predictive value of LOC in children, it appears that even infrequent child self-reported LOC eating episodes (e.g., one episode in the past three months) confer heightened risk for greater emotional eating, depressive symptoms, anxiety symptoms, along with poorer perceived quality of life according to child self-report. Although the pattern of findings differed by informant, in that similar parent-reported variables did not differ between LOC and No LOC children, this subset of children undergoing weight loss treatment consistently self-reported different psychological characteristics at baseline compared to their non-LOC peers. Although this distinct profile of characteristics did not negatively impact short-term FBT outcome, they still may be important to address within treatment given other important outcome variables of interest, such as children's distress or subjective well-being. For example, the mechanism by

which LOC among boys was associated with better weight outcomes merits further study (e.g., perhaps boys' LOC improved with treatment), so that similar weight outcomes can be achieved among girls.

Considering the interplay between high food reinforcement and non-snack food reinforcers in the environment, future weight loss interventions could specifically tailor treatment techniques for children with high food reinforcement, including encouraging parents to provide ample alternate reinforcers, such as physical activity and rewarding social interactions (Wilfley, Vannucci, et al., 2010a). Data appear to support the use of parental skills training with an emphasis on the importance of improving home/neighborhood support for healthy weight control behaviors in pediatric weight control treatments (Wilfley, Stein, et al., 2007a; Wilfley, Van Buren, et al., 2010), although additional treatment strategies may be required for children with high food reinforcement. For example, children with high food reinforcement may have greater difficulty using alternate reinforcers in their environment due to feeling a higher motivation to eat high energy-dense foods, or may be less aware of alternate reinforcers available to them. Indeed, it has been suggested that it may not be sufficient to offer alternate reinforcers in the context of promoting a negative energy balance, but rather that strategies to address high food reinforcement are most potent when in the context of a healthy environment in which access to high energy-dense palatable foods is limited (Epstein et al., 2005).

Summary and Future Directions

Pediatric obesity has reached epidemic proportions (Ogden et al., 2006; Ogden et al., 2002), and the delivery of maximally effective and targeted interventions is urgently needed. A subset of overweight children report loss of control (LOC) eating, which increases risk for excessive weight and body fat gain (Field et al., 2003; Tanofsky-Kraff et al., 2006; Tanofsky-Kraff, Yanovski, et al., 2009) and psychosocial impairment (Tanofsky-Kraff, Faden, et al., 2005; Tanofsky-Kraff et al., 2004). Even infrequent LOC episodes confer additive risk for the development of severe binge eating problems, associated eating pathology, and depressive

symptoms over time (Tanofsky-Kraff et al., 2011). However, preliminary data regarding the potential impact of LOC on pediatric weight loss treatment outcomes were mixed and often failed to use interview methodology to assess children's experiences of LOC. Further, an emerging body of research suggests that high food reinforcement is another factor that prospectively predicts excessive weight gain in children (Hill et al., 2009), although no prior studies had examined the overlap between LOC and food reinforcement in youth, or the influence that high food reinforcement may have on weight loss treatment response. The present study addressed these questions using valid and reliable assessments, including child self-report, parent self-report, and parent-report on child measures to look at intra-familial associations in this large multi-site trial.

Overall, findings provide support for the association between LOC and related indicators of impairment and obesogenic traits in children, including high food reinforcement, emotional eating, depressive and anxiety symptoms, and poorer quality of life. However, results differed by informant. Parents who reported that their children had experienced LOC over eating also identified greater pathology in their children in other domains (e.g., poorer satiety responsiveness, higher internalizing symptoms, poorer quality of life), whereas children who self-reported LOC did not differ on these parent-reported factors. Relative body weight loss during treatment, perhaps the most objectively assessed outcome variable of interest, was unexpectedly greatest among boys with LOC. Findings suggest that at least in the short-term, the presence of LOC in children may not warrant excluding children from standard weight loss treatments. As LOC is only beginning to emerge at this young age, longitudinal studies are needed to elucidate the relation between the early development of LOC and long-term weight control treatment outcome, as well as the potential influence of increases or decreases in LOC that may occur during treatment.

As obesity is highly heritable (Wardle, Carnell, Haworth, & Plomin, 2008), future studies should continue to explore child-parent associations between LOC, food reinforcement, and related traits and behaviors that contribute to excess energy intake, along with their interaction with shared environmental factors. For example, when assessed via questionnaire, child and

parent food reinforcement were modestly positively associated. Regarding LOC, food reinforcement, or other appetitive traits affecting energy intake, stronger relations between child and parent variables may also emerge as children become older.

Although high food reinforcement did not singularly predict weight outcome for all children, the quality of the child home and neighborhood environment with regard to access to alternate (i.e., non-snack food) reinforcers interacted with food reinforcement to impact weight loss treatment success. Children low in food reinforcement with higher access to alternate reinforcers achieved the greatest relative weight loss, illustrating one of the tenets of standard family-based weight loss treatment: improving the home environment. Future interventions should continue to provide parental skills training to ensure that children are set up for success in an environment that provides ample non-snack food reinforcers and limited high energy-dense foods. This strategy may have been particularly effective with children low in food reinforcement in the present sample, but should continue to be personalized and intensified for children high in food reinforcement as well. Longitudinal follow-up analyses will likely also clarify the role of interpersonal reinforcers, which are specifically targeted within the present broader RCT's socially focused weight loss maintenance program.

Considering the differences between children with and without LOC in the present study of overweight treatment-seeking children, future studies should seek to address these and similar questions in other samples, including children with more severe binge eating problems, children with impulse control disorders, and non-treatment seeking youth. Despite the difficulty in assessing young children, the study of the interplay between LOC, food reinforcement, and related appetitive traits (e.g., poor satiety responsiveness, impulsivity) in early childhood could play a major role in discovering how the development of these obesogenic behaviors might be hampered or prevented (Wilfley, Vannucci, et al., 2010a).

As the present study utilized cross-sectional comparisons and short-term treatment outcomes, additional investigations are warranted into the etiology of LOC, food reinforcement, related appetitive traits (e.g., poor satiety responsiveness), and poorer psychosocial functioning in

young children. For example, it may be that some children begin to experience heightened negative affect, which may interact with high food reinforcement to prompt the development of LOC eating as a coping mechanism. Excessive weight gain and its psychosocial ramifications in childhood may then exacerbate this cycle. Alternatively, LOC eating may lead to excess weight gain disproportionately among children with high food reinforcement, low access to alternate reinforcers in the environment, or both.

As obesogenic appetitive traits (e.g., LOC, high food reinforcement) and their correlates (e.g., poor satiety responsiveness, heightened impulsivity) are only starting to become expressed in this young age group, longitudinal investigations beginning in early childhood are needed to inform the etiology of LOC and associated features, so that the severity of obesity and its chronic health and psychological sequelae may be ameliorated within this vulnerable subset of children.

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Appendix A

Relative Body Weight Measurement Form

Child Height and Weight

Participant Age (years, months): _____ Gender: M F

Height should be taken without shoes. Each height measurement should be taken after the child has stepped away from the stadiometer and both child and stadiometer have been repositioned correctly (record to the nearest 0.1 cm).

Height #1: _____ ***cm*** ***Height #2:*** _____ ***cm*** ***Height #3:*** _____ ***cm***

Additional heights should be taken if the first three heights are not within 0.5 cm of each other and taken until three of four consecutive height readings are within 0.5 cm of each other.

Height #4: _____ ***cm*** ***Height #5:*** _____ ***cm*** ***Height #6:*** _____ ***cm***

Height #7: _____ ***cm*** ***Height #8:*** _____ ***cm*** ***Height #9:*** _____ ***cm***

Average of three legitimate height measurements (circle these): _____ ***cm***

Comments about height measurement: _____

Weight should be taken in indoor clothes for children. Each weight measurement should be taken after the child has stepped off the scale and the scale has re-zeroed (record to the nearest 0.1 kg/lb)

Weight #1: _____ kg _____ lb Weight #2: _____ kg _____ lb Weight #3: _____ kg _____ lb

Additional weights should be taken if the first three weights are not within 0.1 kg of each other and taken until three of four consecutive weight readings are within 0.1 kg of each other.

