Published in final edited form as:

J Clin Psychol Med Settings. 2010 December ; 17(4): 285–300. doi:10.1007/s10880-010-9209-0.

Early Intervention of Eating- and Weight-Related Problems

Denise E. Wilfley, Anna Vannucci, and Emily K. White

Department of Psychiatry, Washington University School of Medicine, 660 South Euclid, Box 8134, St. Louis, MO 63110, USA

Denise E. Wilfley: wilfleyd@psychiatry.wustl.edu; Anna Vannucci: anna.vannucci@usuhs.mil; Emily K. White: emilykwhite@gmail.com

Abstract

Obesity and other eating-related problems are widespread and are associated with harmful physical, psychological, and social problems. The dramatic increases in rates of pediatric obesity has created a mounting need for psychologists and other mental health care providers to play a significant role in the assessment and treatment of youth with eating- and weight-related problems. Therefore, it is imperative for providers to be aware of the causes and consequences of eating- and weight-related problems and to be familiar with evidence-based assessment and intervention approaches. Currently, the most well-established intervention approaches are family-based behavioral treatments, and weight loss maintenance treatments with a socio-ecological focus are promising. This paper provides a comprehensive review of these topics and highlights the important roles that mental health care providers can have. Medical settings are often the patient's first point of contact within the healthcare system, making mental health care providers in such settings uniquely suited to assess for a broad range of eating- and weight-related problems and associated comorbidities, to deliver relevant evidence-based interventions, and to make appropriate referrals. Moving forward, providers and researchers must work together to address key questions related to the nature of eating- and weight-related problems in youth and to achieve breakthroughs in the prevention and treatment of such problems in this vulnerable population.

Keywords

Childhood obesity; Intervention; Binge eating; Food reinforcement; Impulsivity; Satiety responsiveness

Obesity as a Public Health Threat

Obesity, the accumulation of excess body weight, and other eating- and weight-related problems are widespread and are associated with harmful physical, mental, and social sequelae. Physical health conditions linked to obesity include increased risk for type II diabetes, hypertension, metabolic syndrome, asthma, sleep apnea, abnormal cholesterol levels, and orthopedic complications (Faith, Saelens, Wilfley, & Allison, 2001; Tanofsky-Kraff, Hayden, Cavazos, & Wilfley, 2003). At the highest levels of obesity, life expectancy may be reduced as much as 9 years (Wardle, 2005). Overweight and obese status can also have detrimental effects in psychosocial and psychological domains, including depression, anxiety, disordered eating, poor body image, discrimination and social exclusion, low self-esteem, and a reduced overall quality of life (Hayden-Wade et al., 2005; Wardle & Cooke, 2005).

In the past few decades, pediatric obesity in particular has emerged as a pressing public health threat, with recent prevalence estimates classifying over one-third of children as overweight (body mass index, BMI, 85th percentile) or obese (95th BMI percentile) in the United States (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). Particularly troubling are recent findings that rates of extreme pediatric obesity (99th BMI percentile for children) are increasing disproportionately faster than overweight and moderate levels of obesity (95th–99th BMI percentile) (Freedman, Kettel Khan, Serdula, Ogden, & Dietz, 2006; Koebnick et al., 2010). Not only are there more obese children now than in the past, but the severity of overweight among these children is also much greater.

The dramatic increases in rates of pediatric obesity has created a mounting need for psychologists and other mental health care providers to play a significant role in the assessment and treatment of youth with eating- and weight-related problems. Because of increased health care utilization among overweight and obese children (Hampl, Carroll, Simon, & Sharma, 2007), mental health care providers in medical settings are more likely to see individuals with eating- and weight-related problems, particularly the subsets who already have greater physical and psychological problems. Therefore, it is imperative for providers to be aware of the causes and consequences of eating- and weight-related problems and to be familiar with evidence-based assessment and intervention approaches.

What Causes Eating- and Weight-Related Issues?

Obesity develops when energy intake regularly exceeds energy expenditure over time. The behavioral susceptibility theory of obesity (Carnell & Wardle, 2008) conceptualizes how multiple eating- and weight-related factors can interact to impact the expression of various energy-balance behaviors (i.e., eating and activity behaviors) and weight status (see Fig. 1). Overall, it is likely that an individual's weight status is determined by complex interactions between biological and environmental factors.

Environmental Factors

Biology alone cannot account for the dramatic increases in rates of obesity over the past few decades. Genes are unable to mutate quickly enough to have produced the rise in obesity, pointing to the significant influence of the modern, obesogenic environment on eating- and weight-related behaviors (Wardle, 2005).

Environmentally, access to and pricing of food and dietary patterns have changed drastically in recent decades, making the consumption of high fat, high calorie foods the default for many individuals. High energy-density (HED) palatable foods (e.g., fast food) are more easily accessible and less expensive than low energy-density (LED) foods (e.g., fruits and vegetables). Moreover, many urban neighborhoods contain “food deserts,” areas devoid of grocery stores or where fresh food is difficult to find, often making fast food the only choice for individuals residing in these locations. Additionally, Americans now eat more meals away from the home (Lin & Frazao, 1999), and portion sizes (Wang, Bleich, & Gortmaker, 2008) and the frequency of snacking has increased, especially for children (Jahns, Siega-Riz, & Popkin, 2001). Even minor calorie excess as caused by these environmental changes can have a lasting and cumulative effect on weight status and adiposity; for example, an excess 12 calories per day will cause up to one pound of adipose tissue gain over the course of 1 year (Rosenbaum, Leibel, & Hirsch, 1997). As a practical example, drinking one regular can of soda (12 ounces; ~150 calories) everyday could lead a child to gain approximately 12 pounds in one year.

Significant environmental changes in the frequency and availability of physical and sedentary activities have also contributed to increases in obesity-promoting eating and

weight-related behaviors (Huang, Drenowski, Kumanyika, & Glass, 2009). Americans engage in less energy expenditure overall, due to lifestyle changes in the community, workplace, and school (Dietz & Gortmaker, 2001; Taveras et al., 2006). Jobs require less physical activity, numerous schools have decreased the frequency of recess and physical education classes, and many neighborhoods are not amenable to physical activity. Characteristics of the built environment, such as perceived and actual barriers to physical activity (i.e., lack of parks or greenspace, few sidewalks, neighborhood safety), also influence activity levels (Huang et al., 2009; Sallis & Glanz, 2006). Youth now increasingly choose sedentary behaviors, such as watching television, using the computer, or playing video games, for leisure activity, which consequently impacts weight status (Epstein, Roemmich, Paluch, & Raynor, 2005).

In sum, the modern environment has engineered children and adolescents' lifestyles toward increased energy intake and decreased energy expenditure, significantly promoting many of the eating- and weight-related problems afflicting today's youth. Therefore, it is integral for clinicians to understand environmental influences on eating- and weight-related behaviors and to assist youth with addressing drivers of unhealthful patterns of eating and activity in their environments.

Individual Factors

Although the pervasive obesogenic environment has contributed to striking increases in rates of obesity in youth and adults (Hedley et al., 2004), weight within populations remains highly variable. There is strong evidence for the significant influence of genetic factors on weight differences between individuals (Wardle, Carnell, Haworth, & Plomin, 2008). Previously, genes were thought to influence only the metabolic and physiological aspects of obesity; however, there is now an increasing recognition that appetite-related behavioral phenotypes are also genetically influenced and contribute to individual differences (Carnell & Wardle, 2008).

Appetitive traits are defined here as behavioral phenotypes that contribute to dysregulated eating behaviors that promote a positive energy balance and thereby, overweight in youth. Research reveals four appetitive traits which represent distinct behavior phenotypes of the obese population, including: binge and loss of control eating (Goldschmidt, Passi Aspen, Sinton, Tanofsky-Kraff, & Wilfley, 2008), satiety responsiveness (Wardle & Carnell, 2009), motivation to eat (Temple, Legierski, Giacomelli, Salvy, & Epstein, 2008), and impulsivity (Nederkoorn, Braet, Van Eijs, Tanghe, & Jansen, 2006). Each of these appetitive traits is highly heritable (Epstein, Salvy, Carr, Dearing, & Bickel, 2010; Javaras et al., 2008; Tanofsky-Kraff, Han et al., 2009; Wardle & Carnell, 2009; Wardle, Llewellyn, Sanderson, & Plomin, 2009), associated with weight in youth (Braet, Claus, Verbeke, & Van Vlierberghe, 2007; Hill et al., 2008; Hill, Saxton, Webber, Blundell, & Wardle, 2009; Moens & Braet, 2007; Nederkoorn et al., 2006; Tanofsky-Kraff et al., 2004), strongly related to increases in energy intake (Birch & Fisher, 1998; Jansen et al., 2003; Mirch et al., 2006; Tanofsky-Kraff, McDuffie et al., 2009; Temple et al., 2008), and predictive of excess weight gain and obesity risk (Butte et al., 2007; Hill et al., 2009; Seevaye et al., 2009; Tanofsky-Kraff, Yanovski et al., 2009). Clearly, it is imperative for clinicians to identify these appetitive traits in youth at an early age and incorporate the presence of these phenotypes into targeted interventions that modify the traits and their impact on weight.

