Abstract—This scientific statement addresses parents and adult caregivers (PACs) as “agents of change” for obese children, evaluating the strength of evidence that particular parenting strategies can leverage behavior change and reduce positive energy balance in obese youth. The statement has 3 specific aims. The first is to review core behavior change strategies for PACs as used in family-based treatment programs and to provide a resource list. The second is to evaluate the strength of evidence that greater parental “involvement” in treatment is associated with better reductions in child overweight. The third is to identify research gaps and new opportunities for the field. This review yielded limited and inconsistent evidence from randomized controlled clinical trials that greater PAC involvement necessarily is associated with better child outcomes. For example, only 17% of the intervention studies reported differential improvements in child overweight as a function of parental involvement in treatment. On the other hand, greater parental adherence with core behavior change strategies predicted better child weight outcomes after 2 and 5 years in some studies. Thus, the literature lacks conclusive evidence that one particular parenting strategy or approach causally is superior to others in which children have a greater focus in treatment. A number of research gaps were identified, including the assessment of refined parenting phenotypes, cultural tailoring of interventions, examination of family relationships, and incorporation of new technologies. A conceptual model is proposed to stimulate research identifying the determinants of PAC feeding and physical activity parenting practices; the results of which may inform new treatments. The statement addresses the need for innovative research to advance the scope and potency of PAC treatments for childhood obesity.

Key Words: AHA Scientific Statements ■ diet ■ lifestyle ■ nutrition ■ obesity ■ pediatrics ■ prevention
This statement addresses parents and adult caregivers (PACs) as “agents of change” for treating obese children in the family; that is, to what extent, and in what specific ways, can PACs help obese youth to reduce excess body fat? How can PACs promote sustainable behavior changes to help obese youth restore energy balance? These are critical questions given the global “epidemic” of childhood obesity,1–4 coupled with the fact that most obese youth become obese adults.5 Children are dependent on parents to structure their home environment and daily lifestyles, which includes diet and physical activity; these behaviors, in turn, influence long-term energy balance and weight status. Obesity runs in families, with parental weight status being one of the strongest and most robust predictors of a child’s obesity risk.5–7 This familial transmission reflects both genetic and (home) environmental factors,8 and therefore, PACs are in a unique role to leverage behavior change in obese children.

There also is a need for healthcare providers to acquire better knowledge of core behavioral change strategies for PACs of obese youth. A national survey of 202 pediatricians, 293 pediatric nurse practitioners, and 444 registered dietitians examined self-perceived skills and competencies for managing pediatric obesity.9 A sizable proportion of respondents perceived themselves as having “low proficiency” in behavioral management strategies (39% of pediatricians), parenting management techniques (31% of registered dietitians and 25% of pediatricians), and assessment of family conduct (46% of registered dietitians and 30% of pediatricians). Another report of 87 primary care pediatricians and nurse practitioners found that only 26% knew the definition of childhood obesity and 9% knew its prevalence, whereas only 39% and 44% knew the American Academy of Pediatrics’ guidelines for exercise and juice consumption, respectively.10 More than 35% of the respondents never discussed fast food, television, or candy and 55% never discussed exercise at well child visits in the first year of life: The management of obesity in primary care settings is an emerging area of healthcare research,11–13 and greater information dissemination on core behavior change strategies by health professionals is needed. Indeed, the importance of this need is underscored by a recent report of the US Preventive Services Task Force (http://www.uspreventiveservicestaskforce.org).14 The report recommended that primary care clinicians screen children ≥6 years of age for obesity and offer or refer for intensive counseling and behavioral interventions those who are obese.

The present statement has 3 aims. The first is to review “core” behavior change strategies that have been shown to promote short-term weight loss and, to some extent, longer-term maintenance in obese youth. These strategies have been used extensively in so-called family-based behavioral modification treatment programs that enlist PAC involvement.15 This section reviews pragmatic questions such as, “How can I begin to make changes today with my child or pediatric patient?” and “What concrete steps can I take?” In this statement, we focus on specific strategies for PACs rather than macroenvironmental or policy changes (eg, soft drink taxes), which were addressed in a prior statement.16