Weight #4: ____ kg _____ lb Weight #5: _____ kg _____ lb Weight #6: _____ kg _____lb

Average of three legitimate weight measurements (circle these): _____ kg _____ lb

BMI: _____ BMI %ile _____ % OW _____

Comments about weight measurement: _____

Appendix B

Barratt Simplified Measure of Social Status

Please put an X in the appropriate box for your Mother's, your Father's, your Spouse / Partner's, and your level of school completed and occupation. If you grew up in a single parent home, mark only your one parent, and mark "N/A" for the other parent. If you are neither married nor partnered, mark "N/A" for Spouse/Partner.

A. Level of School completed	**Mother**	**Father**	**Spouse/ Partner**	**You**
(N/A)				
Less than 7th grade				
Junior high / Middle school (up to 9th grade)				
Partial high school (10th or 11th grade)				
High school graduate				
Partial college (at least one year)				
College education				
Graduate degree				

B. Occupation	**Mother**	**Father**	**Spouse/ Partner**	**You**
(N/A or stay-at-home parent)				
Day laborer, janitor, house cleaner, farm worker, food counter sales, food preparation worker, busboy.				
Garbage collector, short-order cook, cab driver, shoe sales, assembly line workers, masons, baggage porter.				
Painter, skilled construction trade, sales clerk, truck driver, cook, sales counter, or general office clerk.				
Automobile mechanic, typist, locksmith, farmer, carpenter, receptionist, construction laborer, hairdresser.				
Machinist, musician, bookkeeper, secretary, insurance sales, cabinet maker, personnel specialist, welder.				
Supervisor, librarian, aircraft mechanic, artist or artisan, electrician, administrator, military enlisted personnel, buyer.				
Nurse, skilled technician, medical technician, counselor, manager, police or fire personnel, financial manager, physical/occupational/speech therapist.				
Mechanical/nuclear/electrical engineer, educational administrator, veterinarian, military officer, elementary/high school/special education teacher.				
Physician, attorney, professor, chemical/aerospace engineer, judge, CEO, senior manager, public official, psychologist, pharmacist, accountant.				

C. Please indicate whether your current household income is derived from: (circle all that apply)

1. One income
2. Two incomes
3. Unemployment
4. Public assistance
5. Child support / alimony
6. Other: _____

D. Please circle your current annual household income:

1. under $9,999
2. $10,000 - $19,999
3. $20,000 - $29,999
4. $30,000 - $39,999
5. $40,000 - $49,999
6. $50,000 - $59,999
7. $60,000 - $69,999
8. $70,000 - $79,999
9. $80,000 - $89,999
10. $90,000 - $99,999
11. Over $100,000

E. Please circle the ethnic group(s) that YOU identify with (please circle all that apply):

1. American Indian or Alaskan Native
2. Asian
3. Native Hawaiian or Other Pacific Islander
4. Black or African American, not of Hispanic origin
5. White or Caucasian, not of Hispanic origin
6. Hispanic or Latino
7. Other (please specify): _____

F. Please circle the ethnic group(s) that your CHILD most identifies with (please circle all that apply):

1. American Indian or Alaskan Native
2. Asian
3. Native Hawaiian or Other Pacific Islander
4. Black or African American, not of Hispanic origin
5. White or Caucasian, not of Hispanic origin
6. Hispanic or Latino
7. Other (please specify): _____

Appendix C

Child Eating Disorder Examination (ChEDE)

CHILD EATING DISORDER EXAMINATION (ChEDE)

Print out a calendar from the ChEDE Calendar Excel spreadsheet. Put YESTERDAY's date as the last day on the calendar, hit "Enter," and the rest of the days will update.

Have parent complete any important events on the child's calendar of the past 28 days, as best they can. Interviewer should add any standard holidays on the calendar before giving it to the parent. Events the parent might add include days off from school, family events, school events, activities with friends, weekly scheduled events such as extracurriculars or church, etc.

"Hi, my name is _____. We ask all children a set of questions about their eating. Some questions might sound silly to you or you may feel they don't apply to you but I have to ask everyone the same ones. There are no right or wrong answers to any of the questions, just do them as best you can.

I'll be asking you about the past month, and then the two months before that. To help us, I have a calendar of the past month that one of your parents filled in, about what you've been doing over the last four weeks – we'll call this Month 1. So, this goes from _____ to _____. I know it's strange to have the weekends in the middle, but that is just the way it's worked out.

Take a look at this calendar – is there anything wrong on it, or anything missing that we should add?

Also on the calendar, there is what we'll call Month 2 (from _____ to _____) and Month 3 (from _____ to _____). Can you remember if you did anything special between these dates? (e.g., vacation, school events, holidays, etc.)

I'd like to keep this calendar in front of us while we talk so that you can look at it and use it to remind you of what you were doing."

PATTERN OF EATING

To begin with, I'd like to get a general picture of your eating habits over the last 4 weeks. What has been your usual eating pattern?

Have your eating habits varied much day to day?

Have weekdays differed from weekends?

Have there been any days where you haven't eaten anything at all the whole day?

[ask about Months 2 and 3]

What about the previous 2 months (specify dates)…Were your eating habits much the same or were they different?

(space for general notes about child's eating pattern)

OVEREATING SECTION

*** Asterisked questions (found in the manual) must be asked in every case, and subsequent probes are included for further assistance**
Rate the following types of episodes for # of days (in the past 28) during which they occurred, and the total # of episodes in the past 28 (e.g., if more than one episode on any day)

OBE = large amount and loss of control
SBE = loss of control, but not a large amount, although child views as excessive
OO = large amount but NO loss of control

Rate 00 if no episodes
In general, it is best to calculate the number of days first and then the number of episodes.
Rate 777 if the number of episodes is so great that their frequency cannot be calculated.
Then ask about the previous 2 months, to get a number of days and number of episodes in Month 2 and Month 3.

Month 1		**Month 2**		**Month 3**	
OBE days	**[ ]**	**OBE days**	**[ ]**	**OBE days**	**[ ]**
OBE episodes	**[ ]**	**OBE episodes**	**[ ]**	**OBE episodes**	**[ ]**
SBE days	**[ ]**	**SBE days**	**[ ]**	**SBE days**	**[ ]**
SBE episodes	**[ ]**	**SBE episodes**	**[ ]**	**SBE episodes**	**[ ]**
OO days	**[ ]**	**OO days**	**[ ]**	**OO days**	**[ ]**
OO episodes	**[ ]**	**OO episodes**	**[ ]**	**OO episodes**	**[ ]**

→Rate the number of episodes (0-??) and number of days (0-28) on which each episode type occurred
When child is unsure, ask for his or her best guess. If interviewer is unsure, code conservatively (e.g., child is "pretty sure there were 2 or 3 times" but is unable to pick a number, code "2").

→ Then, if no LOC reported in the past 3 months, ***"Have you ever felt a sense of loss of control, where you felt like you just couldn't stop eating once you'd started?" (and, if necessary, "was it more than 3 months ago?") If LOC in the past 3 months and/or ever, check "Yes."***

LOC EVER Yes [ ] No [ ]

QUALITATIVE QUESTIONS

ASK REGARDING EPISODES WITH LOSS OF CONTROL (i.e., OBEs or SBEs, regardless of size)

➔ **IF CHILD HAD NO EPISODES OF LOC IN THE PAST 3 MONTHS, ASK REGARDING "A TYPICAL MEAL OR SNACK IN THE PAST 3 MONTHS"**

*** *Before* times like this (refer to episodes with loss of control in the past 3 months OR a typical meal or snack if no LOC), did you usually…**

[ ] have any bad feeling like angry, sad, or lonely? How about bored or restless? (record any feeling(s) indicated)

[ ] want food as a reward for doing something?

