32 Family-Based Behavioral Interventions for Childhood Obesity

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Introduction

The childhood obesity epidemic is a pressing public health concern, with approximately 31.8% of children with either overweight or obesity [1]. Childhood obesity represents a considerable cost to society through increased health-care burden and associated spending [2]. It has many negative health consequences, including both medical (e.g., increased risk of diabetes, hypertension) and psychosocial comorbidities (e.g., bullying, weight-based teasing, and stigmatization that leads to a reduced quality of life) [3]. Given that 82% of children with obesity become adults with obesity [4], these health-care costs and physical and psychological comorbidities will persist into adulthood if the obesity is not treated effectively.

Fortunately, when obesity is treated at an early age, due to potential for height growth, relatively small weight losses can have a significant impact [5]. Children ages 8–9 years old with a BMI at or above the 97th percentile for age and sex need to lose only 1.8 (girls) to 2.1 (boys) kg over 1 year to achieve a healthy weight, which is in contrast to the 5.5 (boys) to 7.6 (girls) kg weight loss necessary for a 12–13-year-old to reach a healthy weight. Furthermore, maintaining weight and preventing weight gain improve cardiovascular risk factors in children but not adolescents [6], further emphasizing the importance of early intervention. Intervention early in childhood also allows healthy eating and physical activity habits to be established before children become entrenched in obesogenic patterns. Thus, early intervention is critical to promote a healthy weight and cardiovascular health in adulthood. In this chapter we will (1) present current treatment recommendations for childhood obesity and provide a brief review of the literature in support of childhood obesity treatment, (2) describe the components of family-based behavioral treatments for childhood obesity, and (3) explore future directions for FBT research.

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Current Treatment Recommendations for Childhood Obesity

The United States Preventive Services Task Force (USPSTF) recommends that clinicians start tracking BMI percentiles at 2 years of age to screen children aged 6 years and older for obesity and, if diagnosed with obesity, offer them or refer them to a comprehensive, behavioral intervention of ≥26 hours over a period of up to 12 months to improve weight status [7]. These recommendations

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are based upon the results of a rigorous, scientific review that demonstrated the efficacy of interventions of 26 or more hours of contact that include dietary, physical activity, and behavioral counseling components [8].

Underpinning these recommendations and guidelines is a significant body of research demonstrating the potency of intensive, multicomponent lifestyle interventions in inducing weight loss in children and in reducing medical and psychological comorbidities associated with obesity, as compared to no-treatment controls, education-only, or single-component conditions. The amount, or duration of treatment contact, has also been found to be a consistent predictor of long-term weight outcomes in children [9]. Furthermore, the inclusion of parents or caregivers in the treatment of childhood obesity improves weight loss outcomes in comparison with interventions that only target the child. In fact, interventions with a family-based component result in a 6% greater mean reduction in percent overweight compared to those without this component [10].

Family-Based Behavioral Weight Loss Treatment

Family-based behavioral weight loss treatment (FBT) is a multicomponent behavioral weight control intervention developed and refined by Leonard Epstein, Denise Wilfley, and colleagues [11, 12]. FBT targets both children and parents and is considered a first-line treatment for children with overweight and obesity [13]. FBT is effective at improving weight status in both the short and long term [12, 14] and has been shown to improve other obesity-related comorbidities such as cardiometabolic risk factors and improvements in psychological well-being [15, 16]. Although the majority of studies have been conducted with children in middle childhood [11], FBT has also been successfully adapted for use with both preschoolers [17] and adolescents [18].

Sustainable behavior change is associated with early treatment response; specifically, recent work highlights that children who lose weight by week 8 of a weight loss intervention have the greatest likelihood of sustained success [19]. It is important for providers to encourage weight loss early in the intervention to maximize the potential for long-term success.

To improve a child's weight status, FBT targets modification of energy balance behaviors (i.e., decreasing energy intake and increasing energy expenditure) through the use of behavior change strategies and the active involvement of a parent or caregiver. In FBT, the parent or caregiver, who often also has overweight or obesity, is charged with both changing his or her own energy balance behaviors and supporting the child in these endeavors. Furthermore, the parent or caregiver is encouraged to engineer the home environment so that it promotes these behaviors for the entire family. To facilitate long-term weight loss maintenance, treatment contact is extended to allow for the continued practice of behavioral change skills and the development of family and social networks in support of weight loss maintenance behaviors [12]. The components of FBT are described below.

Key Components of Family-Based Behavioral Weight Loss Treatment

Dietary Modification

There are three primary dietary modification goals in FBT: (1) decrease energy intake, (2) improve nutritional quality, and (3) shift food preferences toward more nutrient-dense choices. To facilitate a decrease in energy intake while improving nutritional quality, FBT uses a family-friendly method of categorizing foods according to traffic light colors shown in Table 32.1 [20]. In addition, families learn to gradually adopt healthier eating habits through decreasing portion sizes; reducing intake of energy-dense, low-nutrient-dense foods (red foods); increasing intake of lower-calorie, more nutritious foods (green foods); and regularly consuming three meals a day. To shift taste preferences from less nutritious to more nutritious food options, families are discouraged from swapping energy-dense foods with non- or low-calorie or fat

Table 32.1 Traffic light classification of foods/beverages and activities

	Examples of foods/beverages	Examples of activities
Green (go!) Highest in nutrients, lowest in calories Have 0–1 grams of fat per serving	• Fresh vegetables	• Bicycling • Weight training • Brisk walking
Yellow (slow down) Contain a good amount of nutrients and calories Have 2–5 grams of fat per serving	• Dried fruit • Low-fat milk and plain yogurt • Extra lean beef	• Non-strenuous household chores • Stretching • Yoga
Red (stop and think) Highest in energy density, lowest in nutrient density Have >5 g of fat per serving	• Fried foods • Full-fat dairy • Cakes and cookies	• Watching TV • Using computer • Playing video games

Note: Food/beverage and activity colors are subject to change based on updates in nutrition and physical activity guidance

substitutes (e.g., swapping out ice cream with frozen yogurt) because these latter foods are typically processed to taste the same as their high-calorie alternative.