The second aim is to review the evidence that greater PAC “involvement” in pediatric obesity treatment leads to better outcomes. Two strategies are undertaken to answer this question. First, 12 randomized clinical trials are reviewed that varied the degree or nature of parental involvement in family-based treatment and examined effects on changes in child overweight status. These studies varied parental involvement by virtue of either having PACs be treated together with (versus separately from) their child or having the PAC (versus the youth) be the primary target of intervention. Second, we examine whether greater PAC adherence to behavioral strategies is associated with greater improvements in child overweight in family-based treatment studies. Prior reviews have examined whether greater parental involvement in treatment yields better improvements in child weight status. Conclusions have been mixed, with some reviews17–19 but not others20,21 finding that greater involvement leads to better child weight outcomes. These differences could reflect a number of factors, including qualitative versus quantitative data synthesis, different inclusion/exclusion criteria, and the specific studies that were retrieved. The present statement strives to reconcile these differences while identifying critical areas for future research.

The final aim of this statement is to identify critical research gaps in this field. Greater research in these domains should advance insights into the ways in which PACs can be more effective agents of change for modifying behaviors in their obese children.

What Are Core Behavior Change Strategies for Obese Youth?

Core behavior change strategies to treat childhood obesity include specification of target behaviors, self-monitoring, goal setting, stimulus control, positive parenting strategies, and promotion of self-efficacy and self-management skills.22–23 These core strategies, which are taught in the context of basic information on energy balance and daily calorie intake recommendations for youth,24,25 are grounded in strong theoretical models. These models include social cognitive,26,27 operant conditioning,28 behavioral economic,29,30 and self-determination31 theories. These theories can be linked to specific behavior change strategies, as illustrated in Table 1. Against this background, the “nuts and bolts” of behavior change can be implemented within families. A basic framework of these strategies is illustrated in Figure 1 and summarized in this section.

Empirical support for the particular core behavior change strategies comes from prior reviews of family-based treatments for childhood obesity. These strategies provided the foundation for most of these interventions. Quantitative reviews have supported the efficacy of family-based treatments compared with no-treatment controls,19,20,32,33 as well as in comparison to education-only controls.32 The 10-year follow-up studies by Epstein et al34 further support the long-term efficacy of family-based behavioral weight control. A comprehensive literature review by the US Preventive...
Table 1. Theoretical Models Underlying Core Behavior Change Strategies for Pediatric Obesity Treatment and Hypothetical Implications for Parent and Adult Caregivers

<table>
<thead>
<tr>
<th>Behavioral Theory</th>
<th>Hypothetical Implications for PACs</th>
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</thead>
<tbody>
<tr>
<td>Social cognitive theory</td>
<td></td>
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<tr>
<td>This theory focuses on the interaction of behavior with environmental and personal factors. Strategies for changing behavior emphasize knowledge, motivation, outcome expectancy (ie, what does the parent expect to happen?), and self-efficacy (ie, confidence that change or goal attainment is achievable). See Bandura.26,27</td>
<td>● Asking PACs to describe what they expect to happen in treatment and to rate confidence in achieving specific behavioral goals can provide valuable insights for treating pediatric obesity.</td>
</tr>
<tr>
<td>Operant conditioning</td>
<td></td>
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<tr>
<td>This theory focuses on modifying behavior though positive or negative reinforcement strategies, based largely on Skinner’s applied research with humans. The likelihood that a specific behavior will occur (or increase/decrease) depends on an individual’s reinforcement history (or changes in reinforcement schedules) when the behavior is exhibited. See Skinner.28</td>
<td>● Some PACs inadvertently may contribute to excessive weight gain by using energy-dense foods as a reward (eg, rewarding children with cakes or candies for school accomplishments). Teaching PACs to provide hugs, verbal praise, and other nonfood reinforcements is often part of family-based treatment for childhood obesity.</td>
</tr>
<tr>
<td>Behavioral economics</td>
<td></td>
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<tr>
<td>This theory integrates behavioral and social principles in the examination of how people make choices, including decisions about food and physical activity. Behavioral economics provides a framework for assessing health choices that seemingly violate “rational” economic decision making. Factors that are considered in this model include convenience, cost, and perceived value with regard to food and other commodities. The theory considers variables such as time and money, taste (hedonic appeal), context (distraction, social and emotional variables), and cognition and perception. See Epstein.29,30</td>
<td>● Understanding behavioral economics principles may help PACs in controlling impulse food shopping habits (eg, making unintended purchases of candy that is displayed at the cash register).</td>
</tr>
<tr>
<td>Self-determination</td>
<td></td>
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<tr>
<td>This theory provides a broad framework for understanding human motivation and defining intrinsic and extrinsic sources of motivation. This can be examined in relation to cognitive and social development and individual differences. Conditions that support the experience of autonomy, competence, and relatedness are thought to foster motivation. Developing skills to regulate behavior intrinsically (also called self-regulation) fosters autonomy. See Deci and Ryan.31</td>
<td>● PAC support of the use of age-appropriate behavioral strategies by children (eg, goals that are self-selected by youths) can foster child motivation through increased autonomy and competency.</td>
</tr>
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</table>