Assessment and Treatment of Key Appetitive Traits

Clinicians have the potential to play a crucial role in the early detection and prevention of eating- and weight-related problems. Individuals often do not seek treatment for a specific eating-related problem, but are more likely to seek treatment for associated psychological

and medical complications. This underscores the importance of conducting a comprehensive assessment of eating- and weight-related problems in youth presenting with a wide variety of symptoms. Mental health care providers in medical settings are uniquely suited to assess for a broad spectrum of physical and mental problems and to recommend appropriate treatment and referrals because they are often one of the first points of contact in a patient's interaction with the health care system. Although many mental health care providers are concerned that overweight individuals feel uncomfortable discussing their weight, research actually shows that people want their providers to discuss eating- and weight-related issues (Cohen, Tanofsky-Kraff, Young-Hyman, & Yanovski, 2005).

In addition to routinely screening for weight status and common medical and psychological comorbidities, clinicians are advised to assess for appetitive traits frequently and adapt treatment approaches as need to addressing new and on-going concerns. Recommended screening questions to assess for each of these behavioral phenotypes can be found in Table 1, which may assist clinicians who lack time to administer full-length interviews or self-report measures. Additionally, Table 2 describes general intervention strategies that clinicians can consider in the treatment of appetitive traits.

Binge Eating and Loss of Control Eating

Binge eating is defined as the consumption of an unambiguously large amount of food while experiencing a loss of control over what or how much one is eating (APA, 2000). Loss of control (LOC) eating refers to episodes in which the amount of food consumed is not unambiguously large, but loss of control is still present. Binge and LOC eating often emerge during childhood and adolescence (Spurrell, Wilfley, Tanofsky, & Brownell, 1997), with prevalence rates ranging from approximately 10% in community-based samples to as high as 30% in overweight, treatment-seeking samples (Decaluwé & Braet, 2003; Goossens, Braet, & Decaluwe, 2007; Tanofsky-Kraff, Faden, Yanovski, Wilfley, & Yanovski, 2005).

Assessment of binge eating and LOC eating in youth can be challenging due to its reliance on subjective experience (i.e., sense of LOC) and retrospective recall (i.e., type and amount of food consumed). Given the complex nature of the construct, the concept of LOC may be difficult for children and adolescents to understand. However, children typically understand the analogy "like a car without brakes or a ball rolling down a hill, going faster and faster" in reference to binge and LOC episodes (Goldschmidt, Doyle, & Wilfley, 2007; Tanofsky-Kraff et al., 2004). Determining whether an eating episode is unambiguously large can also be difficult due to unreliable recall and children and adolescents' different nutritional needs (Bull, 1988). Therefore, it is important for clinicians to obtain detailed descriptions of patients' typical episodes in order to establish their clinical significance. Several interview-based and self-report assessment methods have been used to assess binge eating and LOC eating symptoms (see Table 1), and have been well validated in older children and adolescents. However, more research is needed to test the validity of these approaches in children younger than 10 years.

Although there is limited research examining pediatric binge and LOC eating interventions, both cognitive-behavioral therapy (CBT) and interpersonal psychotherapy (IPT) are promising treatment approaches (see Table 2). CBT is the most well-established treatment for BED in adults (Wilfley et al., 2002; Wilson, Grilo, & Vitousek, 2007; Wilson, Wilfley, Agras, & Bryson, 2010), and has been shown to be effective for adolescents (Jones et al., 2008). The primary treatment targets of CBT include establishing regular, healthy eating patterns using self-monitoring, self-control strategies, and problem-solving and to use relapse prevention strategies in promoting maintenance of behavioral change. IPT is considered another "gold standard" treatment for adults with BED (Wilfley et al., 2002; Wilson et al., 2010), and pilot data suggests that group IPT is also effective for adolescents

(Tanofsky-Kraff, Wilfley et al., 2009). IPT treatment goals include drawing connections between interpersonal triggers, negative affect, and LOC eating, so that these patterns can be modified through the use of social skills training and role negotiation.

Satiety Responsiveness

Satiety responsiveness refers to an individual's ability to perceive internal mechanisms that signal that he or she is satiated, and is operationally defined as eating in the absence of hunger (EAH) (i.e., intake of palatable foods following the consumption of a mixed meal to satiety) (Wardle & Carnell, 2009). Although there is limited data, the prevalence of EAH has been estimated to be approximately 60% in samples of children and adolescents (Moen & Braet, 2007), and has been seen in children as young as 4 years old (Fisher, 2007).

Satiety responsiveness/EAH is measured through several objective (Fisher & Birch, 2002) and self-report methods (Tanofsky-Kraff et al., 2008; Wardle, Guthrie, Sanderson, & Rapoport, 2001). While laboratory paradigms offer the most accurate measure of EAH, it requires many resources and is not suitable for use in clinical practice. Rather, it is recommended that clinicians use the Satiety Responsiveness subscale of the Child Eating Behavior Questionnaire (CEBQ) to assess satiety responsiveness in children (see Table 1), which is a brief self-report measure completed by a parent on behalf of their child, and has demonstrated adequate validity when compared with laboratory paradigms in samples of children between 3 and 11 years (Carnell & Wardle, 2007; Wardle et al., 2001). A full copy of the CEBQ can be accessed online at: <http://www.ucl.ac.uk/hbrc/diet/> (Wardle et al., 2001). Alternatively, the EAH Questionnaire may be appropriate for older children and adolescents (Tanofsky-Kraff et al., 2008).

As reviewed in Carnell & Wardle (2008), several intervention strategies targeting improvements in satiety responsiveness may be effective (see Table 2). It may be possible to use pharmaceutical methods to regulate children's appetite, though the efficacy of such approaches are not established at this time. Behavioral interventions, on the other hand, are likely to be more suitable for long-term healthful changes. One study delivered a 6-week intervention using dolls to teach pre-school children to pay greater attention to internal satiety cues, which successfully regulated food intake (Johnson, 2000). Appetite awareness training (Craighead & Allen, 1995) encourages children to focus on their hunger and fullness to guide food intake rather than other eating triggers (e.g., emotional), and has demonstrated significantly greater BMI reductions as compared to a wait-list control in recent studies (Bloom, Wynne, & Chaudhri, 2005; Jones et al., 2008). Clinicians can also teach parents to make environmental changes in the home, such as offering children portion sizes appropriate for their needs, giving children the choice of a variety of healthy foods, and monitoring their child's eating rate.

Motivation to Eat

Motivation to eat is conceptualized as the relative reinforcing value of food, which is defined as the amount of work that an individual will engage in to obtain food (Epstein et al., 2010). While the prevalence of youth with a high motivation to eat is currently unknown, this appetitive trait has been detected in 8-year-old children (Temple et al., 2008). More work is required to elucidate the prevalence and emergence of the motivation to eat.

A child's motivation to eat/relative reinforcing value of food can be measured by assessing how hard he or she will work for food when given a choice between two alternatives (e.g., two types of food, a food and an alternative activity) (Goldfield, Epstein, Davidson, & Saadd, 2005). A brief questionnaire to measure the relative reinforcing value of food has recently been used successfully in children ages 8–12 years old (Epstein, Dearing, Temple,

& Cavanaugh, 2008). A closely related construct is responsiveness to external food cues (Carnell & Wardle, 2009), which can be simply assessed by parents via a brief subscale of the CEBQ (Table 1) (Wardle et al., 2001). While assessing food cue responsiveness may seem more intuitive, further work is required to determine whether this construct is strongly associated with the relative reinforcing value of food assessment.

For youth with a high motivation to eat, the primary goal of intervention approaches is for parents to shift the relative reinforcing value of food by increasing access to healthy foods while simultaneously decreasing availability of unhealthy foods in the home (Epstein et al., 2001). Additionally, another method to reduce energy intake may be to decrease access to activities that are compatible with eating, such as watching television (Epstein et al., 2010). One primary challenge that clinicians face when intervening with children who have a high motivation to eat is to identify healthful alternatives to compete with the highly reinforcing intake of high energy-density foods. One promising substitute for food may be increased social support and social interactions with family and peers (Wilfley, Stein et al., 2007; Wilfley et al., 2010), as overweight youth have been found to make healthier eating and activity choices when they are in the presence of peers as compared to when they are alone (Salvy, Coelho, Kieffer, & Epstein, 2007; Salvy, Kieffer, & Epstein, 2008). Pharmaceutical interventions that target neurobiological correlates, such as the dopaminergic systems in the brain, may be effective. However, much more work is warranted before this is formally recommended.