Other dietary goals include reducing portion sizes of yellow and red foods, which have been shown to reduce intake [21], and reducing food intake away from home, which helps increase overall diet quality and has been shown to be associated with reductions in both child BMI and percent body fat during FBT [22]. FBT has also been shown to decrease food fussiness (i.e., the frequent rejection of both familiar and unfamiliar foods), which increases diet quality, and thus increases relative weight loss [23]. Following sufficient weight loss, children and parents are instructed to increase their caloric intake to a level appropriate for weight maintenance. Other dietary goals for weight maintenance are similar to the dietary goals during weight loss treatment. In fact, continued reduced red food intake predicts weight loss maintenance in both children and their parents [24], indicating that dietary factors that help influence weight loss during FBT are also important for sustained weight maintenance.

Energy Expenditure Modification

The primary energy expenditure goals in FBT are to increase moderate-to-vigorous physical activity and to decrease sedentary behaviors (e.g., non-school or work-related screen time). Shown in Table 32.1, the colors of the traffic light are also used to help families identify which activities to increase (green, moderate-to-vigorous physical activity) and to decrease (red, sedentary behaviors). Families are also encouraged to increase lifestyle activities such as using stairs instead of elevators or walking or riding a bike to school rather than taking a car. Eating is a complementary behavior to sedentary behavior for many people (i.e., they both increase or decrease in the same direction); thus, decreasing time spent engaging in sedentary behaviors not only creates opportunities for greater time spent being physically active but also decreases opportunities for eating [25]. Increasing physical activity not only facilitates weight change in the short term but is also crucial for weight maintenance following FBT; physical activity level is also predictive of sustained weight change 10 years after participation in FBT [14].

Behavior Change Strategies

Components of behavior therapy and behavior change are vital to family-based behavioral weight loss interventions; interventions that incorporate behavior change strategies are more successful at achieving weight loss and the prevention of excess weight gain than education alone [26]. Standard behavior change strategies include goal setting, self-monitoring, family-based reward systems, and stimulus control strategies.

Goal setting is the process of creating specific, measurable, and realistic targets (i.e., goals) for behavior change. Sample goals include consuming less than 15 servings of red foods per week, engaging in 60 min of activity per day, reducing time spent in sedentary behavior by 50%, or

achieving projected weight loss or weight maintenance. The frequency of goal setting is associated with sustained behavior change, and continued, frequent goal setting is an important component of weight maintenance [27]. All children and parents are given weight loss goals, but other goals are individualized to focus on specific behaviors most needing improvement. As the intervention progresses, goals change to accommodate participant progress.

Goals are accompanied by self-monitoring, which allows one to monitor progress and to determine which goals are being met. Those who participate in frequent self-monitoring are more aware of their energy balance behaviors and have more successful weight outcomes [28]. In FBT, both the parent and child are encouraged to participate in regular self-monitoring of weight-related behaviors by weighing at home and recording the weights, on a weekly basis, and parents are encouraged to help their child master this skill.

In FBT, reward systems are used to help reinforce behaviors. To develop a reward-based incentive system, parents and children work together to determine appropriate and appealing rewards. Children earn points for achieving their goals and can exchange their points for rewards. Ideal rewards are those that increase social support and reinforce the targeted behaviors (e.g., park visit with friends); it is strongly recommended that parents do not use food as a reward and instead try to increase the reinforcing value of physical activity or peer interactions.

Stimulus control is defined as using environmental enrichment to restructure the environment to increase the likelihood of engaging in desired behaviors and is a critical component of behavior change interventions for obesity [10]. Within a behavioral economic framework, people's choices to obtain commodities are influenced by the constraints placed on those commodities. As the constraints on the commodities change, so do choices. As such, stimulus control works by placing constraints on undesirable choices (i.e., red foods and activities) to help someone make the best choice thus making the healthy choice the easy choice. In FBT, it is necessary for parents to remove prompts for unhealthy foods and sedentary behaviors (e.g., removing chips and cookies from the home, keeping videogame equipment on a high shelf in the closet) and increase the prompts for healthy foods and physical activity (e.g., placing fruits in a basket on the kitchen counter, keeping sneakers by the door) in the home.