*** Anytime *during* times like this, did you usually…**

[ ] eat in secret?

[ ] try to sneak or hide the food you were eating?

[ ] feel numb or like you spaced or zoned out?

[ ] eat more than other people?

[ ] eat even though you didn't feel physically hungry?

*** *After* times like this, did you usually…**

[ ] feel bad about yourself for eating or about what you ate? For example, did you feel guilty, ashamed, unhappy, or any other kind of bad emotion?

[ ] feel sick? Or actually get sick? Record if child reports any compensatory behaviors (e.g., getting sick after episodes), and their frequency.

→Rate 1 if yes (feature usually present), 0 if no (feature absent)
If unable to obtain a 0 or 1 rating, rate 9 (i.e., occasionally present, but not typical, or unsure if present)

Note: if child reported **purging behaviors on questionnaires (YEDE-Q item #22 or last item on the LOC-ED screening questionnaire)**, but not during the ChEDE interview, ask the child to confirm (e.g., "I noticed you marked on this questionnaire that you had made yourself sick…can you tell me more about that?) **Do NOT change the child's answers on the questionnaires**, but rather confirm the absence/presence of purging behavior for this interview.

Appendix D

Eating Disorder Examination Questionnaire (EDE-Q; Selected Items)

EATING QUESTIONNAIRE

The following questions are concerned with the PAST FOUR WEEKS ONLY (28 days). Please read each question carefully and circle the appropriate number. Please answer all the questions.

Questions 17-21 ask about any binge episodes that you might have had during the past month. A binge episode has two parts: 1) eating an unusually large amount of food and 2) experiencing a sense of loss of control.

What is an "unusually large amount of food?"
An unusually large amount of food is definitely more than most people would eat under similar circumstances. Some examples might be: 1) eating two full meals; 2) eating three main courses; or 3) eating an unusually large amount of one food or combination of foods.

What is a "sense of loss of control?"
A sense of having lost control while eating might be experienced by different people in different ways: 1) feeling driven or compelled to eat; 2) not being able to stop eating once you've started; 3) not being able to keep yourself from eating large amounts of certain kinds of food in the first place; or 4) giving up on even trying to control your eating because you know that, no matter what, you're going to overeat.

Examples of a binge episode:

1. UNUSUALLY LARGE AND LOSS OF CONTROL. After work one evening, Dina ate 2 pieces of chicken, a 16-once package of frozen vegetables, 3 cups of rice, 1/4 of a coffee cake and a piece of fruit. This is an unusually large amount of food. While she ate, Dina felt completely out of control, ate more quickly than usual, and ate until she felt uncomfortably full. Afterwards Dina was very upset about how much she's eaten, and said she felt depressed, guilty, and disgusted with herself for giving in to the urge to binge.

Examples of episodes that do not meet the definition of a binge either because the quantities are too small or the person does not feel a sense of loss of control while eating:

1. UNUSUALLY LARGE BUT NO LOSS OF CONTROL. Several times a week, JoAnne ate lunch at McDonald's with 2 coworkers. Her usual order was a Big Mac, a fish fillet sandwich, 2 large orders of fries, and a large chocolate shake. This is an unusually large amount of food. Although she ate somewhat more than her friends did and knew she was eating a lot of high-fat food, she did not feel out of control while eating or feel upset afterwards about how much she'd eaten.

2. LOSS OF CONTROL BUT NOT UNUSUALLY LARGE. For lunch one day, Joseph had a ham and cheese sandwich with mayonnaise on a roll, a small bag of potato chips, a candy bar, and a Diet Coke. Joseph felt out of control because he'd planned to have turkey on whole wheat with lettuce and tomato plus a piece of fruit for dessert, but couldn't stop himself from changing his order. Although this was a large meal, it was not unusually large, so we wouldn't consider it a binge.

3. LOSS OF CONTROL BUT NOT UNUSUALLY LARGE. Carol ate 2 donuts someone brought into the office one morning. She had started a diet that day and planned to skip breakfast. Carol initially refused the donuts, but after everyone else had gone to a meeting she snuck into the break room and very quickly ate the donuts so no one would see her eating. She felt very guilty and ashamed afterwards and hated feeling so out of control of her eating, resolving to start dieting again the next day. Although Carol felt bad about eating the donuts, this was not an unusually large amount of food, so it would not be considered a binge.

17. . . .Have there been times when you have eaten what most people would regard as an unusually large amount of food. (Please circle)

No	Yes
0	1

18. If "yes," how many such episodes have you had over the past four weeks?

_____

19. During how many of these episodes of overeating did you have a sense of having lost control?

_____

---

20. . . .Have you had other episodes of eating in which you have had a sense of having lost control, but have not eaten an unusually large amount of food? (Please circle)

No	Yes
0	1

21. If "yes," how many such episodes have you had over the past four weeks?

_____

Appendix E

Eating Disorder Examination Questionnaire–Parent Report on Child Version (EDE-Q-Pc)

EATING QUESTIONNAIRE—PARENT REPORT ON CHILD

Some of these questions will ask about any binges that **your child** might have had during the past three months. A binge episode has two parts: 1) eating an unusually large amount of food and 2) experiencing a sense of loss of control.

What is an "unusually large amount of food?"
An unusually large amount of food is definitely more than most people would eat under similar circumstances. Some examples might be: 1) eating two full meals; 2) eating three main courses; or 3) eating an unusually large amount of one food or of a combination of foods.

1. What is a "sense of loss of control?"
A sense of having lost control while eating might be experienced by different children in different ways: 1) feeling driven or compelled to eat; 2) not being able to stop eating once they've started; 3) not being able to keep themselves from eating large amounts of certain kinds of foods in the first place; or 4) giving up on even trying to control their eating because they know that, no matter what, they're going to overeat.

Examples of a binge episode:
1. UNUSUALLY LARGE AND LOSS OF CONTROL. After school one afternoon, Jenny ate 2 pieces of chicken, a 16-ounce package of frozen vegetables, 3 cups of rice, 1/4 of a coffee cake and a piece of fruit. This is an unusually large amount of food. While she ate, Jenny felt completely out of control, ate more quickly than usual, and ate until she felt uncomfortably full. Afterwards Jenny was very upset about how much she'd eaten, and said she felt depressed, guilty, and disgusted with herself for giving in to the urge to binge.

Examples episodes that do not meet the definition of a binge either because the quantities are too small or the person does not feel a sense of loss of control while eating:

1. UNUSUALLY LARGE BUT NO LOSS OF CONTROL. Several times a week, JoAnne ate lunch at McDonald's with 2 friends. Her usual order was a Big Mac, a fish fillet sandwich, 2 large orders of fries, and a large chocolate shake. This is an unusually large amount of food. Although she ate somewhat more than her friends did and knew she was eating a lot of high-fat food, she did not feel out of control while eating or feel upset afterwards about how much she'd eaten.

2. LOSS OF CONTROL BUT NOT UNUSUALLY LARGE. For lunch one day, Joey had a ham and cheese sandwich with mayonnaise on a roll, a small bag of potato chips, a candy bar, and a Diet Coke. Joey felt out of control because he'd planned to have turkey on whole wheat with lettuce and tomato plus a piece of fruit for dessert, but

couldn't stop himself from changing his order. Although this was a large meal, it was not unusually large, so we wouldn't consider it a binge.

3. LOSS OF CONTROL BUT NOT UNUSUALLY LARGE. Lizzie ate 2 donuts someone brought to homeroom one morning. She had started a diet that day and planned to skip breakfast. Lizzie initially refused the donuts, but after everyone else had gone to their other classes she snuck back into homeroom and very quickly ate the donuts so no one would see her eating. She felt very guilty and embarrassed afterwards and hated feeling so out of control of her eating, resolving to start dieting again the next day. Although Lizzie felt bad about eating the donuts, this was not an unusually large amount of food, so it would not be considered a binge.