Impulsivity

Impulsivity refers to an individual's diminished capacity to resist immediate needs rather than self-regulate one's behaviors in favor of desired long-term goals. The impulsivity construct is often operationally defined by a child's ability to delay gratification, which is his or her ability to postpone immediate rewards to attain subsequent but more valued outcomes. Impulsivity/delay of gratification is seen in very young children, as early as 3 years old (Francis & Susman, 2009; Seevaye et al., 2009).

Impulsivity, like many personality traits, is a multidimensional construct and therefore can be measured in a variety of ways. Impulsivity is typically measured in youth with weight-related problems through a delay of gratification paradigm in a laboratory setting, whereby children choose between a smaller, immediate food reward (e.g., one marshmallow) and larger, delayed reward (e.g., 3 marshmallows) (Mischel, Shoda, & Rodriguez, 1989). While this method has consistently identified individual differences in impulsivity, it is not practical for everyday use. Reward sensitivity has been noted as a key aspect of impulsivity in obesity (Stice, Presnell, & Spangler, 2002), and can be assessed behaviorally or via self-report questionnaires in youth (Nederkoorn et al., 2006; Nederkoorn, Jansen, Mulken, & Jansen, 2007; Patton, Stanford, & Barratt, 1995). The reward sensitivity subscale of the Barratt Impulsivity Scale (Patton et al., 1995) has been validated in adolescents and can be adapted for use by clinicians (Table 1); however, research is required to determine the validity of this measure in younger children.

Impulsive youth's inability to delay gratification for food is likely expressed as an increased frequency of food cravings coupled with an inability to resist those cravings (Epstein et al., 2010). Targeted intervention approaches for impulsivity, therefore, ought to focus on training youth in self-control skills, such as planning ahead of time what to do when food cravings occur. Interventions that teach general self-regulation skills, such as focusing attention and following instructions, have also demonstrated encouraging results (Israel, Stollmaker, Sharp, Silverman, & Simon, 1984). Parents can also support their children to delay gratification for food by limiting access to unhealthy foods to decrease temptation. Additionally, it is recommended that parents learn to distract their children's attention away

from food with rewarding, alternative activities (e.g., playing active games together). Much research is needed to further understand how to effectively shift behavioral choices from unhealthy, immediate options to healthy, long-term choices.

Interplay Among Appetitive Traits

All of the appetitive traits are similar in that such individuals have an impaired ability to regulate their energy intake; these vulnerable youth are unable to initiate eating only when they are hungry and/or terminate eating when they are full (Shomaker, Tanofsky-Kraff, & Yanovski, in press). This observation may reflect a common propensity for youth with appetitive traits to rely on external influences to determine food intake. Studies reveal overlaps among appetitive traits in overweight youth, including between binge eating and satiety responsiveness (Mirch et al., 2006), binge eating and impulsivity (Nederkoorn et al., 2006, 2007), and motivation to eat and impulsivity (Epstein et al., 2010).

It is likely that youth with more than one appetitive trait have increased risk for excess weight gain and obesity (see Fig. 2). For instance, binge eating, which is considered the most pathological of the appetitive traits, often involves other appetitive traits such as impaired satiety responsiveness and impulsivity. Therefore, youth with a combination of appetitive traits likely have greater eating- and weight-related problems (Fig. 2); however, substantial research is needed to support this theory and to elucidate the impact of the interplay among appetitive traits on weight. These individuals with overlapping appetitive traits may have heightened susceptibility to the obesogenic environment, further underscoring the importance for clinicians to assess for and treat each of these appetitive traits in youth.

Treatment of Eating- and Weight-Related Problems

Above and beyond individual differences in appetitive traits that contribute to eating- and weight-related problems, the broader environment makes it far too easy for individuals to overeat unhealthy foods and to live sedentary lifestyles. It is, therefore, necessary for interventions to create a “healthy food/activity zone” that makes limiting energy intake and having active lifestyles the default (Ashcroft, Semmler, Carnell, van Jaarsveld, & Wardle, 2008). This approach may be particularly effective for vulnerable individuals with genetic susceptibility and associated behavioral phenotypes. Not only would this strategy minimize the opportunity for expression of appetitive traits, but also it would benefit all individuals who struggle with weight-related problems. This section will provide an overview of such weight management interventions and key treatment components.

Family-Based Behavioral Interventions

Lifestyle interventions, defined as active treatment approaches that focus on changing overweight children’s daily weight-related behaviors, have been shown to be superior to no-treatment control, education-only, and usual care (i.e., visits with a primary care physician) in the treatment of childhood overweight (McGovern et al., 2008; Wake et al., 2009; Wilfley, Tibbs et al., 2007). A recent meta-analysis indicated that lifestyle interventions produce an average decrease in percent overweight of 8.9%, as compared to education-only controls that produce an average increase of 2.7% at follow-up (Wilfley, Tibbs et al., 2007). Furthermore, these approaches result in significant psychosocial health benefits and improvements in overweight-related medical problems (American Dietetic Association, 2006; Kalarichian et al., 2009).

Family-based behavioral interventions are one example of a lifestyle intervention, and are often considered the first-line of treatment for pediatric overweight due to their demonstrated efficacy in reducing percent overweight (Epstein, Myers, Raynor, & Saelens,

1998; Wilfley, Vannucci, & White, in press) and for their relative safety, compared to pharmacotherapy and bariatric surgery (Epstein et al., 1998). It is notable that pharmacotherapy or bariatric surgery may be warranted in some cases dependent upon child age, severity of obesity, and the presence of obesity-related comorbidities (Pratt, Stevens, & Daniels, 2008). However, these approaches should always be implemented in consort with family-based lifestyle interventions. Overall, intensive family-based behavioral lifestyle interventions have powerful treatment effects and provide a promising alternative to more invasive procedures.

The goal of family-based behavioral interventions is either to (1) induce weight loss or (2) prevent excess weight gain and normalize growth by slowing the trajectory of weight gain relative to height. When determining whether to target weight loss or weight gain prevention, it is necessary to consider the child's severity of obesity and age. Weight gain prevention is recommended for very young children and youth who are overweight, not obese (Spear et al., 2007), and is accomplished through achieving a stable energy balance. Weight loss is indicated for older children and adolescents, especially for those above the 95th BMI percentile (Spear et al., 2007), and is achieved through inducing a negative energy balance. Family-based behavioral interventions seek to attain either of these goals by promoting small, successive changes in children's dietary and physical activity behaviors through the use of behavior-change strategies and familial support.

The most efficacious lifestyle treatment approaches for pediatric eating- and weight-related problems focus on four primary components: dietary modification, changes in energy expenditure, behavior change techniques, and parental involvement at all levels of change. Table 3 provides a summary of specific intervention targets and strategies for each of these components (for a more comprehensive review of components of family-based lifestyle interventions, see Wilfley et al., in press). Parental and family involvement in treatment is considered crucial because: (1) parents play an important role as key agents of change in a child's daily life (Young, Northern, Lister, Drummond, & O'Brien, 2007); (2) a greater degree of parental involvement leads to greater child weight outcomes (Kirschenbaum, Harris, & Tomarken, 1984; White et al., 2004); (3) targeting both the parent and child is more effective than targeting the child alone (Golan & Crow, 2004); and (4) there is a high concordance between parent and child weight outcomes (Wrotniak, Epstein, Paluch, & Roemmich, 2005; Wrotniak, Epstein, Paluch, & Roemmich, 2004). In summary, family-based behavioral interventions are most effective for treating children's eating- and weight-related problems, likely because they have the greatest potential to produce lasting beneficial effects by creating a parent-facilitated environment that is supportive of a healthy lifestyle.

Problem of Weight Regain

Although family-based behavioral interventions have clearly demonstrated their efficacy, weight regain after lifestyle change is a common challenge for adults and children (Epstein et al., 1994; Jeffery et al., 2000). According to the socio-ecological model of childhood obesity (Davison & Birch, 2001), weight regain (Fig. 3) occurs following the conclusion of traditional family-based behavioral interventions because the contextual stimuli that set the occasion for previously learned, obesity-related behaviors are not modified, cuing the child and caregiver to relapse into old behavior patterns (Wilfley et al., 2010). Therefore, concerted efforts must be made by clinicians to ensure that new learning is practiced across most or all relevant contexts, that appropriate support and cues for healthful behaviors are in place, and that there is sufficient time devoted to the mastery and practice of these strategies (Bouton, 2002).

There is also increasing evidence that behavior change may be particularly challenging for genetically susceptible individuals with key appetitive traits. Although it is not possible to

alter an individual's genetic makeup after birth, it is possible to change one's surrounding environment through interventions designed to decrease the likelihood of the phenotypic expression of obesity-related behaviors and appetitive traits. One approach to preventing weight regain in the long-term is to expand the scope, intensity, and duration of family-based behavioral interventions to allow more time to practice newly acquired behaviors across contexts. This strategy likely enhances the generalization of healthful behavior patterns to multiple contexts, which significantly increases the likelihood that weight maintenance will continue after contact with the clinician ends (Wilfley et al., 2010).