Family Involvement and Support

Given that greater degree of parental involvement leads to greater child weight loss and that targeting the parent and child together is more effective than targeting the child alone [29], family involvement is a critical component of FBT. In FBT, participating parents and caregivers are also taught to systematically use behavioral principles and positive parenting approaches to help shape and support their child's weight change efforts. Children's weight-related behaviors exist in the context of their home and family environment. The goal of including parents in their child's treatment is to capitalize on this parental influence to promote healthier behavior choices and maximize health outcomes for both parent and child. Parents are encouraged to create a healthy home environment and model healthy behaviors by purchasing healthier foods, planning healthier meals, developing a family-based reward system to reinforce healthy choices, participating in and encouraging increased physical activity, and using praise to reinforce healthy behaviors while simultaneously minimizing attention to unhealthy behaviors [30]. While parents are tasked with helping their child reduce their consumption of energy-dense foods, it is critical to do so without using overly restrictive feeding practices or using excessive control over when and how much food a child eats. Thus, as a part of the emphasis on parenting skills in FBT, parents are taught how to use limit setting to help create structure and routines around eating (and activity and sleep) behaviors to avoid conceptualizing certain foods

as forbidden. As such, FBT has been shown to decrease restrictive parent feeding practices, which is associated with reductions in child relative weight during treatment [31].

Parents participating in FBT are encouraged to actively work toward changing their own weight status in addition to supporting their child's efforts. By including parents as active treatment targets, they can model the healthier eating and physical activity behavior critical for weight loss success. According to social learning theory, modeling is a critical way for parents to socialize their children's behavior [32]. When children are learning a new behavior, observing a key socialization agent (i.e., a parent) engaged in this behavior reinforces it. In fact, children with overweight or obesity may be particularly sensitive to adult influence in the transmission of health behaviors [33], underscoring the importance of active parental involvement in FBT. As such, parent weight loss is a positive predictor of child weight loss in FBT [34].

Importance of Intervening Across Time and Contexts

While weight loss during family-based behavioral interventions has been clearly demonstrated, weight regain after lifestyle change is a common phenomenon among adults and is a challenge for children as well [35]. A child's weight-related dietary and physical activity behaviors are not just developed and maintained in the context of the family home but also the broader community within which children and their families live, work, and play. Thus, interventions that utilize a socioenvironmental approach are efficacious for weight loss because they extend the focus of behavior change beyond the individual to encompass the home, peer, and community contexts [36]. Bouton's work on context-specific extinction shows that when new weight control behaviors are acquired during the course of FBT, these new behaviors do not replace the old behaviors associated with weight gain but rather coexist with them [37]. Unfortunately, new behaviors are not very generalizable outside of the setting in which they were learned, and old behaviors are easily activated across the different contexts of our obesogenic world. Therefore, concerted efforts must be made 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. As a result of this contextual influence on the acquisition and practice of energy balance behaviors, FBT takes a socioenvironmental or multilevel approach to behavior change to improve maintenance of weight losses over time [38]. To address challenges to the maintenance of these new behaviors, FBT teaches families to plan for the different constraints or barriers to maintaining a healthy energy balance across these different levels of influence, e.g., learn how to identify and capitalize on facilitators for healthy living within peer networks and the community.

Peer Level

The overarching goal of the peer component in FBT is to increase the number of peers that are supportive of a healthier lifestyle rather than to change the attitudes and behaviors of everyone within the social network. Peer interactions are naturally reinforcing to children, and good peer relationships have a positive influence on overall quality of life. When peers are supportive of healthy energy balance behaviors, weight loss maintenance efforts are enhanced [39]. Conversely, a lack of peer support for physical activity and healthy eating contributes to weight gain [12]. In FBT, heightened social problems (e.g., loneliness, jealousy, susceptibility to teasing) predict greater weight regain after FBT [40], and children with higher levels of social problems evidence poorer weight loss maintenance [12]. These findings may be partially explained by the fact that youth who experience social problems or rejection may be more likely to use food as a coping mechanism [41] and less likely to engage in physical activity [42]. These findings highlight the need to

include training in pro-social techniques as part of treatment. Therefore, in FBT, families are encouraged to establish healthy peer networks and to disentangle socializing from unhealthy activities (e.g., encourage active playdates and birthday parties). In an effort to improve children's confidence in their ability to relate positively to peers, FBT also includes training in pro-social techniques for dealing with teasing and cognitive behavioral techniques to improve body image and self-esteem.

Community Level

At the community level, aspects of the built environment may affect an individual's choice to engage in energy balance behaviors. Environmental features of one's neighborhood are associated with rates of obesity and physical activity in children [43]. Important environmental factors include access to healthy foods (i.e., proximity of grocery stores), proximity to fast-food restaurants, relative cost of healthy and unhealthy foods, perceived safety and neighborhood walkability, and access to community recreation facilities and local parks [44]. For example, the built environment influences children's weight loss success in FBT; access to parks and open spaces predicted greater weight loss success at a 2-year follow-up, whereas reduced access to parks and greater access to supermarkets and convenience stores predicted poorer outcome [45]. In FBT, families engage in a number of activities to help increase their familiarity with how their built environment can both help and interfere with the establishment of healthy habits over the long term. It is also important that families learn 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). Problem-solving, goal setting, and stimulus control are techniques that families can use in FBT to better work around or with their built environments. In addition, families are encouraged to become advocates for increased access to healthy foods and activity choices in their schools, their work places, and other community settings. Families are encouraged to build a culture of health in their homes, in their relationships, and in their communities to provide support for the difficult challenge of healthy weight maintenance in our obesogenic world.

Future Directions in the Behavioral Treatment of Obesity

Although FBT is a very effective treatment for childhood obesity, transdisciplinary research is needed to facilitate our understanding of individual, modifiable factors that can affect treatment response and to contribute to the development of even more potent, personalized, and efficient forms of FBT.