Part II Instructions: Some of these questions are about the past four weeks (past 28 days) whereas others are about the past three months. In order to help you remember your child's eating patterns over the past three months, try to think of any events that might have changed the way your child normally eats, such as holidays, parties, vacations, or stressful events (such as a school project being due, or getting in a fight with family members). Please read each question carefully and answer all of the questions. If you are unsure of an answer, please provide your best estimate. Thank you very much!

1. Over the past 28 days, have there been times when your child has eaten an unusually large amount of food, compared to what other kids his/her age would eat in the same situation? (Please circle)

No Yes

2. If YES, how many times has this happened over the past 28 days?

_____

3. On how many of these times did your child feel like he/she had lost control while eating? _____

4. Over the past 3 months, have there been times when your child has eaten an unusually large amount of food, compared to what other kids his/her age would eat in the same situation? (Please circle)

No Yes

5. If YES, how many times has this happened over the past 3 months?

_____

6. On how many of these times did your child feel like he/she had lost control while eating? _____

7. Over the <u>past 28 days,</u> has <u>your child</u> had times where he/she felt that he/she had lost control over his/her eating, but has <u>not</u> eaten an unusually large amount of food? (Please circle)

No Yes

8. If YES, how many <u>times</u> has this happened over the <u>past 28 days</u>?

_____

9. Over the <u>past 3 months,</u> has <u>your child</u> had times where he/she felt that he/she had lost control over his/her eating, but has <u>not</u> eaten an unusually large amount of food? (Please circle)

No Yes

10. If YES, how many <u>times</u> has this happened over the <u>past 3 months</u>?

_____

---

11. Has your child <u>EVER</u> had an eating episode where he/she has lost control over his/her eating? (please circle one)

No Yes

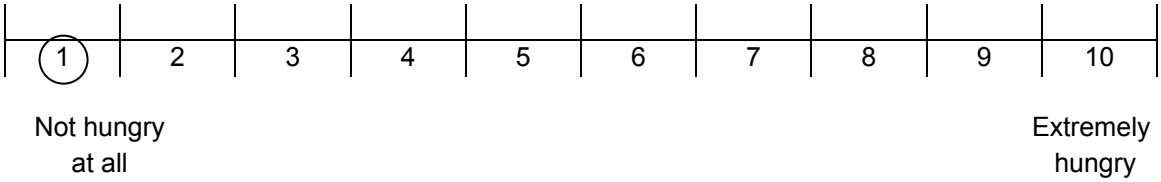
Appendix F

Relative Reinforcing Value (RRV) of Food Task

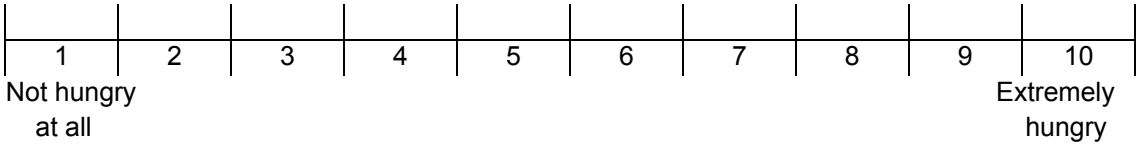
RRV TASK – CHILD FORM

Directions: Circle the number between 1 and 10 that best shows how you are feeling <u>right now</u>.

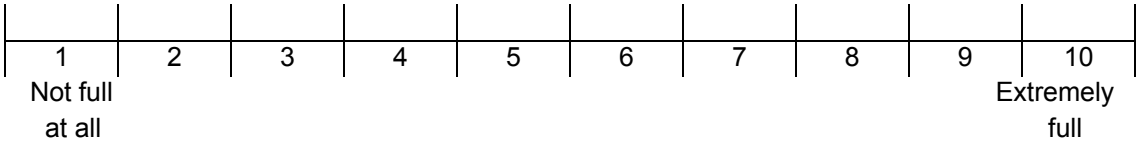
Example:
Jane just ate lunch, so she is not hungry at all. She circles a 1 on the scale below.



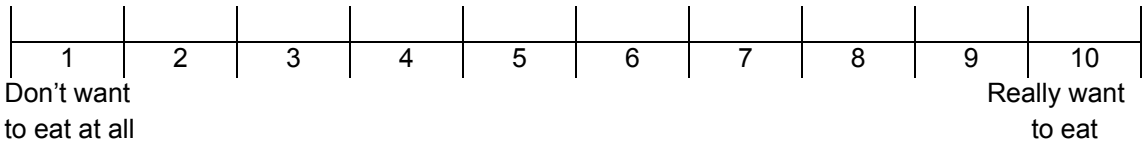
1. How hungry do **you** feel right now?



2. How **full** do you feel right now?



3. How much do you **want to eat** right now?



4. How much do you **like** chocolate chip cookies? *(If you have never eaten chocolate chip cookies, put an "x" here _____)*

1	2	3	4	5	6	7	8	9	10

Don't like at all Really like a lot

5. How much do you **like** potato chips? *(If you have never eaten potato chips, put an "x" here __)*

1	2	3	4	5	6	7	8	9	10

Don't like at all Really like a lot

6. How much do you **like** Doritos cheese-flavored chips? *(If you have never eaten Doritos, put an "x" here __)*

1	2	3	4	5	6	7	8	9	10

Don't like at all Really like a lot

7. How much do you **like** M&Ms chocolate candies? *(If you have never eaten M&Ms, put an "x" here ___)*

1	2	3	4	5	6	7	8	9	10

Don't like at all Really like a lot

8. How much do you **like** Skittles fruit-flavored candies? *(If you have never eaten Skittles, put an "x" here ___)*

1	2	3	4	5	6	7	8	9	10

Don't like at all Really like a lot

9. How much do you **like** Kit Kat chocolate candy bars? *(If you have never eaten Kit Kats, put an "x" here ___)*

1	2	3	4	5	6	7	8	9	10

Don't like at all Really like a lot

RRV TASK – INTERVIEWER FORM, CHILD

- **Look at the RRV questionnaire completed by the participant,** to ensure completeness and that he/she understood the questions. For example, items 1-3 should be concordant (i.e., if high hunger, then low fullness, etc.) If participant indicated that they have never eaten any of the reinforcers, verbally confirm this (e.g., "*So, it looks like you've never had M&Ms before*?")
- **Select the food item rated most highly by the participant.**
  If 2 or more top-rated items are marked equally, ask "If you had to choose, which would you rather eat right now: _____ or _____?" and select that food item.
  If participant marked a score less than 5 on all food items, ask participant if s/he indeed dislikes all food items to ensure that s/he understood the questions. If participant indicates s/he likes any food item at least somewhat, select that food item.
  If participant either dislikes all foods or has never eaten any of the foods, check here _____ and end interview.

  10a. Food item selected (circle one):

  Cookies Potato chips Doritos M&Ms Skittles Kit Kat

  10b. "What are some of your favorite fruits or vegetables?"
  "OK – now, if you had to pick a favorite (that is, if you were to eat a fruit or vegetable right now), which one would you choose?

  Record participant's preferred fruit/vegetable: _____

  10c. "We'd also like to know about what types of physical activity you like to do with other kids. For example, some kids like to play sports with their friends such as basketball or soccer, some kids like to do activities in water or snow with their friends like swimming or going sledding, or some kids like to play a game with a friend that is active, like tag, kickball, or an exercise video game (e.g., Wii Fit).
  "What are some of your favorite types of physical activity that you can do with a friend?"
  "OK – now, if you had to pick a favorite (that is, if a friend were here now that you could do something physically active with), which activity would you choose to do?

  Record participant's preferred PA: _____

  10d. "For this task, we want to see how kids respond to different rewards. One type of reward could be money, such as this quarter (***show to child***). What some kids do with a quarter is buy something small at the store…or they could add it to the money they already have. What do you think you would do with this quarter?"