Family-Based Weight Maintenance Treatment: A Multi-Level Approach

In order to overcome the problem of weight regain, it is recommended that clinicians to include weight maintenance approaches following weight loss or weight gain prevention programs. Maintenance approaches build on what is learned in family-based behavioral interventions, but assume that the skills required to maintain weight are distinct from those needed to lose weight (Perri, 1998; Wilfley, Stein et al., 2007, 2010). Family-based maintenance interventions with a socio-ecological focus are thought to produce sustainable behavior modifications by effecting change across multiple contexts (see Fig. 3), thus enhancing the efficacy of treatment in the long-term (Wilfley et al., 2010).

Wilfley, Stein et al. (2007) were the first to target weight maintenance in children following traditional family-based treatment. Two distinct approaches, Behavioral Skills Maintenance treatment (BSM) and Social Facilitation Maintenance treatment (SFM), were compared to a no treatment control condition. BSM emphasizes maintaining healthful changes within the individual context and focuses on self-regulation behaviors and relapse-prevention strategies (e.g., cognitive restructuring, coping with high risk situations). SFM extends the scope of the intervention to the family's social context, teaching methods to help parents bolster child peer networks that support health behaviors and targets peer (e.g., teasing) and self-perceptual (e.g., body image) factors. Findings indicate that children receiving either BSM or SFM maintained relative weight significantly better than the control group in the short-term; however BSM was no more effective than control at long-term follow-up (Wilfley, Stein et al., 2007). Further, children receiving SFM demonstrated significantly greater improvements in their ability to cope with teasing and to enlist friends to support physical activity over the short- and long-term, compared to both BSM and control (Wilfley, Stein et al., 2007). These results suggest that weight maintenance approaches like SFM are effective; however, improvements are needed to further enhance their long-term efficacy.

One promising approach for enhancing long-term weight maintenance is to use a socio-ecological framework of health behavior change that extends the scope of treatment into additional socio-environmental settings (Davison & Birch, 2001). Socio-ecological models posit that eating- and weight-related problems are the result of individual/family, peer/social, and community factors that interact dynamically with genetic susceptibilities and behavioral phenotypes (Glass & McAtee, 2006; Huang et al., 2009). Wilfley et al. (2010) were the first to apply this theory to treatment in the design and evaluation of an enhanced version of SFM, which expands its interpersonal focus at the peer/social level, includes additional self-regulation strategies at the individual/family level, and promotes environmental change at the community level (see Fig. 3). The projected efficacy of Enhanced SFM is an anticipated decrease of 12.9% overweight at the most distal timepoint (30 month follow-up) (Wilfley et al., 2010). These results suggest that Enhanced SFM, with its focus on social ecology and multiple behavioral contexts, is a promising approach for improving weight maintenance treatment outcomes.

Components of a Family-Based, Multi-Level Maintenance Intervention

In general, it may be helpful for clinicians to view obesity as a chronic disease that necessitates a long-term intervention approach, particularly within the current pervasive obesogenic environment that promotes relapse and weight regain. Mental health care providers can contribute a unique perspective on eating- and weight-related problems and may be particularly well-suited for delivering multilevel maintenance interventions due to their familiarity with psychosocial difficulties and behavior change techniques. Promising treatment components at each level are described below and depicted in Fig. 4.

At the *individual/family level*, persistent self-regulation is required to maintain long-term adherence to healthy eating behaviors and regular physical activity associated with successful weight maintenance in both adults (Perri, 1998) and children (Wilfley, Stein et al., 2007). Specific self-regulation behaviors include comparing one's current weight with a maintenance weight (through regular self-weighing and using a weight graph), adhering to healthy eating and activity behaviors, planning for high-risk situations, and returning to weight loss behaviors if even minimal weight regain occurs (Wing, Tate, Gorin, Raynor, & Fava, 2006). In addition, it would be useful for clinicians to incorporate tailored treatment components for children endorsing key appetitive traits as well as for those with medical and psychiatric comorbidities.

At the *peer/social level*, expanding the peer contexts that support, reward, and encourage healthy behaviors can have a powerful influence on whether or not healthful behaviors are sustained (Christakis & Fowler, 2007; Smith, 1999). The overarching goal of a peer/social component is to increase the ratio of individuals that are supportive of a healthier lifestyle rather than to change the attitudes and behaviors of all individuals within the social network (e.g., a grandmother who is unwilling to change) (Litt, Kadden, Kabela-Cormier, & Petry, 2007). Family-based approaches are an obvious source of social support for healthful behaviors, and incorporating an interpersonal focus can help families create a supportive health-oriented social network. Parents can also foster healthful peer networks by organizing active play dates for children and exposing them to healthful events within their communities.

At the *community level*, aspects of the built environment (e.g., access to healthy foods and local parks, proximity to fast food restaurants, perceived neighborhood safety) may affect an individual's choice to engage in energy balance behaviors (Sallis & Glanz, 2006). Parents are encouraged to create a lifestyle that capitalizes on healthful environmental opportunities (e.g., local parks) while limiting access to obesity-promoting aspects of the environment (e.g., fast food restaurants) (Wilfley et al., 2010). Families can develop lists of community resources and events that are supportive of weight maintenance behaviors, and make plans to increase the utilization of those resources. Overall, weight loss maintenance treatment would be enhanced by encouraging parents and children to modify, where possible, the stimuli present in the contexts of school, neighborhood, and community that facilitate or constrain their use of newly acquired weight maintenance skills.

Practical Considerations for Intervention Implementation

Although obesity is a prevalent condition in the United States, overweight individuals are often discriminated against and face numerous practical challenges. In addition, many overweight individuals may be hesitant to seek treatment or feel discomfort with the treatment process. Therefore, it is important that clinicians take steps to ensure that obese individuals receive treatment in an environment that is sensitive to the stigma and challenges faced by the overweight, and concrete steps are taken to reduce potential bias against overweight individuals. Specifically, staff members should receive sensitivity training

regarding screening and assessment of eating- and weight-related behaviors, in addition to training in how to interact with overweight children in a non-stigmatizing or discriminating manner. Clinics can also address practical concerns by ensuring that treatment facilities are designed to accommodate the physical and space needs of overweight clients. Overall, minimizing client discomfort within the treatment setting can help improve adherence and treatment uptake.

Implementing socio-environmentally-based interventions within the clinic setting requires clinicians to encourage and facilitate contexts which making healthy eating and behaviors the default. Optimally, this involves delivering interventions tailored to address eating- and weight-related behaviors on multiple levels: the individual, family, and community. To enhance the success of socio-environmentally- based interventions, clinicians must allow ample time to modify the default unhealthful dietary practices and sedentary behaviors. Clinicians may assist parents in the use of positive reinforcement strategies to increase the occurrence of desired healthful behaviors, while simultaneously targeting the decrease of punishment for unwanted, unhealthy behaviors (Epstein et al., 2001). For example, clinicians can teach parents to provide positive rewards for children's healthful lifestyles changes (e.g., eating 5 servings of fruits and vegetables, decreasing sedentary behavior) and to minimize attention to and punishment for unhealthy behaviors (e.g., taking away privileges for watching too much television). For instance, clinicians can help patients create a hierarchical list of reinforcing healthful activities and work with the parents and their children to progressively incorporate difficult activities into their lives. Clinicians can also assist individuals struggling with eating- and weight-related concerns by providing opportunities to practice new behaviors across multiple contexts (i.e., at home with family, eating out with friends, at work) that extend beyond the consultation setting. Incorporating family members or friends in the intervention is one method that clinicians can use to help facilitate a social support network for weight loss maintenance.

It is important to consider that factors beyond the individuals' control may constrain their ability to adopt healthful eating- and weight-related behaviors. Some key factors include socio-economic status, racial/ethnic identity and associated dietary and activity preferences, and residing within a food desert or unsafe neighborhood. Clinicians must be aware of and sensitive to these individual differences, and can work with clients to problem-solve methods to overcome barriers. For example, clinicians can help families who live in food deserts or in areas with aesthetically unappealing places for physical activity to generate practical alternatives (e.g., locating boys and girls clubs in the area). Finding ways to use community resources will promote greater behavioral adherence to family-based interventions. Moreover, it is important to acknowledge the factors that may enhance an individual's ability to enact eating- and weight-related changes (i.e., strong social support for weight loss maintenance) and capitalized upon these factors during treatment delivery.

Due to the high comorbidity of overweight and psychiatric or medical conditions (Faith et al., 2001; Tanofsky- Kraff et al., 2003), clinicians must be prepared to assess for and potentially treat comorbidities within the context of lifestyle interventions. The most common comorbid conditions in youth include depression, eating disorders, and attention deficit/hyperactivity disorder. Approximately 11% of overweight youth seeking behavioral treatment are depressed (Zeller & Modi, 2006), up to 30% of treatment-seeking overweight individuals meet criteria for BED (Stunkard, 2002), and nearly 60% of morbidly obese youth have ADHD (Agranat-Meged et al., 2005). Comorbid conditions commonly related to obesity can effectively be addressed through a multi-level lifestyle approach to weight management. Often, common behavioral components, such as self-monitoring, can be harnessed to treat obesity and related conditions simultaneously.