Personalized and Adaptive Treatment Designs

Previous work has identified predictors of FBT treatment success [46]; predictors of better child relative weight loss at the end of FBT included lower child baseline zBMI and age, higher baseline parent-reported self-efficacy at reducing calories, and greater parent BMI reductions across treatment [46]. Additionally, it has been shown that a child's weight loss by the eighth week of FBT predicts long-term treatment success [19]. Given this knowledge, advances in educational and systems sciences [47, 48] could be brought to bear to assist in the development of mastery learning models [49] or adaptive treatment algorithms [50] that would allow the intensity or direction of FBT to adjust to the needs or characteristics of individual families, thus conserving resources and improving treatment outcomes.

The varying intervention needs of individuals may not be met by uniform intervention dose, content, or frequency; thus, adaptive interventions deploy intervention content depending on specific individual needs [51]. For example, adaptive interventions can change or enhance treatment dose for non-responders, reintroduce

treatment for those who experience relapse, and decrease or alter dose for those who are early responders. Sequential, multiple assignment, randomized trials (SMARTs) allow one to simultaneously test multiple adaptive interventions [52]. Specifically, a SMART framework has been proposed for weight loss research [53]. SMARTs use decision roles for deciding when to adapt treatment [51]. For example, weight loss at week 8 of FBT could be used to adapt treatment; those who have not achieved their weight loss goal by week 8 could have their treatment frequency increased or enhanced to identify whether this potentiates treatment response.

Another option to enhance outcomes may be to tailor treatment using a mastery approach, which calibrates content and dose to the needs of the individual and has been shown to enhance weight loss outcomes [49]. Like many protocol-based interventions, FBT is designed to ensure that all participants receive the same dose of treatment. This ensures standardization of the protocol but may not ideally allocate treatment resources to meet participant's needs. An alternative approach, based on education research [54], is to use mastery teaching that takes into account different learning rates and does not present new information until patients master previous information. To examine whether a mastery-based learning approach to FBT improved treatment outcomes relative to standardization of FBT, families were randomized to mastery or usual FBT. The same information was presented to both groups, but the mastery group had to demonstrate mastery of information and mastery of behavioral goals. Results showed significantly better changes for the mastery group at 1 year in comparison with usual FBT [49]. While the terms "personalized" or "precision" medicine have traditionally been associated with medical treatments [55, 56], the use of mastery-based FBT for treating childhood obesity may serve as a model to efficiently and effectively match treatment "dose" or intensity to patient progress across a wide variety of behavioral health problems.

Co-location Within Primary Care Settings

Currently, FBT is typically only offered in specialty clinics or as part of research studies. One way to increase the availability of FBT while preserving its potency would be to conduct FBT with individual families within primary care settings. Co-location is a model of coordinated health care that places a behavioral health-care provider within the same location as the primary care physician. Primary care offers an optimal setting for timely, continuous delivery of evidence-based obesity treatment by capitalizing on the established and ongoing relationship between primary care providers and families [57] and reducing fragmented care that can occur through multiple providers and offices. As such, integrated care has been associated with improved treatment outcomes and patient satisfaction with treatment for other diseases [58]. Preliminary research suggests that FBT interventionists can be successfully co-located within pediatric primary care practices and achieve both child and parent weight losses [59]. However, this study used an abbreviated form of FBT in terms of both treatment content and intensity. Although further research is needed to test the efficacy of full-dose FBT in primary care, the co-location of a behavioral health interventionist within primary care would allow pediatricians to more easily refer appropriate families to comprehensive behavioral treatment for weight loss while still retaining them within the familiar practice setting. Furthermore, co-location would also allow for easier coordination of care, which is important given the comorbidities associated with obesity.

Need for Centers for Excellence

While FBT has proven to be effective for treatment of childhood obesity, access to care remains a challenge. Barriers include time and cost of training providers in FBT delivery, lack of reimbursement for treatment, and limited specialty clinics to which providers can refer their patients [60]. As insurers and medical service delivery

systems shift toward a health-care market that incentivizes prevention and the effective management of complex, multilevel diseases such as obesity, interventions such as FBT will be in demand to meet this need. In anticipation of this shift in the health-care system, it will be necessary to determine how best to scale up FBT for broader implementation without losing its potency. To achieve the broadest reach, professionals must be equipped to deliver FBT across multiple settings. One proposed approach to address this gap is creating regional centers of excellence in which FBT experts train center leaders to deliver FBT and supervise delivery. Such centers would have the potential to bridge the gap between treatment experts and interventionists to ensure proper delivery of FBT on a large scale [60].

Influence of FBT on the Microbiome

The gut microbiome, the set of genes accompanying the microbiota in the human gut, provides important metabolic capabilities and offers a promising new avenue for childhood obesity research. Seminal work in mice demonstrated that the microbiome in mice with obesity is more efficient at harvesting energy than the microbiome of mice without obesity [61], and human twin data support that the microbiome impacts host energetics [62]. Diet plays a large role in shaping the gut microbiome. Promising research in mice has shown that the diet affects the microbiome; switching from a low-fat, high-fat diet to a "Western" diet (i.e., high fat, high sugar) changed the metabolic pathways and shifted the structure of the mouse microbiome relatively quickly [63], indicating that the microbiome is responsive to changes in the diet. A recent meta-analysis highlights the importance of a diet higher in fruits, vegetables, and fiber for microbial health, integrity, and richness [64]. Given that FBT targets changes in the diet so that the diet is higher in fiber-containing foods such as fruits and vegetables, it follows that FBT would favorably alter the microbiome. As such, if FBT alters the microbiome, this may bolster and reinforce the weight loss seen in treatment. However, the impact of behavioral treatment for obesity on the gut microbiome has yet to be tested and remains an important next step in FBT research.