  Record response: _____

11. "When was the last time you ate or drank anything (other than water) today?" **_____** (am/pm)

Current time **_____** (am/pm)

Time since last food/drink consumption: **_____** hours

12. Counterbalancing order ***(find the randomly chosen number as designated on the participant's folder; tasks are given at a different order across time points)***

ABC ACB BAC BCA CAB CBA

Instructions to read aloud:

"For this task, we want to see how kids respond to different foods. There are no right or wrong answers, we just want to know more about what factors affect kids' preferences and choices. We will imagine using this hand clicker as a way to work to get a reward. (***give clicker to child and let them practice for 20 clicks***). For each question below I will ask you whether you would prefer to work for two different rewards. The work to do is pushing the button a certain number of times. We will read each question carefully together to see how much work is required to get either item."

- ***On each of the following pages, circle or fill in the items just selected by the child.***

"Now what we are going to do is imagine doing different amounts of work in order to get either of two rewards: the first rewards we will start with are the **_____** (***the HED snack food selected by the child***) or **_____** (***the non-snack food reward in the first task***). Do you have any questions?"

- ***Cover all except the first item, and ask the first question, "Would you prefer to push the button 20 times for _____(e.g., the snack food item they selected) or to push the button 20 times for _____ (e.g., $0.25)?"***

- ***If they seem to understand and don't have any questions, go on to uncover the second item, then the third, and so on. Complete all 12 items for each task.***

→ Following administration of all RRV Tasks, the participant should be given the <u>RRV Questionnaire</u>, on which the interviewer should <u>fill in the participant's preferred snack food used in this task</u>.

A – HED FOOD vs. MONEY

Display both the selected HED snack food item and 25 cents (one quarter)

"For this one, the two options for rewards are the snack food you picked before (_____ ***participant's preferred HED food***) *or* ***25 cents (a quarter)***. For each question below I'll ask you whether you would prefer to work for the (_____***snack food***) or ***the quarter***, and the work to do is pushing the button a certain number of times."

HED Food item (circle <u>one</u>):
Cookies Potato chips Doritos M&Ms Skittles Kit Kat

*Food reward = **1** of the selected item (e.g., 1 bag)*
Money reward = One quarter

	Would you prefer to…
1a	Push the button **20** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐
2a	Push the button 4**0** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐
3a	Push the button **60** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐
4a	Push the button **80** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐
5a	Push the button **100** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐
6a	Push the button 1**20** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐
7a	Push the button **140** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐
8a	Push the button **160** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐
9a	Push the button **180** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐
10a	Push the button **200** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐
11a	Push the button **220** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐
12a	Push the button **240** times for HED food ☐ **OR** Push the button **20** times for $.25 ☐

Appendix G

Food Purchasing Questionnaire (FPQ)

Food Purchasing Questionnaire – CHILD

Imagine a TYPICAL DAY on which you eat snack foods, such as chips, cookies, candy, etc. The following questions ask how many portions of snack food you would buy and eat if they cost various amounts of money. The available snack food is _____ (***preferred snack food***). A "portion" of snack food is one serving, such as one small bag.

Assume you have the same amount of money that you usually have nowadays, and NO ACCESS to any snack food other than the snack food offered at these prices. Also, for these questions, imagine that you would eat the snack food that you buy on that same day; that is you cannot save up or stockpile snack food for a later date. Please answer the questions honestly.

How many portions of _____ (*preferred snack food*) would you eat if they were ____ each at the following 19 prices?:

	Price of each portion of snack food	How many portions would you buy at this price?
a.	$0 (free)	
b.	$.01	
c.	$.05	
d.	$.13	
e.	$.25	
f.	$.50	
g.	$1	
h.	$2	
i.	$3	
j.	$4	

	Price of each portion of snack food	How many portions would you buy at this price?
k.	$5	
l.	$6	
m.	$11	
n.	$35	
o.	$70	
p.	$140	
q.	$280	
r.	$560	
s.	$1,120	

Appendix H

Environmental Questionnaire

Environmental Adherence Questionnaire – PARENT

For each of the following food types, please tell us whether they are RIGHT NOW in your home, immediately eatable, and about how much is there. (Answer yes if any of the items listed for each question is in your home.)

In home = The food can be in the kitchen, pantry, bedrooms, basement, garage, or other rooms
Child can immediately eat it = Is the food in a package/container that the child is able to open, and/or does it require preparation that the child can do on her/his own? (Regardless of whether or what rules may be about your child accessing food by himself/herself)
How much = *A little* (enough for up to 2 people to eat at a snack/meal), *Some* (enough for 3-8 people to eat at a snack/meal), *A lot* (more than a little or some)

FOOD	*In home?*	*Child can immediately eat?*	*How much is there?*
1. chocolate or other candy (can include chocolate chips)	*Yes No*	*Yes No*	*A little Some A lot*
2. already made cakes, brownies, cookies, muffins (not English)	*Yes No*	*Yes No*	*A little Some A lot*
3. boxed mixes for cakes, brownies, cookies, muffins (not English)	*Yes No*	*No*	*A little Some A lot*
4. regular chips (e.g., potato chips, corn chips)	*Yes No*	*Yes No*	*A little Some A lot*
5. pretzels or baked (or other non-fried) chips	*Yes No*	*Yes No*	*A little Some A lot*
6. fruit roll-ups or other dried fruit (no sugar added; including raisins)	*Yes No*	*Yes No*	*A little Some A lot*
7. sweetened breakfast cereal **(≥ 7g sugar/serving)**	*Yes No*	*Yes No*	*A little Some A lot*
8. unsweetened breakfast cereal **(< 7g sugar/serving)**	*Yes No*	*Yes No*	*A little Some A lot*
9. Non-butter crackers (e.g., saltines, graham crackers, wheat crackers, rye crispbread, plain: matzo, melba, or toast rye wafers)	*Yes No*	*Yes No*	*A little Some A lot*
10. fresh bananas, oranges, pineapple, melons	*Yes No*	*Yes No*	*A little Some A lot*
11. fresh apples, grapes, celery, lettuce	*Yes No*	*Yes No*	*A little Some A lot*
12. potatoes, corn on the cob, whole tomato, frozen vegetables	*Yes No*	*Yes No*	*A little Some A lot*
13. "100% fruit juice"	*Yes No*	*Yes No*	*A little Some A lot*

FOOD	*In home?*	*Child can immediately eat?*	*How much is there?*
14. juice other than “100% fruit juice” (e.g., punch)	*Yes No*	*Yes No*	*A little Some A lot*
15. regular sodas	*Yes No*	*Yes No*	*A little Some A lot*
16. sports drinks (e.g., Gatorade)	*Yes No*	*Yes No*	*A little Some A lot*
17. regular (whole) or 2% milk	*Yes No*	*Yes No*	*A little Some A lot*
18. frozen or unprepared bacon, sausage, or other breakfast meat (not turkey or low-fat meat based)	*Yes No*	*No*	*A little Some A lot*
19. ice cream or other frozen desserts (not low sugar or non- or low-fat)	*Yes No*	*Yes No*	*A little Some A lot*
20. non- or low-fat cheese or non- or low-fat yogurt	*Yes No*	*Yes No*	*A little Some A lot*
21. hot dogs or bologna (not turkey or low-fat meat based)	*Yes No*	*Yes No*	*A little Some A lot*
22. turkey, chicken, fish or other lean labeled meat	*Yes No*	*Yes No*	*A little Some A lot*

For the following electronic devices, please <u>write down the total number</u> in each room that work, regardless of whether the child uses it.

If an electronic device has multiple functions, please list each function in the appropriate spot UNLESS it is a DVD/CD player. For DVD/CD players, just include under DVD. However, if you have a stereo that plays CDs, tapes, and the radio, count all three of these functions.

General room categories are listed at the end for you to add rooms that are specific to your home that may have the below devices (study, rec/play room, additional bedrooms, dining room, etc.). BR stands for Bedroom.