PACs indicates parents and adult caregivers.

Services Task Force assigned an evidence category of grade B in support of screening for pediatric obesity, recommending that clinicians screen children ≥6 years of age for obesity and offer them or refer them to intensive counseling or behavioral interventions.14 Moreover, these strategies were incorporated for the family-based lifestyle intervention in the Treatment Options for type 2 Diabetes in Adolescents and Youth (TODAY) study, a 15-center clinical trial that compared treatments for 10- to 17-year-olds with type 2 diabetes mellitus.35 The TODAY Lifestyle Program used the core behavior change strategies to help youth attempt a weight loss of 7% to 10% of initial body weight, as well as ongoing lifestyle maintenance and contact for up to 28 months. Hence, these strategies can be effective. At the same time, the potency of existing treatments using these strategies needs to be improved, and they need to be made more generalizable to a broader range of families.35

Specifying Target Behaviors

Identification of specific behaviors to be changed by obese youth, as well as the PAC, is an initial step for behavior change. Rather than prescribing gross or nonspecific changes

![Figure 1. Core strategies for changing behavior in family-based interventions for pediatric obesity that include parent and adult caregivers.](image-url)
(eg, “Eating healthier” or “Be more active”), identification of specific behaviors is essential. A number of health behaviors have been targeted in family-based intervention studies of pediatric obesity, such as daily intake of particular foods (eg, fruits and vegetables versus energy-dense “red light” foods), time spent in different types of physical activity (eg, lifestyle versus aerobics versus calisthetics), and sedentary time. Recent work has also shown that modification of home food environments, such as the visibility and convenience of access to certain foods, has been effective in reducing overeating in laboratory studies and has been correlated with weight loss in short-term field studies. Daily caloric intake also is commonly monitored in treatment. In the broader context of discussions on energy balance and daily energy requirements, means writing down or keeping track of a target behavior (eg, food consumption, physical activity) every time it occurs. Self-monitoring serves to raise awareness of the frequency with which the target behavior typically occurs before “intervention” begins, a critical skill because many adults and children lack such awareness.

There are a variety of diaries, forms, and logs that can be used for self-monitoring. Indeed, an emerging area of interest involves Internet-based tracking and other technological innovations to enhance self-monitoring (Research Opportunities below). Recording one’s behavior or compliance, even if only in the form of a checkmark on a calendar, forces accountability and can provide a small form of positive reinforcement. The mere action of tracking one’s behavior can promote behavior change and therefore can be an intervention in its own right. The frequency with which individuals self-monitor is a reliable predictor of weight loss in obese children and adults and is associated with long-term weight loss maintenance in adults.

**Goal Setting**

Setting daily or weekly goals for target behaviors is a core behavior change strategy. Smaller goals may be more attainable and sustainable, although research in this area is limited. Moreover, smaller goals have not always led to greater reductions in child overweight than larger goals. In studies of adult weight loss, it was found that people who were asked to make 1 consistent change reported losing more weight over a 3-month period than did those who were asked to make 5 changes. This was attributed to the higher adherence level of those who were asked to consistently make 1 small change in contrast to many changes. Reappraisal and adjustment of goals is an ongoing process that requires PAC attention. An important consideration is establishing achievable goals, because many obese adults reportedly have had unrealistic weight loss goals. This may lead to frustration and hinder behavior change, although research with obese children on this topic is virtually nonexistent.