FBT with Comorbid Psychiatric Conditions

Rates of low self-esteem, anxiety, and depression are higher among children with overweight and obesity than among the general population [3]. Moreover, children with psychiatric conditions may be particularly vulnerable to the development of obesity and comorbid conditions [65], and this risk is exacerbated by the use of antipsychotic medications, many of which have the side effect of weight gain [66]; see also Chap. 37 by Drs. Reeves and Sikich. Notably, children with psychiatric conditions are twice as likely to develop obesity-related conditions such as diabetes or hypertension than children in the general population [67]. In many of these children, the use of antipsychotics cannot be discontinued as they are necessary to stabilize the psychiatric disorder, and thus obesity treatment is necessary to mitigate weight gain. Behavioral weight loss treatments among this high-risk population have been promising in adults, with more participants in the treatment group achieving clinically significant weight loss (i.e., ≥5% initial body weight) than participants in the control group [68]. While this is a nascent area in childhood obesity treatment research, a pilot FBT trial with three children with overweight or obesity taking antipsychotic medications was promising, showing that FBT is feasible among this population [69]. Additional research with larger samples is needed to confirm this finding.

Conclusions

Evidence supports early intervention for obesity during childhood as robust, and sustainable changes can be made at this time. FBT for childhood obesity, a multicomponent treatment that intervenes across several socioenvironmental contexts, has demonstrated effectiveness in reducing weight and

improving physiological and psychosocial outcomes in children and their parents. Given its reach beyond the target child, FBT may be a very cost-effective way to treat obesity across multiple generations [70].

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Editor's Comments and Questions

1. Effective management of pediatric obesity requires considerable commitment on the part of the child, family, and health-care providers; successful counseling programs generally involve frequent and often prolonged (26 to >75 h) contact[a]. You note that streamlined approaches integrated with primary care could be effective in selected circumstances.
   (a) Do you believe in "preventive" counseling in young children at high risk (e.g., those with obese parents)?
   (b) What essential elements of counseling might be conveyed in an "abbreviated" form of family-based behavioral weight loss treatment (FBT) administered in a primary care clinic?
   (c) How might the use of short-term FBT be applied to adolescents, who in general are far more resistant than young children to weight loss interventions?
   (d) Do you consider group counseling an effective tool for prevention or treatment of childhood obesity?
2. Studies in adults suggest that monetary rewards may be useful in promoting weight loss in adults. Women, singles, and the unemployed appear most likely to respond. The amount of the award can spell success or failure. It is currently unclear if the effects of the incentives are sustained after termination of the program[b]. Financial incentives seem inappropriate for children but are commonly used by parents to support behavior change in their wayward teens.

   Do you believe that parents should pay, or provide gifts to, their overweight children or teenagers to reward them for losing weight?

References for Editor's Comments and Questions Section

(a) Whitlock EP, O'Connor EA, Williams SB, Beil TL, Lutz KW. Effectiveness of weight management interventions in children: a targeted systematic review for the USPSTF. Pediatrics. 2010; 125(2):e396–418.
(b) Paloyo AR, Reichert AR, Reuss-Borst M, Tauchmann H. Who responds to financial incentives for weight loss? Evidence from a randomized controlled trial. Soc Sci Med. 2015; 145:44–52.

Authors' Responses

1. Given that the most reliable risk factor for childhood obesity is having a parent with obesity,[a] and since two-thirds of adults have overweight or obesity,[b] the majority of children may be considered at high risk for obesity. Moreover, the risk for developing obesity increases as a child's BMI percentile increases (e.g., children with a BMI percentile >75th have a 40–50% change of developing overweight over time[c]); therefore, even children at BMI percentiles below the cutoffs for overweight or obesity are at risk. Thus health professionals should not wait until a child meets criteria for

overweight (i.e., BMI ≥ 85th percentile) but should consider having conversations regarding healthy behaviors with all children. These conversations should emphasize messages that target healthful eating, physical activity, and parental modeling of these behaviors (e.g., Let's Go! message of 5–2–1-0,[d] or 5+ servings of fruits/vegetables per day, ≤ 2 h screen time per day, 1 + _ h of physical activity per day, and 0 sugar-sweetened beverages per day).