	Kitchen	**Living Room**	**Parent's BR**	**Child's BR**	**BR #3:**	**BR #4:**	**Other Room: _____**	**Other Room: _____**	**Other Room: _____**	**In house (not always in 1 room)**
23. TVs										
24. VCR (not portable)										
25. DVD player (not portable)										
26. Digital TV recorders (e.g., TiVo, ReplayTV)										
27. Radio (not portable) can include alarm clock										
28. CD player (not portable)										
29. Tape Player (not portable)										
30. Desktop computer <u>with</u> internet access										
31. Desktop computer <u>without</u> internet access										
32. Video game player (e.g., Playstation, Xbox)										
33. Telephone (non-cell phone)										
34. Portable CD player										
35. Portable Tape Player										
36. Portable Radio Player										
37. Portable MP3 player (ex: iPod)										
38. Portable DVD player										
39. Hand held videogame player (e.g., Game boy, Sony PSP etc)										
40. Laptop or portable computer										
Total number of electronics in each room:										

Which of the following things are **available and in useable condition** in your home or yard/common area?
Do not include things that are buried in boxes (except toy boxes), buried in a closet, or in storage.
Please circle either "Not Available" or "Available," and then indicate whether your child commonly uses the item(s)
If any of the items listed for each question is available, circle *available*.

	Not Available	Available	If available, does your child commonly use this item?		
41. Bike	0	1	Yes	No	N/A
42. basketball hoop (includes child size or adult size)	0	1	Yes	No	N/A
33. jump rope	0	1	Yes	No	N/A
44. sports equipment (e.g., balls, racquets, bats, sticks)	0	1	Yes	No	N/A
45. swimming pool (including kiddie pool)	0	1	Yes	No	N/A
46. roller skates, skateboard, scooter	0	1	Yes	No	N/A
47. fixed play equipment (e.g., swing set, play house, jungle gym)	0	1	Yes	No	N/A
48. home aerobic equipment (e.g., treadmill, cycle, cross trainer, stepper, rower, workout video or audiotapes)	0	1	Yes	No	N/A
49. weight lifting equipment, toning devices (e.g., free weights, pull up bars, exercise balls, ankle weights, etc.)	0	1	Yes	No	N/A
50. water or snow equipment (e.g., skis, skates, canoe, row boat, surf board, boogie board, windsurf board, slip-n-slide, etc.)	0	1	Yes	No	N/A
51. yoga/exercise mats	0	1	Yes	No	N/A
52. exercise, play or recreation room	0	1	Yes	No	N/A
53. trampoline	0	1	Yes	No	N/A

54. How many books are in the home that are approximately at your child's reading level and that he/she has access to? (please check the best option):

___ 0 books ___ 1 - 10 books ___ 11 - 20 books ___ 21 - 30 books ___ 31 - 40 books ___ 41 or more books

	Never	Rarely	Sometimes	Often	Very Often
55. How often does a parent or caregiver in the home read to your child?					
56. How often does your child read for pleasure?					
57. How often does your family receive magazines and/or newspapers?					
58. How often does a parent or caregiver take your child to a museum?					
59. How often does a parent or caregiver take your child to a show or performance?					

60. Are there any musical instruments in the home that your child has access to? **Yes** **No**

61. Does your child receive lessons for singing or playing a musical instrument? **Yes** **No**

62. Does your child engage in any other regular hobbies or activities? **Yes** **No**

If YES, please specify: _____

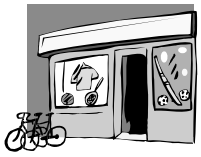
63. Have your child's parents/caregivers paid fees during the <u>past 6 months</u> so that your child:

a. could take lessons related to a physical activity? **Yes** **No**

b. could participate in organized physical activity or play on a sports team? **Yes** **No**

Appendix I

Neighborhood Environment Walkability Scale (NEWS) – Land Use Mix – Diversity Subscale



B. Stores, facilities, and other things in your neighborhood

About how long would it take to get from your home to the <u>nearest</u> businesses or facilities listed below if you <u>walked</u> to them? Please put only <u>one</u> check mark (√) for each business or facility.

	1–5 min	6-10 min	11-20 min	20-30 min	30+ min	Don't Know
Example: gas station			√			
1. convenience/small grocery store						
2. supermarket						
3. hardware store						
4. fruit/vegetable market						
5. laundry/dry cleaners						
6. clothing store						
7. post office						
8. library						
9. elementary school						
10. other schools						
11. book store						
12. fast food restaurant						
13. coffee place						

	1–5 min	6-10 min	11-20 min	20-30 min	30+ min	Don't Know
14. bank/credit union						
15. non-fast food restaurant						
16. video store						
17. pharmacy/drug store						
18. salon/barber shop						
19. your job or school [check here ____ if N/A]						
20. bus or train stop						
21. park						
22. recreation center						
23. gym or fitness facility						

Appendix J

Alcohol Reinforcement Questionnaire (ARQ)

ALCOHOL QUESTIONNAIRE – PARENT

1. Do you ever drink alcohol (including beer or wine)? **Yes [ ] No [ ]**

2. Regardless of whether or not you drink alcohol, is there alcohol currently available in your house? **Yes [ ] No [ ]**

3. Please imagine the following scenario and indicate your responses below. Please note that for this questionnaire, "one drink" would refer to: a standard size beer (12 oz.), a glass of wine (5 oz.), a shot of hard liquor (1.5 oz.), or a mixed drink containing one shot of liquor.

Imagine that you are at a social event where alcohol is available for purchase, and you are considering drinking. How many drinks do you think you would buy for yourself if each drink was priced at each of the following amounts? **(if you would not plan on purchasing any drinks at that price, please indicate "0").**

	Price of each drink	How many drinks would you buy at this price?
a.	$0 (free)	
b.	$.01	
c.	$.05	
d.	$.13	
e.	$.25	
f.	$.50	
g.	$1	
h.	$2	
i.	$3	
j.	$4	

	Price of each drink	How many drinks would you buy at this price?
k.	$5	
l.	$6	
m.	$11	
n.	$35	
o.	$70	
p.	$140	
q.	$280	
r.	$560	
s.	$1,120	

Appendix K

Child Eating Behavior Questionnaire (CEBQ)

Please read the following statements and check the boxes most appropriate to your child's eating behavior.

	Never	Rarely	Sometimes	Often	Always
1. My child loves food	□	□	□	□	□
2. My child eats more when worried	□	□	□	□	□
3. My child has a big appetite	□	□	□	□	□
4. My child finishes his/her meal quickly	□	□	□	□	□
5. My child is interested in food	□	□	□	□	□
6. My child is always asking for a drink	□	□	□	□	□
7. My child refuses new foods at first	□	□	□	□	□
8. My child eats slowly	□	□	□	□	□
9. My child eats less when angry	□	□	□	□	□
10. My child enjoys tasting new foods	□	□	□	□	□
11. My child eats less when s/he is tired	□	□	□	□	□
12. My child is always asking for food	□	□	□	□	□
13. My child eats more when annoyed	□	□	□	□	□
14. If allowed to, my child would eat too much	□	□	□	□	□
15. My child eats more when anxious	□	□	□	□	□
16. My child enjoys a wide variety of foods	□	□	□	□	□
17. My child leaves food on his/her plate at the end of a meal	□	□	□	□	□

	Never	Rarely	Sometimes	Often	Always
18. My child takes more than 30 minutes to finish a meal	□	□	□	□	□
19. Given the choice, my child would eat most of the time	□	□	□	□	□
20. My child looks forward to mealtimes	□	□	□	□	□
21. My child gets full before his/her meal is finished	□	□	□	□	□
22. My child enjoys eating	□	□	□	□	□
23. My child eats more when she is happy	□	□	□	□	□
24. My child is difficult to please with meals	□	□	□	□	□
25. My child eats less when upset	□	□	□	□	□
26. My child gets full easily	□	□	□	□	□
27. My child eats more when s/he has nothing else to do	□	□	□	□	□
28. Even if my child is full up s/he finds room to eat his/her favorite food	□	□	□	□	□
29. If given the chance, my child would drink continuously throughout the day	□	□	□	□	□
30. My child cannot eat a meal if s/he has had a snack just before	□	□	□	□	□
31. If given the chance, my child would always be having a drink	□	□	□	□	□
32. My child is interested in tasting food s/he hasn't tasted before	□	□	□	□	□
33. My child decides that s/he doesn't like a food, even without tasting it	□	□	□	□	□
34. If given the chance, my child would always have food in his/her mouth	□	□	□	□	□
35. My child eats more and more slowly during the course of a meal	□	□	□	□	□

Appendix L

Emotional Eating Scale – Adapted for Children (EES-C)

FEELINGS AND EATING

We all react to different feelings in different ways. Some types of feelings make us want to eat.
Please let us know how much the following feelings make you want to eat by checking the appropriate box.