Finally, for older youth who are severely obese, clinicians can consider the potential benefit of implementing more aggressive treatment approaches, such as bariatric surgery and pharmacotherapy, to lifestyle interventions. Currently, bariatric surgery is indicated for adolescents who are: severely overweight; have reached their adult height; have attempted to lose weight (unsuccessfully) for at least 6 months; and have obesity-related comorbidities (Inge, Xanthakos, & Zeller, 2007). Clinician involvement, including the assessment of the adolescent's social and emotional development, is imperative for youth who are considering undergoing bariatric surgery, as the long-term impact of bariatric surgery early in life on development is not yet fully understood (Bean, Stewart, & Olbrisch, 2008). Although recommendations for the use of pharmacological weight loss therapy in children have not been established, preliminary research suggests that pharmacotherapy may increase the efficacy of lifestyle interventions (Duncan, Desilets, & Montalbano, 2007) for severely overweight youth. Clinicians can help emphasize that both bariatric surgery and pharmacotherapy is best utilized as an adjunctive treatment to lifestyle behavioral interventions.

Discussion and Future Directions

Obesity and other eating- and weight-related concerns are complex, multiply determined disorders that require complex, multi-level solutions. Mental health care providers have the potential to play a crucial role in the identification and early intervention of eating- and weight-related problems. The various individual and environmental factors that contribute to eating- and weight-related problems in youth require intervention approaches that focus on modifying the child's social ecology across multiple contexts. Given the central role that parents play in shaping children's environments, it is crucial to capitalize on this influence and involve parents as key players in laying a foundation for creating an environment that makes healthy behaviors the default. Screening and identifying appetitive traits in youth can allow clinicians to tailor interventions for this particularly vulnerable subset of the population with weight-related problems, which may further improve intervention efficacy. To further improve intervention efficacy, it is crucial that future research identify the treatment components associated with the most broad-based and persistent effects as well as the biological, social, environmental characteristics and factors that constrain or prompt weight-regulating behaviors. Focusing on weight loss maintenance and the practice of new behaviors across multiple contexts has been shown to be effective and merits further evaluation.

It is clear that the rapid increases in obesity seen over the past decades necessitate immediate and intensive response. Given this pressing need, it is critical in moving forward to determine how best to disseminate and implement effective programs into community clinic, primary care, and other medical settings. Additionally, continued research on the biological and behavioral mechanisms underlying eating and appetite is necessary for our understanding of how to effect change through weight management interventions and is particularly relevant for clinicians working with pediatric populations who are likely to see such vulnerable youth in practice. Clinicians and researchers must work together to address key questions related to the nature of eating- and weight-related problems in youth and to achieve breakthroughs in the prevention and treatment of such problems in this vulnerable population.

Acknowledgments

This work was supported by K24MH070446, R01HD36904, R01MH081125, R01MH064153. 2009 Pfizer Visiting Professorship in Obesity, Visiting Professorship at Baylor College of Medicine, and Aubuchon Obesity and Behavioral Health Fund.

References

- American Dietetic Association. Position of the American Dietetic Association: Individual-, family-, school-, and community- based interventions for pediatric overweight. *Journal of the American Dietetic Association*. 2006; 106:925–945. [PubMed: 16812927]
- Agranat-Meged AN, Deitcher C, Goldzweig G, Leibson L, Stein M, Galili-Weisstub E. Childhood obesity and attention deficit/hyperactivity disorder: A newly described comorbidity in obese hospitalized children. *International Journal of Eating Disorders*. 2005; 37:357–359. [PubMed: 15856493]
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4. Washington, DC: 2000. text rev
- Ashcroft J, Semmler C, Carnell S, van Jaarsveld CMH, Wardle J. Continuity and stability of eating behaviour traits in children. *European Journal of Clinical Nutrition*. 2008; 62:985–990. [PubMed: 17684526]
- Bean MK, Stewart K, Olbrisch ME. Obesity in America: Implications for clinical and health psychologists. *Journal of Clinical Psychology in Medical Settings*. 2008; 15:214–224. [PubMed: 19104966]
- Birch LL, Fisher JO. Development of eating behaviors among children and adolescents. *Pediatrics*. 1998; 101:539–549. [PubMed: 12224660]
- Bloom S, Wynne K, Chaudhri O. Gut feeling: The secret of satiety? *Clinical Medicine*. 2005; 5:147–152. [PubMed: 15847007]
- Bouton ME. Context, ambiguity, and unlearning: Sources of relapse after behavioral extinction. *Biological Psychiatry*. 2002; 52(10):976–986. [PubMed: 12437938]
- Braet C, Claus L, Verbeken S, Van Vlierberghe L. Impulsivity in overweight children. *European Journal of Adolescent Psychiatry*. 2007; 15:473–483.
- Bull NL. Studies of the dietary habits, food consumption and nutrient intakes of adolescents and young adults. *World Review of Nutrition and Dietetics*. 1988; 57:24–74. [PubMed: 3067453]
- Butte NF, Cai GW, Cole SA, Wilson TA, Fisher JO, Zakeri IF, et al. Metabolic and behavioral predictors of weight gain in Hispanic children: The Viva la Familia Study. *American Journal of Clinical Nutrition*. 2007; 85:1478–1485. [PubMed: 17556682]
- Carnell S, Wardle J. Measuring behavioural susceptibility to obesity: Validation of the child eating behaviour questionnaire. *Appetite*. 2007; 48:104–113. [PubMed: 16962207]
- Carnell S, Wardle J. Appetite and adiposity in children: Evidence for a behavioral susceptibility theory of obesity. *American Journal of Clinical Nutrition*. 2008; 88:22–29. [PubMed: 18614720]
- Carnell S, Wardle J. Appetitive traits in children. New evidence for associations with weight and a common, obesity-associated genetic variant. *Appetite*. 2009; 53(2):260–263. [PubMed: 19635515]
- Christakis NA, Fowler JH. The spread of obesity in a large social network over 32 years. *New England Journal of Medicine*. 2007; 357:370–379. [PubMed: 17652652]
- Cohen ML, Tanofsky-Kraff M, Young-Hyman D, Yanovski JA. Weight and its relationship to adolescent perceptions of their providers (WRAP): A qualitative and quantitative assessment of teen weight-related preferences and concerns. *Journal of Adolescent Health*. 2005; 37:163. [PubMed: 16026727]
- Craighead LW, Allen HN. Appetite awareness training: A cognitive behavioral intervention for binge-eating. *Cognitive and Behavioral Practice*. 1995; 2:249–270.
- Davison KK, Birch LL. Childhood obesity: A contextual model and recommendations for future research. *Obesity Reviews*. 2001; 2:159–171. [PubMed: 12120101]
- Decaluwé V, Braet C. Prevalence of binge-eating disorder in obese children and adolescents seeking weight-loss treatment. *International Journal of Obesity*. 2003; 27:404–409. [PubMed: 12629570]
- Dietz WH, Gortmaker SL. Preventing obesity in children and adolescents. *Annual Review of Public Health*. 2001; 22:337–353.
- Dunican KC, Desilets AR, Montalbano JK. Pharmacotherapeutic options for overweight adolescents. *Annals of Pharmacotherapy*. 2007; 41:1445–1455. [PubMed: 17652127]
- Epstein LH, Dearing KK, Temple JL, Cavanaugh MD. Food reinforcement and impulsivity in overweight children and their parents. *Eating Behaviors*. 2008; 9:319–327. [PubMed: 18549991]