Goals also need to be developmentally appropriate and guided by basic learning research. For example, laboratory studies with children of preschool age indicate that it takes multiple taste exposures, ~14 at a minimum, before an increase in acceptance of certain foods may be seen. In addition to multiple exposures, having the opportunity to have a choice of foods, even if it is seemingly meaningless, appears to influence children toward healthier eating. In a lunchtime study, one group of 186 middle school children was given the choice between having carrots or brownish celery, and all children selected carrots. A second group was given no choice but simply given carrots. Those children who believed they had a choice ate a higher percentage of their carrots and rated the taste as better than those who were not given the seemingly artificial choice. Parents who expect taste preferences to shift with a small number of exposures to a food or when giving a child no choice among other healthy options may be setting unrealistic goals that can lead to frustration.

There is growing interest in motivational interviewing strategies that can be used to help families establish more realistic and achievable goals for target behaviors. This occurs through a guided conversation, with the use of established motivational interviewing principles, that makes use of open-ended and eliciting questions rather than rigid prescriptions for behavior change. Motivational interviewing strategies address families’ readiness for and ambivalence toward behavior change, striving to elicit greater internal motivation to reach goals that are negotiated with families. Barlow et al described a 5-step, “15-Minute Obesity Prevention Protocol” to be used with parents that is based on motivational interviewing principles and includes strategies for establishing target behaviors and goal setting. As noted below, the role of motivational interviewing in childhood obesity provides an opportunity for greater research.

Goal setting around daily caloric requirements for children is common in treatment. In practice, translating daily energy requirements into practical systems that families can use to guide food choices can be challenging and has been approached most successfully to date by use of the “stop light” approach. This method classifies foods into “red light” (eat limited amounts), “yellow light” (eat in moderation), and “green light” (eat generously) categories based on nutrient density, including fat/sugar content. Goals are set based on the initial frequency of red, yellow, and/or green light food intake, and families then monitor progress around these goals. It is unclear that focusing on caloric goals per se is necessary for the core behavior change strategies to work, because behavioral treatments consistently achieve better weight loss outcomes for children than education-only controls. Nonetheless, this information has been part of most behavioral intervention packages tested to date.

**Stimulus Control**

PACs typically are encouraged to structure the home environment to make healthier (ie, less energy-dense) foods more available while reducing access to less healthy (ie, more
energy-dense) foods, as well as to increase physical activity. This is known as “stimulus control.”63 Stimulus control to reduce target behaviors can include restricting locations in the home for eating (eg, only in the kitchen or dining room), not permitting televisions in the children’s bedrooms,64 using smaller dinnerware,65,66 relocating snacks to be less visible,67 and limiting weekly visits to fast food restaurants.68 These strategies can be effective for weight control for children and youth. For example, Robinson69 demonstrated that altering the home environment to limit television access was associated with prevention of child weight gain in a school-based study70 and with body mass index (BMI) z-score reduction in an obesity-treatment investigation.39 Stimulus control to increase desirable behaviors can include greater access to games and activities that promote play and movement. Interactive media games can also incentivize physical activity.71,72

Positive Reinforcement Strategies
Use of positive reinforcement techniques by PACs is a core behavior change strategy.22 Praise and child recognition can be among the strongest strategies, as well as time spent together, nonmonetary prizes, and nonfood rewards.15 This is important, because many PACs focus on their children’s shortcomings rather than training themselves to “catch their child being good” or experiencing success. Parents can furthermore reinforce these principles through their own consistent behavior. The American Academy of Pediatrics’ Committee on Psychosocial Aspects of Child and Family Health published recommendations on strategies for effective child discipline practices,73 which are consistent with the positive reinforcement strategies used in family-based childhood obesity treatment. Table 2 summarizes several of their suggestions.74–79.

Positive reinforcement is generally incompatible with commonly used but largely ineffective discipline practices such as yelling, punishment, or reprimands. In a survey of 2134 parents of 2- to 11-year-old youths, a large number of respondents reported using removal of privileges (41.5%), time-out (45.2%), yelling (13.0%), and spanking (8.5%) in the past month.80 Parents were more likely to use spanking or yelling if they experienced those discipline practices themselves as children. In a national phone survey of 2068 parents of 4- to 36-month-old youths, frequent child discipline practices included spanking (26%), taking away toys and treats (65%), yelling (67%), and using time-out (70%).81 Parent frustration predicted greater use of all discipline practices, including a greater inclination to use aversive ones. To the best of our knowledge, there are no national data on the prevalence of positive parenting practices among PACs and predictors thereof.