EXAMPLE:

WHEN I FEEL THIS WAY…	**I have no desire to eat**	**I have a small desire to eat**	**I have a moderate desire to eat**	**I have a strong desire to eat**	**I have a very strong desire to eat**
Starving	☐	☐	☐	☐	**X**

WHEN I FEEL THIS WAY…	**I have no desire to eat**	**I have a small desire to eat**	**I have a moderate desire to eat**	**I have a strong desire to eat**	**I have a very strong desire to eat**
Resentful	☐	☐	☐	☐	☐
Discouraged	☐	☐	☐	☐	☐
Shaky	☐	☐	☐	☐	☐
Worn Out	☐	☐	☐	☐	☐
Not doing enough	☐	☐	☐	☐	☐
Excited	☐	☐	☐	☐	☐
Disobedient	☐	☐	☐	☐	☐
Down	☐	☐	☐	☐	☐

WHEN I FEEL THIS WAY…	I have no desire to eat	I have a small desire to eat	I have a moderate desire to eat	I have a strong desire to eat	I have a very strong desire to eat
Stressed Out	☐	☐	☐	☐	☐
Sad	☐	☐	☐	☐	☐
Uneasy	☐	☐	☐	☐	☐
Irritated	☐	☐	☐	☐	☐
Jealous	☐	☐	☐	☐	☐
Worried	☐	☐	☐	☐	☐
Frustrated	☐	☐	☐	☐	☐
Lonely	☐	☐	☐	☐	☐
Furious	☐	☐	☐	☐	☐
On Edge	☐	☐	☐	☐	☐
Confused	☐	☐	☐	☐	☐
Nervous	☐	☐	☐	☐	☐
Angry	☐	☐	☐	☐	☐
Guilty	☐	☐	☐	☐	☐
Bored	☐	☐	☐	☐	☐
Helpless	☐	☐	☐	☐	☐
Upset	☐	☐	☐	☐	☐
Happy	☐	☐	☐	☐	☐

Thank you!

Appendix M

Child Behavior Checklist (CBCL) – Sample Items

Please print. Be sure to answer all items.

Below is a list of items that describe children and youths. For each item that describes your child ***now or within the past 6 months***, please circle the ***2*** if the item is ***very true or often true*** of your child. Circle the ***1*** if the item is ***somewhat or sometimes true*** of your child. If the item is ***not true*** of your child, circle the ***0***. Please answer all items as well as you can, even if some do not seem to apply to your child.

0 = Not True (as far as you know) **1 = Somewhat or Sometimes True** **2 = Very True or Often True**

0 1 2 1. Acts too young for his/her age
0 1 2 2. Drinks alcohol without parents' approval (describe): _____
0 1 2 3. Argues a lot
0 1 2 4. Fails to finish things he/she starts
0 1 2 5. There is very little he/she enjoys
0 1 2 6. Bowel movements outside toilet
0 1 2 7. Bragging, boasting
0 1 2 8. Can't concentrate, can't pay attention for long
0 1 2 9. Can't get his/her mind off certain thoughts; obsessions (describe): _____
0 1 2 10. Can't sit still, restless, or hyperactive
0 1 2 11. Clings to adults or too dependent
0 1 2 12. Complains of loneliness
0 1 2 13. Confused or seems to be in a fog
0 1 2 14. Cries a lot
0 1 2 15. Cruel to animals
0 1 2 16. Cruelty, bullying, or meanness to others
0 1 2 17. Daydreams or gets lost in his/her thoughts
0 1 2 18. Deliberately harms self or attempts suicide
0 1 2 19. Demands a lot of attention
0 1 2 20. Destroys his/her own things
0 1 2 21. Destroys things belonging to his/her family or others
0 1 2 22. Disobedient at home
0 1 2 23. Disobedient at school
0 1 2 24. Doesn't eat well
0 1 2 25. Doesn't get along with other kids
0 1 2 26. Doesn't seem to feel guilty after misbehaving
0 1 2 27. Easily jealous
0 1 2 28. Breaks rules at home, school, or elsewhere
0 1 2 29. Fears certain animals, situations, or places, other than school (describe): _____
0 1 2 30. Fears going to school
0 1 2 31. Fears he/she might think or do something bad
0 1 2 32. Feels he/she has to be perfect
0 1 2 33. Feels or complains that no one loves him/her
0 1 2 34. Feels others are out to get him/her
0 1 2 35. Feels worthless or inferior
0 1 2 36. Gets hurt a lot, accident-prone
0 1 2 37. Gets in many fights
0 1 2 38. Gets teased a lot
0 1 2 39. Hangs around with others who get in trouble
0 1 2 40. Hears sound or voices that aren't there (describe): _____
0 1 2 41. Impulsive or acts without thinking
0 1 2 42. Would rather be alone than with others
0 1 2 43. Lying or cheating
0 1 2 44. Bites fingernails
0 1 2 45. Nervous, highstrung, or tense
0 1 2 46. Nervous movements or twitching (describe): _____
0 1 2 47. Nightmares
0 1 2 48. Not liked by other kids
0 1 2 49. Constipated, doesn't move bowels
0 1 2 50. Too fearful or anxious
0 1 2 51. Feels dizzy or lightheaded
0 1 2 52. Feels too guilty
0 1 2 53. Overeating
0 1 2 54. Overtired without good reason
0 1 2 55. Overweight
56. Physical problems ***without known medical cause:***
0 1 2 a. Aches or pains (***not*** stomach or headaches)
0 1 2 b. Headaches
0 1 2 c. Nausea, feels sick
0 1 2 d. Problems with eyes (***not*** if corrected by glasses) (describe): _____
0 1 2 e. Rashes or other skin problems
0 1 2 f. Stomachaches
0 1 2 g. Vomiting, throwing up
0 1 2 h. Other (describe): _____

PAGE 3 ***Be sure you answered all items. Then see other side.***

Appendix N

Short Mood and Feelings Questionnaire (SMFQ)

MOODS AND FEELINGS

This form is about how you might have been feeling or acting recently. For each question, please check how much you have felt or acted this way in the past two weeks. If a sentence was *not true*, place an "X" in the box for ***not true***. If a sentence was *sometimes true*, place an "X" in the box for ***sometimes***. If a sentence was *true most of the time*, place an "X" in the box for ***true***.

	Not true	Sometimes	True
1. I felt miserable or unhappy.	☐	☐	☐
2. I didn't enjoy anything at all.	☐	☐	☐
3. I felt so tired I just sat around and did nothing.	☐	☐	☐
4. I was very restless.	☐	☐	☐
5. I felt I was no good anymore.	☐	☐	☐
6. I cried a lot.	☐	☐	☐
7. I found it hard to think properly or concentrate.	☐	☐	☐
8. I hated myself.	☐	☐	☐
9. I felt I was a bad person.	☐	☐	☐
10. I felt lonely.	☐	☐	☐
11. I thought nobody really loved me.	☐	☐	☐
12. I thought I could never be as good as other kids.	☐	☐	☐
13. I felt I did everything wrong.	☐	☐	☐

Appendix O

Screen for Child Anxiety Related Emotional Disorders (SCARED)

Below is a list of statements that describe how people feel. Read each statement carefully and decide if it is **"Not True or Hardly Ever True"** or **"Somewhat True or Sometimes True"** or **"Very True or Often True"** for you. Then for each statement, place an "X" in the box that corresponds to the answer that seems to describe you **now or within the past 2 weeks**. Please respond to all statements as well as you can, even if some do not seem to concern you.