- Epstein LH, Gordy CC, Raynor HA, Beddome M, Kilanowski CK, Paluch R. Increasing fruit and vegetable intake and decreasing fat and sugar intake in families at risk for childhood obesity. *Obesity Research*. 2001; 9:171–178. [PubMed: 11323442]
- Epstein LH, Myers MD, Raynor HA, Saelens BE. Treatment of pediatric obesity. *Pediatrics*. 1998; 101:554–570. [PubMed: 12224662]
- Epstein LH, Roemmich JN, Paluch RA, Raynor HA. Physical activity as a substitute for sedentary behavior in youth. *Annals of Behavioral Medicine*. 2005; 29:200–209. [PubMed: 15946114]
- Epstein LH, Salvy SJ, Carr KA, Dearing KK, Bickel WK. Food reinforcement, delay discounting, and obesity. *Physiology and Behavior*. 2010; 100:438–445. [PubMed: 20435052]
- Epstein LH, Valoski AM, Wing RR, McCurley J. Ten-year outcomes of behavioral family-based treatment for childhood obesity. *Health Psychology*. 1994; 13:373–383. [PubMed: 7805631]
- Faith, MS.; Saelens, BE.; Wilfley, DE.; Allison, DB. Behavioral treatment of childhood and adolescent obesity: Current status, challenges, and future directions. In: Thompson, JK.; Smolak, L., editors. *Body image, eating disorders, and obesity in youth: Assessment, prevention, and treatment*. Washington, DC: American Psychological Association; 2001. p. 313-339.
- Fisher JO. Effects of age on children's intake of large and self-selected food portions. *Obesity*. 2007; 15:403–412. [PubMed: 17299114]
- Fisher JO, Birch LL. Eating in the absence of hunger and overweight in girls from 5 to 7 y of age. *American Journal of Clinical Nutrition*. 2002; 76:226–231. [PubMed: 12081839]
- Francis LA, Susman EJ. Self-regulation and rapid weight gain in children from age 3 to 12 years. *Archives of Pediatrics and Adolescent Medicine*. 2009; 163:297–302. [PubMed: 19349557]
- Freedman DS, Kettel Khan L, Serdula MK, Ogden CL, Dietz WH. Racial and ethnic differences in secular trends for childhood BMI, weight, and height. *Obesity*. 2006; 14:301–308. [PubMed: 16571857]
- Glass TA, McAtee MJ. Behavioral science at the crossroads in public health: Extending horizons, envisioning the future. *Social Science and Medicine*. 2006; 62:1650–1671. [PubMed: 16198467]
- Golan M, Crow S. Parents are key players in the prevention and treatment of weight-related problems. *Nutrition Reviews*. 2004; 62:39–50. [PubMed: 14995056]
- Goldfield GS, Epstein LH, Davidson M, Saadd F. Validation of a questionnaire measure of the relative reinforcing value of food. *Eating Behaviors*. 2005; 6:283–292. [PubMed: 15854874]
- Goldschmidt AB, Doyle AC, Wilfley DE. Assessment of binge eating in overweight youth using a questionnaire version of the child eating disorder examination with instructions. *International Journal of Eating Disorders*. 2007; 40:460–467. [PubMed: 17497710]
- Goldschmidt AB, Passi Aspen VA, Sinton MM, Tanofsky-Kraff M, Wilfley DE. Disordered eating attitudes and behaviors in overweight youth. *Obesity Research*. 2008; 16:257–264.
- Goossens L, Braet C, Decaluwe V. Loss of control over eating in obese youngsters. *Behaviour Research and Therapy*. 2007; 45:1–9. [PubMed: 16516139]
- Hampel SE, Carroll CA, Simon SD, Sharma V. Resource utilization and expenditures for overweight and obese children. *Archives of Pediatrics and Adolescent Medicine*. 2007; 161:11–14. [PubMed: 17199061]
- Hayden-Wade HA, Stein RI, Ghaderi A, Saelens BE, Zabinski MF, Wilfley DE. Prevalence, characteristics, and correlates of teasing experiences among overweight children vs. non-overweight peers. *Obesity Research*. 2005; 13:1381–1392. [PubMed: 16129720]
- Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM. Prevalence of overweight and obesity among US children, adolescents, and adults, 1999–2002. *JAMA*. 2004; 291:2847–2850. [PubMed: 15199035]
- Hill C, Llewellyn CH, Saxton J, Webber L, Semmler C, Carnell S, et al. Adiposity and 'eating in the absence of hunger' in children. *International Journal of Obesity*. 2008; 32:1499–1505. [PubMed: 18645573]
- Hill C, Saxton J, Webber L, Blundell J, Wardle J. The relative reinforcing value of food predicts weight gain in a longitudinal study of 7–10-yr-old children. *American Journal of Clinical Nutrition*. 2009; 90:1–6. [PubMed: 19439460]
- Huang TT, Drenowski A, Kumanyika SK, Glass TA. A systems-oriented multilevel framework for addressing obesity in the 21st century. *Preventing Chronic Disease*. 2009; 6:1–10.

- Inge TH, Xanthakos SA, Zeller MH. Bariatric surgery for pediatric extreme obesity: Now or later? *International Journal of Obesity*. 2007; 31:1–14. [PubMed: 17173060]
- Israel AC, Stoltmaker L, Sharp JP, Silverman WK, Simon LG. An evaluation of 2 methods of parental involvement in treating obese children. *Behavior Therapy*. 1984; 15:266–272.
- Jahns L, Siega-Riz AM, Popkin BM. The increasing prevalence of snacking among US children from 1977 to 1996. *Journal of Pediatrics*. 2001; 138:493–498. [PubMed: 11295711]
- Jansen A, Theunissen N, Slechten K, Nederkoorn C, Boon B, Mulkens S, et al. Overweight children overeat after exposure to food cues. *Eating Behaviors*. 2003; 4:197–209. [PubMed: 15000982]
- Javaras KN, Laird NM, Reichborn-Kjennerud T, Bulik CM, Pope HG Jr, Hudson JI. Familiality and heritability of binge eating disorder: Results of a case-control family study and a twin study. *International Journal of Eating Disorders*. 2008; 41:174–179. [PubMed: 18095307]
- Jeffery RW, Drewnowski A, Epstein LH, Stunkard AJ, Wilson GT, Wing RR, et al. Long-term maintenance of weight loss: Current status. *Health Psychology*. 2000; 19:5–16. [PubMed: 10709944]
- Johnson SL. Improving preschoolers' self-regulation of energy intake. *Pediatrics*. 2000; 106:1429–1435. [PubMed: 11099599]
- Jones M, Luce KH, Osborne MI, Taylor K, Cunnings D, Doyle AC, et al. Randomized, controlled trial of an internet-facilitated intervention for reducing binge eating and overweight in adolescents. *Pediatrics*. 2008; 121:453–462. [PubMed: 18310192]
- Kalarchian MA, Levine MD, Arslanian SA, Ewing LJ, Houck PR, Cheng Y, et al. Family-based treatment of severe pediatric obesity: Randomized, controlled trial. *Pediatrics*. 2009; 124:1060–1068. [PubMed: 19786444]
- Kirschenbaum DS, Harris ES, Tomarken AJ. Effects of parental involvement in behavioral weight-loss therapy for preadolescents. *Behavior Therapy*. 1984; 15:485–500.
- Koebnick C, Smith N, Coleman KJ, Getahun D, Reynolds K, Quinn VP, et al. Prevalence of extreme obesity in a multiethnic cohort of children and adolescents. *Journal of Pediatrics*. 2010; 157(1):1–6. [PubMed: 20547260]
- Lin, BH.; Frazao, E. Agriculture Information Bulletin no AIB749. Washington, DC: U.S. Department of Agriculture, Economic Research Service; 1999. Away-from-home foods increasingly important to quality of American diet; p. 1-32.
- Litt MD, Kadden RM, Kabela-Cormier E, Petry N. Changing network support for drinking: Initial findings from the network support project. *Journal of Consulting and Clinical Psychology*. 2007; 75:542–555. [PubMed: 17663609]
- McGovern L, Johnson JN, Paulo R, Hettinger A, Singhal V, Kamath C, et al. Treatment of pediatric obesity: A systematic review and meta-analysis of randomized trials. *Journal of Clinical Endocrinology and Metabolism*. 2008; 93:4600–4605. [PubMed: 18782881]
- Mirch MC, McDuffie JR, Yanovski SZ, Merel Schollnberger M, Tanofsky-Kraff M, Theim KR, et al. Effects of binge eating on satiation, satiety, and energy intake of overweight children. *American Journal of Clinical Nutrition*. 2006; 84:732–738. [PubMed: 17023698]
- Mischel W, Shoda Y, Rodriguez ML. Delay of gratification in children. *Science*. 1989; 244:933–938. [PubMed: 2658056]
- Moens E, Braet C. Predictors of disinhibited eating in children with and without overweight. *Behavior Research and Therapy*. 2007; 45:1357–1368.
- Nederkoorn C, Braet C, Van Eijs Y, Tanghe A, Jansen A. Why obese children cannot resist food: The role of impulsivity. *Eating Behaviors*. 2006; 7:315–322. [PubMed: 17056407]
- Nederkoorn C, Jansen E, Mulkens S, Jansen A. Impulsivity predicts treatment outcome in obese children. *Behavior Research and Therapy*. 2007; 45:1071–1075.
- Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in US children and adolescents, 2007–2008. *JAMA*. 2010; 303:242–249. [PubMed: 20071470]
- Patton JN, Stanford MS, Barratt ES. Factor structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology*. 1995; 51:768–774. [PubMed: 8778124]
- Perri MG. The maintenance of treatment effects in the long-term management of obesity. *Clinical Psychology: Science and Practice*. 1998; 5:526–543.