2. An abbreviated form of FBT delivered in a primary care clinic still should contain the core components of FBT, which are modification of energy balance behaviors (i.e., increase in energy expenditure, decrease in energy intake), use of behavior change strategies (e.g., goal setting, self-monitoring), and active parental/caregiver involvement. For example, the effective abbreviated form of FBT that was delivered in primary care clinics among 2–5-year-old children and their parents included modification of energy balance behaviors, behavior change strategies, and active involvement of a parent.[e] Of note, treatment was abbreviated by reducing the number of sessions to 10 (4 weekly, 2 bimonthly, and 4 monthly), all delivered in a group-based format.
3. The central components of FBT (modification of energy balance behaviors, behavior change strategies, and parental involvement) are still critical for FBT with adolescent populations; however, unlike with younger children, the role of the parent is primarily to support their child and less to act as an agent of change.[f] For example, parents may attend separate sessions from their child in which they learn how they can best support their child and implement behavior change strategies such as stimulus control. If an incentive system is used as part of FBT, the lists of rewards will be different than those used with children to be consistent with the interests of adolescents (e.g., having car privileges).
4. Potential benefits of group-based childhood obesity treatments are that they may treat more people with fewer resources (e.g., staffing, time) and promote social support among individuals. However, a review of the effectiveness of group-based childhood obesity treatment found mixed results.[g] Mixed-format approaches (i.e., some individual sessions, some group sessions) were found to be preferable because they retain the benefits of group-based treatments while still achieving medium to large weight loss effects similar to those seen with the individual family format.
5. Incentive or point systems are a behavior change tool frequently used in FBT for childhood obesity. Points are used to incentivize the attainment of behavior goals (e.g., ≤ 15 servings of high energy-dense foods/week). Families are typically given a list of suggested rewards, with several examples listed for each of the following categories: (1) sporting events and activities, (2) time with mom or dad, (3) privileges, and (4) specific places to go. Parents and children work together to choose the rewards for which children can exchange their points, with the ideal rewards being ones that reinforce the targeted behaviors (e.g., physically active outings such as getting to go to the baseball batting cages).

References for Authors' Responses Section

(a) Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. New

England Journal of Medicine. 1997; 337(13):869–73.

(b) Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011–2012. Journal of the American Medical Association. 2014;311(8):806–14.

(c) Let's Go! http://www.letsgo.org/

(d) Nader PR, O'Brien M, Houts R, Bradley R, Belsky J, Crosnoe R, Friedman S, Mei Z, Susman EJ. Identifying risk for obesity in early childhood. Pediatrics. 2006;118(3):e594–601.

(e) Quattrin T, Roemmich JN, Paluch R, Yu J, Epstein LH, Ecker MA. Efficacy of family-based weight control program for preschool children in primary care. Pediatrics. 2012;130(4):660–6.

(f) Lloyd-Richardson EE, Jelalian E, Sato AF, Hart CN, Mehlenbeck R, Wing RR. Two-year follow-up of an adolescent behavioral weight control intervention. Pediatrics. 2012;130(2):e281–8.

(g) Hayes JF, Altman M, Coppock JH, Wilfley DE, Goldschmidt AB. Recent updates on the efficacy of group-based treatments for pediatric obesity. Current cardiovascular risk reports. 2015;9(4):1–0.

References

1. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. JAMA. 2014;311(8):806–14.
2. Finkelstein EA, Trogdon JG, Cohen JW, Dietz W. Annual medical spending attributable to obesity: payer-and service-specific estimates. Health Aff (Millwood). 2009;28(5):w822–w31.
3. Dietz WH. Health consequences of obesity in youth: childhood predictors of adult disease. Pediatrics. 1998;101(Suppl 2):518–25.
4. Juonala M, Magnussen CG, Berenson GS, Venn A, Burns TL, Sabin MA, et al. Childhood adiposity, adult adiposity, and cardiovascular risk factors. N Engl J Med. 2011;365(20):1876–85.
5. Goldschmidt AB, Wilfley DE, Paluch RA, Roemmich JN, Epstein LH. Indicated prevention of adult obesity: how much weight change is necessary for normalization of weight status in children? JAMA Pediatr. 2013;167(1):21–6.
6. Reinehr T. Lifestyle intervention in childhood obesity: changes and challenges. Nat Rev Endocrinol. 2013;9(10):607–14.
7. US Preventive Services Task Force, Grossman DC, Bibbins-Domingo K, et al. Screening for obesity in children and adolescents: US Preventive Services Task Force recommendation statement. JAMA. 2017;317(23):2417–26.
8. O'Connor EA, Evans CV, Burda BU, Walsh ES, Eder M, Lozano P. Screening for obesity and intervention for weight management in children and adolescents: Evidence report and systematic review for the US Preventive Services Task Force. JAMA. 2017;317(23):2427–44.
9. Janicke DM, Steele RG, Gayes LA, Lim CS, Clifford LM, Schneider EM, et al. Systematic review and meta-analysis of comprehensive behavioral family lifestyle interventions addressing pediatric obesity. J Pediatr Psychol. 2014;39(8):809–25.
10. Young KM, Northern JJ, Lister KM, Drummond JA, O'Brien WH. A meta-analysis of family-behavioral weight-loss treatments for children. Clin Psychol Rev. 2007;27(2):240–9.
11. Epstein LH, Paluch RA, Roemmich JN, Beecher MD. Family-based obesity treatment, then and now: twenty-five years of pediatric obesity treatment. Health Psychol. 2007;26(4):381–91.
12. 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(14):1661–73.
13. Wilfley DE, Kass AE, Kolko RP. Counseling and behavior change in pediatric obesity. Pediatr Clin North Am. 2011;58(6):1403–24.
14. Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year outcomes of behavioral family-based treatment for childhood obesity. Health Psychol. 1994;13(5):373–83.
15. Gunnarsdottir T, Einarsson SM, Njardvik U, Olafsdottir AS, Gunnarsdottir AB, Helgason T, et al. Family-based behavioral treatment for obese children-results and two year follow up. Laeknabladid. 2014;100(3):139–45.
16. Gunnarsdottir T, Njardvik U, Olafsdottir AS, Craighead L, Bjarnason R. Childhood obesity and co-morbid problems: effects of Epstein's family-based behavioural treatment in an Icelandic sample. J Eval Clin Pract. 2012;18(2):465–72.
17. Quattrin T, Roemmich JN, Paluch R, Yu J, Epstein LH, Ecker MA. Efficacy of family-based weight control program for preschool children in primary care. Pediatrics. 2012;130(4):660–6.
18. Jelalian E, Lloyd-Richardson EE, Mehlenbeck RS, Hart CN, Flynn-O'Brien K, Kaplan J, et al. Behavioral weight control treatment with supervised exercise or peer-enhanced adventure for overweight adolescents. J Pediatr. 2010;157(6):923–8.e1.