	Not True or Hardly Ever True	Somewhat True or Sometimes True	Very True or Often True
1. When I feel frightened, it is hard to breathe.	☐	☐	☐
2. I get headaches when I am at school.	☐	☐	☐
3. I don't like to be with people I don't know well.	☐	☐	☐
4. I get scared if I sleep away from home.	☐	☐	☐
5. I worry about other people liking me.	☐	☐	☐
6. When I get frightened, I feel like passing out.	☐	☐	☐
7. I am nervous.	☐	☐	☐
8. I follow my mother or father wherever they go.	☐	☐	☐
9. People tell me that I look nervous.	☐	☐	☐
10. I feel nervous with people I don't know well.	☐	☐	☐
11. I get stomachaches at school.	☐	☐	☐
12. When I get frightened, I feel like I am going crazy.	☐	☐	☐
13. I worry about sleeping alone.	☐	☐	☐
14. I worry about being as good as other kids.	☐	☐	☐
15. When I get frightened, I feel like things are not real.	☐	☐	☐
16. I have nightmares about something bad happening to my parents.	☐	☐	☐
17. I worry about going to school.	☐	☐	☐
18. When I get frightened, my heart beats fast.	☐	☐	☐
19. I get shaky.	☐	☐	☐
20. I have nightmares about something bad happening to me.	☐	☐	☐

	Not True or Hardly Ever True	Somewhat True or Sometimes True	Very True or Often True
21. I worry about things working out for me.	☐	☐	☐
22. When I get frightened, I sweat a lot.	☐	☐	☐
23. I am a worrier.	☐	☐	☐
24. I get really frightened for no reason at all.	☐	☐	☐
25. I am afraid to be alone in the house.	☐	☐	☐
26. It is hard for me to talk with people I don't know well.	☐	☐	☐
27. When I get frightened, I feel like I am choking.	☐	☐	☐
28. People tell me that I worry too much.	☐	☐	☐
29. I don't like to be away from my family.	☐	☐	☐
30. I am afraid of having anxiety (or panic) attacks.	☐	☐	☐
31. I worry that something bad might happen to my parents.	☐	☐	☐
32. I feel shy with people I don't know well.	☐	☐	☐
33. I worry about what is going to happen in the future.	☐	☐	☐
34. When I get frightened, I feel like throwing up.	☐	☐	☐
35. I worry about how well I do things.	☐	☐	☐
36. I am scared to go to school.	☐	☐	☐
37. I worry about things that have already happened.	☐	☐	☐
38. When I get frightened, I feel dizzy.	☐	☐	☐
39. I feel nervous when I am with other children or adults and I have to do something while they watch me (for example: read aloud, speak, play a game, play a sport).	☐	☐	☐
40. I feel nervous when I am going to parties, dances, or any place where there will be people that I don't know well.	☐	☐	☐
41. I am shy.	☐	☐	☐

Appendix P

Pediatric Quality of Life (PedsQL) Inventory – Child Version

Pediatric Quality of Life Inventory (PedsQL)
CHILD REPORT

Directions:
On the following page is a list of things that might be a problem for you. Please tell us **how much of a problem** each one has been for you during the **past ONE month** by circling:

0 if it is **NEVER** a problem
1 if it is **ALMOST NEVER** a problem
2 if it is **SOMETIMES** a problem
3 if it is **OFTEN** a problem
4 if it is **ALMOST ALWAYS** a problem

There are no right or wrong answers.
If you do not understand a question, please ask for help.

In the past **ONE month**, how much of a **problem** has this been for you …

ABOUT MY HEALTH AND ACTIVITIES (problems with…)	**Never**	**Almost Never**	**Sometimes**	**Often**	**Almost Always**
1. It is hard for me to walk more than one block	0	1	2	3	4
2. It is hard for me to run	0	1	2	3	4
3. It is hard for me to do sports activity or exercise	0	1	2	3	4
4. It is hard for me to lift something heavy	0	1	2	3	4
5. It is hard for me to take a bath or shower by myself	0	1	2	3	4
6. It is hard for me to do chores around the house	0	1	2	3	4
7. I hurt or ache	0	1	2	3	4
8. I have low energy	0	1	2	3	4

ABOUT MY FEELINGS (problems with…)	**Never**	**Almost Never**	**Sometimes**	**Often**	**Almost Always**
1. I feel afraid or scared	0	1	2	3	4
2. I feel sad or blue	0	1	2	3	4
3. I feel angry	0	1	2	3	4
4. I have trouble sleeping	0	1	2	3	4
5. I worry about what will happen to me	0	1	2	3	4

HOW I GET ALONG WITH OTHERS (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. I have trouble getting along with other kids	0	1	2	3	4
2. Other kids do not want to be my friend	0	1	2	3	4
3. Other kids tease me	0	1	2	3	4
4. I cannot do things that other kids my age can do	0	1	2	3	4
5. It is hard to keep up when I play with other kids	0	1	2	3	4

ABOUT SCHOOL (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. It is hard to pay attention in class	0	1	2	3	4
2. I forget things	0	1	2	3	4
3. I have trouble keeping up with my schoolwork	0	1	2	3	4
4. I miss school because of not feeling well	0	1	2	3	4
5. I miss school to go to the doctor or hospital	0	1	2	3	4

Appendix Q

Pediatric Quality of Life (PedsQL) Inventory – Parent-report on Child Version

Pediatric Quality of Life Inventory (PedsQL)
PARENT REPORT for CHILDREN

Directions:
On the following page is a list of things that might be a problem for **your child**. Please tell us **how much of a problem** each one has been for your child during the past ONE month by circling:

0 if it is **NEVER** a problem
1 if it is **ALMOST NEVER** a problem
2 if it is **SOMETIMES** a problem
3 if it is **OFTEN** a problem
4 if it is **ALMOST ALWAYS** a problem

There are no right or wrong answers.
If you do not understand a question, please ask for help.

In the past **ONE month**, how much of a **problem** has your child had with…

PHYSICAL FUNCTIONING (problems with…)	**Never**	**Almost Never**	**Sometimes**	**Often**	**Almost Always**
1. Walking more than one block	0	1	2	3	4
2. Running	0	1	2	3	4
3. Participating in sports activity or exercise	0	1	2	3	4
4. Lifting something heavy	0	1	2	3	4
5. Taking a bath or shower by him or herself	0	1	2	3	4
6. Doing chores around the house, like picking up his or her toys	0	1	2	3	4
7. Having hurts or aches	0	1	2	3	4
8. Low energy level	0	1	2	3	4

EMOTIONAL FUNCTIONING (problems with…)	**Never**	**Almost Never**	**Sometimes**	**Often**	**Almost Always**
1. Feeling afraid or scared	0	1	2	3	4
2. Feeling sad or blue	0	1	2	3	4
3. Feeling angry	0	1	2	3	4
4. Trouble sleeping	0	1	2	3	4
5. Worrying about what will happen to him or her	0	1	2	3	4

SOCIAL FUNCTIONING (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. Getting along with other children	0	1	2	3	4
2. Other kids not wanting to be his or her friend	0	1	2	3	4
3. Getting teased by other children	0	1	2	3	4
4. Not able to do things that other children his or her age can do	0	1	2	3	4
5. Keeping up when playing with other children	0	1	2	3	4

SCHOOL FUNCTIONING (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. Paying attention in class	0	1	2	3	4
2. Forgetting things	0	1	2	3	4
3. Keeping up with schoolwork or school activities	0	1	2	3	4
4. Missing school because of not feeling well	0	1	2	3	4
5. Missing school to go to the doctor or hospital	0	1	2	3	4