- Pratt CA, Stevens J, Daniels S. Childhood obesity prevention and treatment: Recommendations for future research. *American Journal of Preventive Medicine*. 2008; 35:249–252. [PubMed: 18617353]
- Rosenbaum M, Leibel RL, Hirsch J. Medical progress: Obesity. *New England Journal of Medicine*. 1997; 337:396–407. [PubMed: 9241130]
- Sallis JF, Glanz K. The role of built environments in physical activity, eating, and obesity in childhood. *Future of Children*. 2006; 16:89–108. [PubMed: 16532660]
- Salvy SJ, Coelho JS, Kieffer E, Epstein LH. Effects of social contexts on overweight and normal-weight children's food intake. *Physiology and Behavior*. 2007; 92:840–846. [PubMed: 17628616]
- Salvy SJ, Kieffer E, Epstein LH. Effects of social context on overweight and normal-weight children's food selection. *Eating Behaviors*. 2008; 9:190–196. [PubMed: 18329597]
- Seevaye DM, Coleman S, Appugliese D, Corwyn RF, Bradley RH, Davidson NS, et al. Ability to delay gratification at age 4 years and risk for overweight at age 11 years. *Archives of Pediatrics and Adolescent Medicine*. 2009; 163:303–308. [PubMed: 19349558]
- Shomaker, LB.; Tanofsky-Kraff, M.; Yanovski, JA. Disinhibited eating and body weight in youth. In: Preedy, VR.; Watson, RR.; Watson, CR., editors. *International Handbook of Behavior, Diet and Nutrition*. Springer Publishers; in press
- Smith AE. Perceptions of peer relationships and physical activity participation in early adolescence. *Journal of Sports Medicine and Physical Fitness*. 1999; 21:329–350.
- Spear BA, Barlow SE, Ludwig DS, Saelens BE, Schetzina KE, Taveras EM. Recommendations for treatment of child and adolescent overweight and obesity. *Pediatrics*. 2007; 120:S254–S288. [PubMed: 18055654]
- Spurrell EB, Wilfley DE, Tanofsky MB, Brownell KD. Age of onset for binge eating: Are there different pathways to binge eating? *International Journal of Eating Disorders*. 1997; 21:55–65. [PubMed: 8986518]
- Stice E, Presnell K, Spangler D. Risk factors for binge eating onset: A prospective investigation. *Health Psychology*. 2002; 21:131–138. [PubMed: 11950103]
- Stunkard, AJ. Binge eating disorder and the night eating syndrome. In: Wadden, TA.; Stunkard, AJ., editors. *Handbook of obesity treatment*. New York: Guilford Press; 2002. p. 107–121.
- Tanofsky-Kraff M, Faden D, Yanovski SZ, Wilfley DE, Yanovski JA. The perceived onset of dieting and loss of control eating behaviors in overweight children. *International Journal of Eating Disorders*. 2005; 38:112–122. [PubMed: 16134103]
- Tanofsky-Kraff M, Han JC, Anandalingham K, Shomaker LB, Columbo KM, Wolkoff LE, et al. The FTO gene rs9939609 obesity-risk allele and loss of control over eating. *American Journal of Clinical Nutrition*. 2009; 90:1483–1488. [PubMed: 19828706]
- Tanofsky-Kraff, M.; Hayden, HA.; Cavazos, PA.; Wilfley, DE. Pediatric obesity prevention and treatment. In: Andersen, R., editor. *Obesity: Etiology, assessment, treatment, and prevention*. Champaign, IL: Human Kinetics; 2003. p. 155–175.
- Tanofsky-Kraff M, McDuffie JR, Yanovski SZ, Kozlosky M, Schvey NA, Shomaker LB, et al. Laboratory assessment of the food intake of children and adolescents with loss of control eating. *American Journal of Clinical Nutrition*. 2009; 89:738–745. [PubMed: 19144730]
- Tanofsky-Kraff M, Ranzenhofer LM, Yanovski SZ, Schvey NA, Faith M, Gustafson J, et al. Psychometric properties of a new questionnaire to assess eating in the absence of hunger in children and adolescents. *Appetite*. 2008; 51:148–155. [PubMed: 18342988]
- Tanofsky-Kraff M, Wilfley DE, Young JF, Mufson L, Yanovski SZ, Glasofer DR, et al. A pilot study of interpersonal psychotherapy for preventing excess weight gain in adolescent girls at-risk for obesity. *International Journal of Eating Disorders*. 2009; 1002/eat.20773
- Tanofsky-Kraff M, Yanovski SZ, Schvey NA, Olsen CH, Gustafson J, Yanovski JA. A prospective study of loss of control eating for body weight gain in children at high risk for adult obesity. *International Journal of Eating Disorders*. 2009; 42:26–30. [PubMed: 18720473]
- Tanofsky-Kraff M, Yanovski SZ, Wilfley DE, Marmarosh C, Morgan CM, Yanovski JA. Eating-disordered behaviors, body fat, and psychopathology in overweight and normal-weight children. *Journal of Consulting and Clinical Psychology*. 2004; 72:53–61. [PubMed: 14756614]

- Taveras EM, Sandora TJ, Shih MC, Ross-Degnan D, Goldmann DA, Gillman MW. The association of television and video viewing with fast food intake by preschool-age children. *Obesity*. 2006; 14:2034–2041. [PubMed: 17135621]
- Temple JL, Legierski CM, Giacomelli AM, Salvy SJ, Epstein LH. Overweight children find food more reinforcing and consume more energy than do their nonoverweight children. *American Journal of Clinical Nutrition*. 2008; 87:1121–1127. [PubMed: 18469229]
- Wake MW, Baur LA, Gerner B, Gibbons K, Gold L, Gunn J, et al. Outcomes and costs of primary care surveillance and intervention for overweight or obese children: The LEAP 2 randomised controlled trial. *BMJ*. 2009; 339:1–8.
- Wang YC, Bleich SN, Gortmaker SL. Increasing caloric contribution from sugar-sweetened beverages and 100% fruit juices among US children and adolescents, 1988–2004. *Pediatrics*. 2008; 121:e1604–e1614. [PubMed: 18519465]
- Wardle J. The triple whammy. *Psychologist*. 2005; 18:216–219.
- Wardle J, Carnell S. Appetite is a heritable phenotype associated with adiposity. *Annals of Behavioral Medicine*. 2009; 38:25–30.
- Wardle J, Carnell S, Haworth CMA, Plomin R. Evidence for a strong genetic influence on childhood adiposity despite the force of the obesogenic environment. *American Journal of Clinical Nutrition*. 2008; 87:398–404. [PubMed: 18258631]
- Wardle J, Cooke L. The impact of obesity on psychological well-being. *Best Practice and Research Clinical Endocrinology and Metabolism*. 2005; 19:421–440. [PubMed: 16150384]
- Wardle J, Guthrie CA, Sanderson S, Rapoport L. Development of the Children's Eating Behaviour Questionnaire. *Journal of Child Psychology and Psychiatry and Allied Disciplines*. 2001; 42:963–970.
- Wardle J, Llewellyn C, Sanderson S, Plomin R. The FTO gene and measured food intake in children. *International Journal of Obesity*. 2009; 33:42–45. [PubMed: 18838977]
- White MA, Martin PD, Newton RL, Walden HM, York-Crowe EE, Gordon ST, et al. Mediators of weight loss in a family-based intervention presented over the internet. *Obesity Research*. 2004; 12:1050–1059. [PubMed: 15292468]
- Wilfley DE, Stein RI, Saelens BE, Mockus DS, Matt GE, Hayden-Wade HA, et al. Efficacy of maintenance treatment approaches for childhood overweight: A randomized controlled trial. *JAMA*. 2007; 298:1661–1673. [PubMed: 17925518]
- Wilfley DE, Tibbs TL, Van Buren DJ, Reach KP, Walker MS, Epstein LH. Lifestyle interventions in the treatment of childhood overweight: A meta-analytic review of randomized controlled trials. *Health Psychology*. 2007; 26:521–532. [PubMed: 17845100]
- Wilfley DE, Van Buren DJ, Theim KR, Stein RI, Saelens BE, Ezzet F, et al. The use of biosimulation in the design of a novel multilevel weight loss maintenance program for overweight children. *Obesity*. 2010; 18:S91–S98. [PubMed: 20107468]
- Wilfley, DE.; Vannucci, A.; White, EK. Family-based behavioral interventions. In: Freemark, M., editor. *Pediatric obesity: Etiology, pathogenesis, and treatment*. Vol. 1. New York: Humana Press; in press
- Wilfley DE, Welch RR, Stein RI, Spurrell EB, Cohen LR, Saelens BE, et al. A randomized comparison of group cognitive-behavioral therapy and group interpersonal psychotherapy for the treatment of overweight individuals with binge-eating disorder. *Archives of General Psychiatry*. 2002; 59:713–721. [PubMed: 12150647]
- Wilson GT, Grilo CM, Vitousek KM. Psychological treatment of eating disorders. *American Psychologist*. 2007; 62:199–216. [PubMed: 17469898]
- Wilson GT, Wilfley DE, Agras WS, Bryson SW. Psychological treatments of binge eating disorder. *Archives of General Psychiatry*. 2010; 67:94–101. [PubMed: 20048227]
- Wing RR, Tate DF, Gorin AA, Raynor HA, Fava JL. A self-regulation program for maintenance of weight loss. *New England Journal of Medicine*. 2006; 355:1563–1571. [PubMed: 17035649]
- Wrotniak BH, Epstein LH, Paluch RA, Roemmich JN. Parent weight change as a predictor of child weight change in family-based behavioral obesity treatment. *Archives of Pediatrics and Adolescent Medicine*. 2004; 158:342–347. [PubMed: 15066873]

- Wrotniak BH, Epstein LH, Paluch R, Roemmich JN. The relationship between parents and child self-reported adherence and weight-loss. *Obesity Research*. 2005; 13:1089–1096. [PubMed: 15976152]
- Young KM, Northern JJ, Lister KM, Drummond JA, O'Brien WH. A meta-analysis of family-behavioral weight-loss treatments for children. *Clinical Psychology Review*. 2007; 27:240–249. [PubMed: 17070638]
- Zeller MH, Modi AC. Predictors of health-related quality of life in obese youth. *Obesity* (Silver Spring, Md). 2006; 14:122–130.