19. Goldschmidt AB, Stein RI, Saelens BE, Theim KR, Epstein LH, Wilfley DE. Importance of early weight change in a pediatric weight management trial. Pediatrics. 2011;128(1):e33–e9.
20. Epstein LH, Squires S. The stoplight diet for children. New York: Little Brown; 1988.
21. Fisher JO, Rolls BJ, Birch LL. Children's bite size and intake of an entree are greater with large portions than with age-appropriate or self-selected portions. Am J Clin Nutr. 2003;77(5):1164–70.
22. Altman M, Holland JC, Lundeen D, Kolko RP, Stein RI, Saelens BE, et al. Reduction in food away from home is associated with improved child relative weight and body composition outcomes and this relation is mediated by changes in diet quality. J Acad Nutr Diet. 2015;115(9):1400–7.
23. Hayes JF, Altman M, Kolko RP, Balantekin KN, Holland JC, Stein RI, et al. Decreasing food fussiness in children with obesity leads to greater weight loss in family-based treatment. Obesity. 2016;24(10):2158–63.
24. Best JR, Goldschmidt AB, Mockus-Valenzuela DS, Stein RI, Epstein LH, Wilfley DE. Shared weight and dietary changes in parent–child dyads following family-based obesity treatment. Health Psychol. 2015;35(1):92–5.
25. Epstein LH, Paluch RA, Gordy CC, Dorn J. Decreasing sedentary behaviors in treating pediatric obesity. Arch Pediatr Adolesc Med. 2000;154(3):220–6.
26. Golan M, Fainaru M, Weizman A. Role of behaviour modification in the treatment of childhood obesity with the parents as the exclusive agents of change. Int J Obes Relat Metab Disord. 1998;22(12):1217–24.
27. Nothwehr F, Yang J. Goal setting frequency and the use of behavioral strategies related to diet and physical activity. Health Educ Res. 2007;22(4):532–8.
28. Saelens BE, Sallis JF, Wilfley DE, Patrick K, Cella JA, Buchta R. Behavioral weight control for overweight adolescents initiated in primary care. Obes Res. 2002;10(1):22–32.
29. Epstein LH, Wing RR, Koeske R, Andrasik F, Ossip DJ. Child and parent weight loss in family-based behavior modification programs. J Consult Clin Psychol. 1981;49(5):674–85.
30. Epstein LH, Paluch RA, Kilanowski CK, Raynor HA. The effect of reinforcement or stimulus control to reduce sedentary behavior in the treatment of pediatric obesity. Health Psychol. 2004;23(4):371–80.
31. Holland JC, Kolko RP, Stein RI, Welch RR, Perri MG, Schechtman KB, et al. Modifications in parent feeding practices and child diet during family-based behavioral treatment improve child zBMI. Obesity. 2014;22(5):E119–E26.
32. Bandura A. Social learning theory. New York: General Learning Press; 1977.
33. Frerichs LM, Araz OM, Huang TTK. Modeling social transmission dynamics of unhealthy behaviors for evaluating prevention and treatment interventions on childhood obesity. PLoS One. 2013;8(12):e82887.
34. Wrotniak BH, Epstein LH, Paluch RA, Roemmich JN. Parent weight change as a predictor of child weight change in family-based behavioral obesity treatment. Arch Pediatr Adolesc Med. 2004;158(4):342–7.
35. Epstein LH, Myers MD, Raynor HA, Saelens BE. Treatment of pediatric obesity. Pediatrics. 1998;101(Suppl 2):554–70.
36. Huang TT, Drewnowski A, Kumanyika SK, Glass TA. A systems-oriented multilevel framework for addressing obesity in the 21st century. Prev Chronic Dis. 2009;6(3):A82.
37. Bouton ME. Context, ambiguity, and unlearning: sources of relapse after behavioral extinction. Biol Psychiatry. 2002;52(10):976–86.
38. Wilfley DE, 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(S1):S91–S8.
39. Salvy S-J, Bowker JW, Roemmich JN, Romero N, Kieffer E, Paluch R, et al. Peer influence on children's physical activity: an experience sampling study. J Pediatr Psychol. 2008;33(1):39–49.
40. Epstein LH, Klein KR, Wisniewski L. Child and parent factors that influence psychological problems in obese children. Int J Eat Disord. 1994;15(2):151–8.
41. DeWall CN, Bushman BJ. Social acceptance and rejection the sweet and the bitter. Curr Dir Psychol Sci. 2011;20(4):256–60.
42. Jefferson A. Breaking down barriers–examining health promoting behaviour in the family. Kellogg's Family Health Study 2005. Nutr Bull. 2006;31(1):60–4.
43. Roemmich JN, Epstein LH, Raja S, Yin L, Robinson J, Winiewicz D. Association of access to parks and recreational facilities with the physical activity of young children. Prev Med. 2006;43(6):437–41.
44. Sallis JF, Glanz K. The role of built environments in physical activity, eating, and obesity in childhood. Future Child. 2006;16(1):89–108.
45. Epstein LH, Raja S, Daniel TO, Paluch RA, Wilfley DE, Saelens BE, et al. The built environment moderates effects of family-based childhood obesity treatment over 2 years. Ann Behav Med. 2012;44(2):248–58.
46. Goldschmidt AB, Best JR, Stein RI, Saelens BE, Epstein LH, Wilfley DE. Predictors of child weight loss and maintenance among family-based treatment completers. J Consult Clin Psychol. 2014;82(6):1140–50.
47. Epstein LH, Wrotniak BH. Future directions for pediatric obesity treatment. Obesity. 2010;18(S1):S8–S12.
48. Savage JS, Downs DS, Dong Y, Rivera DE. Control systems engineering for optimizing a prenatal weight gain intervention to regulate infant birth weight. Am J Public Health. 2014;104(7):1247–54.
49. Epstein LH, McKenzie SJ, Valoski A, Klein KR, Wing RR. Effects of mastery criteria and contingent reinforcement for family-based child weight control. Addict Behav. 1994;19(2):135–45.
50. Lavori PW, Dawson R. Adaptive treatment strategies in chronic disease. Annu Rev Med. 2008;59:443–53.