Self-Efficacy and Self-Management Skills
The development of self-efficacy and self-management skills appears to be important for sustaining behavior change by PACs.27,82 These skills foster self-confidence in one’s ability to make changes within the family.83,84 Because childhood obesity has been linked to poorer self-regulatory eating65,86 and self-control skills,87–89 PACs who foster better self-

<table>
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<th>Relationship conditions</th>
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<td>● Maintaining a positive emotional tone in the home through play and parental warmth and affection for the child;42</td>
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<td>● Providing attention to the child to increase positive behavior (conversely ignoring, removing, or withholding parent attention to decrease the frequency or intensity of undesirable behaviors);71 For older children, attention includes being aware of and interested in their school and other activities;</td>
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<td>● Providing consistency in the form of regular times and patterns for daily activities and interactions to reduce resistance, convey respect for the child, and make negative experiences less stressful20;</td>
</tr>
<tr>
<td>● Responding consistently to similar behavioral situations to promote more harmonious parent-child relationships and more positive child outcomes27; and</td>
</tr>
<tr>
<td>● Being flexible, particularly with older children and adolescents, through listening and negotiation to reduce fewer episodes of child noncompliance with parental expectations.27 Involving the child in decision-making has been associated with long-term enhancement in moral judgment.78</td>
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</tbody>
</table>

Parenting strategies
● Providing regular positive attention, sometimes called special time (opportunities to communicate positively are important for children of all ages); |
● Listening carefully to children and helping them use words to express their feelings; |
● Providing children with opportunities to make choices whenever appropriate options exist and helping them learn to evaluate the potential consequences of their choice; |
● Reinforcing emerging desirable behaviors with frequent praise and ignoring trivial misdeeds; and |
● Modeling orderly, predictable behavior, respectful communication, and collaborative conflict-resolution strategies.79

<table>
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<tr>
<th>Table 2. Conditions in Parent-Child Relationships That Help to Increase the Likelihood of Positive Child Behaviors and Parenting Strategies to Help Children Learn New Behaviors</th>
</tr>
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</table>

Summary
The core behavior change strategies described in this section have been studied extensively in family-based treatment studies for >3 decades. PAC involvement has been a critical component of these studies, because poor PAC involvement can impede treatment progress. Reviews conclude that family-based approaches achieve better reductions in child overweight than wait-list controls or educational interventions.32,91 On the other hand, other reviews have challenged the efficacy of existing treatments of pediatric obesity.92 Even favorable reviews15(p546) have noted: “Substantial progress has been made in the development of treatments for childhood and adolescent obesity. However, most pediatric obesity interventions are marked by small changes in relative weight or adiposity and substantial relapse.” It might be the case that treatments that enlist the greatest PAC involvement and adherence are more efficacious for child weight control.
Table 3. Hypothetical Implementation of Core Behavior Change Strategies, With and Without Parent/Adult Caregiver Involvement, as Applied to Reducing Sugar-Sweetened Beverage Intake