Fig. 1.

Behavioral susceptibility theory of obesity. An individual's weight status is determined by the overall energy balance between energy intake and energy expenditure. Individual and environmental factors influence energy-balance behaviors through direct channels (e.g., individuals who binge eating consume excess energy) and through complex interactions (e.g., individuals who have a high motivation to eat may seek out environments with easy access to unhealthy foods). The figure depicted is adapted from Carnell and Wardle (2008), *Proceedings of the Nutrition Society*

Studies reveal overlaps among appetitive traits, which likely increase risk for excess weight gain and obesity.

Fig. 2.

Interplay among appetitive traits. Appetitive traits are similar in that they are associated with dysregulated eating behaviors that make it more difficult to for individuals to initiate eating only when they are hungry and/or terminate eating when they are full. Studies reveal overlaps in appetitive traits, which likely increase risk for excess weight gain and obesity. The figure indicates the relative prevalence rates of each appetitive trait found in children. Further work is warranted to elucidate the precise rates of each trait in youth. The figure depicted is adapted from Carnell and Wardle (2008), *Proceedings of the Nutrition Society*, (c) Cambridge Journals, reproduced with permission

Fig. 3.
Socio-ecological model of weight regain. Reprinted with permissions from Wilfley et al., 2010

Fig. 4.

Enhanced social facilitation maintenance treatment: A social-ecological model. Reprinted with permissions from Wilfley et al., in press

Table 1

Recommended screening questions to assess for appetitive traits

Appetitive trait	Screening questions for clinicians
Binge eating/loss of control eating ^a	<p>Have you ever eaten a really big amount of food and felt like you just could not stop, like a car without brakes?</p> <p>Have you ever felt like you just could not stop eating, but the amount was not that big?</p> <p>Can you tell me what you ate at one of those times?</p> <p>What usually causes you to eat like this? For example, do you usually feel bad or upset about something before you start eating?</p> <p>How upset do you feel about eating like this?</p> <p>How often and for how long have you been eating like this?</p>
Satiety responsiveness ^b	<p>Does your child have a big appetite?</p> <p>How often does your child leave food on his/her plate after eating a meal?</p> <p>How often does your child get full before his/her meal is finished?</p> <p>Does your child get full easily?^e</p> <p>How frequently can your child eat a meal if he/she eats a snack right before?</p>
Motivation to eat ^c	<p>How much does your child like food? (not at all, a little, neutral, likes it, likes it a lot)</p> <p>How often does your child ask for food? (never, rarely, sometimes, often, always)</p> <p>If given the chance, would your child always have food in his/her mouth?</p> <p>If given the choice, how often would your child be eating?</p> <p>When your child is full, how often does he/she find room for his/her favorite foods?</p>
Impulsivity ^d	<p>Would you describe yourself as a kid who thinks before they act, or a kid who acts before they think?</p> <p>Has there ever been a time when these kinds of (impulsive) behaviors got you into trouble? Can you give me some examples?</p> <p>Do you ever find it difficult to sit still for long periods of time? If yes, why?</p> <p>Do you ever say things out loud without thinking first?</p> <p>Do you ever find it difficult to concentrate on tasks, like homework or playing a game?</p>

Questions adapted from

^a Goldschmidt et al. (2008),

^{b, c} Wardle et al. (2001), and

^d Patton et al. (1995)

^e This item should be reverse coded

Table 2

Targeted intervention strategies for appetitive traits *

Appetitive trait	Intervention strategies
Binge eating/loss of control eating ^a	Cognitive behavior therapy to establish regular, healthy eating patterns using self-monitoring, self-control strategies, and problem-solving and to use relapse prevention strategies in promoting maintenance of behavioral change Interpersonal psychotherapy to draw connections between interpersonal triggers and binge eating, so as to modify these patterns through social skills training and role negotiation
Impaired satiety responsiveness ^b	Appetite regulation through pharmaceutical means Use a doll model to increase attention to internal satiety cues Appetite awareness training to encourage youth to focus on their hunger and fullness to guide food intake rather than other eating triggers Environmental changes: managed portion sizes, conscious control of eating rate, emphasis on low energy-density foods
Increased motivation to eat ^c	Stimulus control to maximize accessibility to healthy foods and minimize accessibility to unhealthy foods and sedentary behaviors Parents pay greater attention to alternatives they give their child or adolescent (e.g., use increased social support with family and peers to increase reward value of non-food alternatives) Pharmaceutical interventions based on neurobiological and hormonal correlates
Increased impulsivity ^d	Training in self-control skills, focusing attention, and following instructions Parenting strategies to help youth delay gratification for food (e.g., limit access to unhealthy foods to decrease temptation, distract child's attention away from food with alternative activities)

* As discussed in Carnell & Wardle (2008)

Intervention strategies recommended are adapted from:

^a Jones et al. (2008), Tanofsky-Kraff, Wilfley et al. (2009), Wilfley et al. (2002), Wilson et al. (2010)

^b Bloom et al. (2005), Craighead and Allen (1995), Johnson (2000)

^c Epstein et al. (2001), Epstein et al. (2010), Wilfley et al. (2010)

^d Epstein et al. (2010), Israel et al. (1984)

Table 3

Components of family-based behavioral interventions

Intervention component	Intervention targets	Parental involvement
Dietary modification	<p><i>Induce overall caloric deficit^a by:</i></p> <p>Increasing low energy density (LED) foods:</p> <ol style="list-style-type: none"> 1 Fruits and vegetables (5 daily servings recommended) 2 “Good” fats (e.g., nuts, fish) 3 High-fiber foods (e.g., raisins, multi-grain breads) <p>Decreasing high energy density (HED) foods (no more than 15 servings per week):</p> <ol style="list-style-type: none"> 1 Sugar-sweetened beverages (i.e., soda, sugary fruit juice) 2 Snacking (e.g., foods that contain > 5 g of fat, fast food, sugary cereals) 3 Meals outside the home 	<p>Provide and plan for healthy meals</p> <p>Serve fruits and vegetables for snacks</p> <p>Limit access to HED foods in the home</p> <p>Aim for appropriate portion sizes</p>
Energy expenditure modification	<p><i>Increase overall energy expenditure by:</i></p> <p>Increasing daily activity:</p> <ol style="list-style-type: none"> 1 60 min of moderate- to vigorous-intensity physical activity every day 2 Lifestyle activity (e.g., taking the stairs instead of the elevator, parking car far away) <p>Decrease sedentary activity (no more than 2 h per day):</p> <ol style="list-style-type: none"> 1 Watching television/movies 2 Playing videogames 3 Using the computer 	<p>Provide youth with proper equipment for physical activity</p> <p>Plan family activities that include physical activity (e.g., make use of local parks)</p> <p>Monitor youth’s time spent in key sedentary activities</p> <p>Provide prompts for physical activity rather than sedentary cues</p>
Behavior change techniques	<p>Promote sustainable, healthful eating- and weight-related behaviors by:</p> <ol style="list-style-type: none"> 1 Self-monitor goal achievement (e.g., log daily fruit and vegetable intake) 2 Set eating and activity behavior goals (e.g., dietary intake, energy expenditure) 3 Increase the availability of healthful alternatives through stimulus control (e.g., limit access to HED foods, increase access to LED foods) 4 Implement a family-based reward system to encourage goal achievement (e.g., offer non-food rewards for meeting targeted goals) 	<p>Review self-monitoring logs with child or adolescent</p> <p>Help youth set appropriate goals</p> <p>Model behavior change techniques (e.g., healthy eating, self-monitoring)</p> <p>Encourage healthful behaviors and minimize attention to unhealthful behaviors</p>

^aSetting calorie limits is often recommended and varies by individuals (i.e., age, weight status), but general guidelines include: (1) Weight loss = 1200–1400 Calories/day; (2) weight gain prevention = 1400–2000 Calories/day