51. Collins LM, Murphy SA, Bierman KL. A conceptual framework for adaptive preventive interventions. Prev Sci. 2004;5(3):185–96.
52. Collins LM, Murphy SA, Strecher V. The multiphase optimization strategy (MOST) and the sequential multiple assignment randomized trial (SMART): new methods for more potent eHealth interventions. Am J Prev Med. 2007;32(5):S112–S8.
53. Almirall D, Nahum-Shani I, Sherwood NE, Murphy SA. Introduction to SMART designs for the development of adaptive interventions: with application to weight loss research. Transl Behav Med. 2014;4(3):260–74.
54. Bloom BS. Human characteristics and school learning. New York: McGraw-Hill; 1976.
55. Yang N, Ginsburg G, Simmons L. Personalized medicine in women's obesity prevention and treatment: implications for research, policy and practice. Obes Rev. 2013;14(2):145–61.
56. Heckman-Stoddard BM, Smith JJ. Precision medicine clinical trials: defining new treatment strategies. Semin Oncol Nurs. 2014;30(2):109–16.
57. Harwood MD, O'brien KA, Carter CG, Eyberg SM. Mental health services for preschool children in primary care: a survey of maternal attitudes and beliefs. J Pediatr Psychol. 2009;34(7):760–8.
58. Druss BG, Rohrbaugh RM, Levinson CM, Rosenheck RA. Integrated medical care for patients with serious psychiatric illness: a randomized trial. Arch Gen Psychiatry. 2001;58(9):861–8.
59. Quattrin T, Roemmich JN, Paluch R, Yu J, Epstein LH, Ecker MA. Treatment outcomes of overweight children and parents in the medical home. Pediatrics. 2014;134(2):290–7.
60. Wilfley DE, Staiano AE, Altman M, Lindros J, Lima A, Hassink SG, et al. Improving access and systems of care for evidence-based childhood obesity treatment: conference key findings and next steps. Obesity. 2017;25(1):16–29.
61. Turnbaugh PJ, Ley RE, Mahowald MA, Magrini V, Mardis ER, Gordon JI. An obesity-associated gut microbiome with increased capacity for energy harvest. Nature. 2006;444(7122):1027–131.
62. Turnbaugh PJ, Hamady M, Yatsunenko T, Cantarel BL, Duncan A, Ley RE, et al. A core gut microbiome in obese and lean twins. Nature. 2009;457(7228):480–4.
63. Turnbaugh PJ, Ridaura VK, Faith JJ, Rey FE, Knight R, Gordon JI. The effect of diet on the human gut microbiome: a metagenomic analysis in humanized gnotobiotic mice. Sci Transl Med. 2009;1(6):6ra14.
64. Albenberg LG, Wu GD. Diet and the intestinal microbiome: associations, functions, and implications for health and disease. Gastroenterology. 2014;146(6):1564–72.
65. Janicke DM, Harman JS, Kelleher KJ, Zhang J. Psychiatric diagnosis in children and adolescents with obesity-related health conditions. J Dev Behav Pediatr. 2008;29(4):276–84.
66. Newcomer JW. Antipsychotic medications: metabolic and cardiovascular risk. J Clin Psychiatry. 2007;68(suppl 4):8–13.
67. Correll CU, Manu P, Olshanskiy V, Napolitano B, Kane JM, Malhotra AK. Cardiometabolic risk of second-generation antipsychotic medications during first-time use in children and adolescents. JAMA. 2009;302(16):1765–73.
68. Daumit GL, Dickerson FB, Wang N-Y, Dalcin A, Jerome GJ, Anderson CA, et al. A behavioral weight-loss intervention in persons with serious mental illness. N Engl J Med. 2013;368(17):1594–602.
69. Nicol GE, Kolko RP, Mills M, Gunnarsdottir T, Yingling MD, Schweiger JA, et al. Behavioral weight loss treatment for youth treated with antipsychotic medications. Scand J Child Adolesc Psychiatr Psychol. 2016;4(2):96–104.
70. Epstein LH, Paluch RA, Wrotniak BH, Daniel TO, Kilanowski C, Wilfley D, et al. Cost-effectiveness of family-based group treatment for child and parental obesity. Child Obes. 2014;10(2):114–21.