<table>
<thead>
<tr>
<th>Strategy</th>
<th>PAC Actively Involved and Potentially Facilitating Child Behavior Change</th>
<th>PAC Less Involved and Potentially Undermining Child Behavior Change</th>
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</thead>
<tbody>
<tr>
<td>Target behavior specification</td>
<td>PAC and child identify excess sugar-sweetened beverage intake as a specific behavior that family members can reduce. Although other behaviors could be targeted for change (eg, reducing screen time), PAC believes that his/her child can have initial success with this particular behavior. PAC and child jointly agree to focus on gradually reducing sugar-sweetened beverage intake.</td>
<td>PAC identifies excess sugar-sweetened beverage consumption as a specific behavior for his/her child to reduce but is unwilling to make any changes in his/her own consumption. This is not identified as a target for change for other family members, for whom PAC believes “there is no problem.”</td>
</tr>
<tr>
<td>Stimulus control</td>
<td>PAC and child agree to limit number of 2-liter bottles of soda brought into the home each week. Whereas family initially purchases 8 bottles per week, the family will initially reduce to 4 bottles per week. Additionally, they will have colorful water bottles available and sample 2 flavored seltzer waters to see which ones they like.</td>
<td>PAC not willing to limit purchase of 2-liter soda bottles brought into the home food environment. PAC believes that other family members, including nonobese siblings, should not be “punished” just because the obese target child is changing beverage choices. Additionally, PAC enjoys soda at the end of his/her work day and does not want this to change. PAC says s/he will not drink in front of child but will not change purchases for home food environment.</td>
</tr>
<tr>
<td>Self-monitoring</td>
<td>PAC and child commit to recording their daily intake of sugar-sweetened beverages and water in a booklet and to review each evening before bedtime. In their booklet, they report the type and amount of each beverage, as well as where they drank it, who else was present, and time of day. PAC and child engage in these behaviors as a team and, in the first week, discover how many total servings of sugar-sweetened beverages and water they typically consume. After this initial week, PAC and child set a weekly “allowance” for sugar-sweetened beverages (eg, reducing their initial weekly intake by 20%). They continue to self-monitor sugar-sweetened beverage intake together, reviewing their progress during the week, whether they are within their goal ranges, and whether they are encountering barriers. Goals are reassessed and adjusted over time, depending on progress. PAC and child support each other’s efforts.</td>
<td>PAC unwilling to support child’s self-monitoring efforts because of reported “lack of time.” S/he does not designate another adult family member or older sibling to support daily self-monitoring efforts. Consequently, there is no consistency or structure within the family to support the child’s progress on reducing sugar-sweetened beverages and to provide feedback. Child records his/her intake only once in the initial week.</td>
</tr>
<tr>
<td>Reinforcement</td>
<td>PAC acknowledges and celebrates child’s progress toward reducing sugar-sweetened beverage intake and increasing water consumption. This can occur at the daily review of the self-monitoring form, plus other spontaneous times during the week when PAC “catches” their child making progress. PAC uses praise, hugs, and other low- or no-cost rewards to incentivize progress. If goals are not met, PAC does not discourage or demean; rather, s/he assesses reasons and barriers, considers potential goal adjustments, and encourages ongoing effort and progress. Rather than focusing on child “failures,” PAC treats this as an opportunity to support any changes in the right direction.</td>
<td>Because PAC does not participate in review of daily self-monitoring forms, there is no structured opportunity to reinforce the child’s progress toward reducing sugar-sweetened beverages. Rather, PAC notices when child is drinking soda and “not doing a good job.” PAC more likely to give critical comments than to acknowledge progress. Additionally, PAC does not believe that child should be “bribed” for engaging in healthy behaviors.</td>
</tr>
<tr>
<td>Self-efficacy and self-management skills</td>
<td>PAC develops a sense of confidence in his/her ability to implement core behavior change strategies for reducing sugar-sweetened beverages and to consistently structure changes to the home food environment to promote water intake (ie, stimulus control).</td>
<td>PAC believes that “it is impossible to control my child,” and therefore, s/he cannot alter beverage choices of the child. Additionally, PAC believes that s/he cannot manage the home food environment because grandparents or older siblings bring in sugar-sweetened beverages. PAC believes that these individuals, and their beverage choices, are “out of my control.”</td>
</tr>
</tbody>
</table>

PAC indicates parent/adult caregiver.
Table 3 provides a hypothetical illustration of the core behavior change strategies for the reduction of a child’s sugar-sweetened beverage consumption with and without PAC involvement. (We note that the scenarios in Table 3 could equally pertain to other target behaviors, such as reduced screen time or energy-dense snack food consumption.)

Is Greater PAC Involvement in Treatment Associated With a Child’s Weight Reduction?
In this section, we review evidence to support the hypothesis that greater parental involvement in family-based treatment studies promotes greater reductions in child overweight. Two strategies were undertaken to address this question. First, we identified and reviewed randomized clinical trials that manipulated the degree or nature of parental involvement in family-based treatment, and we examined effects on changes in child obesity status. Second, we examined whether greater PAC adherence to behavioral strategies was associated with greater improvements in child overweight in family-based treatment studies.

Regarding our first strategy, we specifically sought studies in which competing treatment arms provided the same or a very similar behavioral intervention to families with the exception of parental involvement, which was determined via random assignment. We did not focus on studies in which the main comparison was a family-based treatment package versus no-treatment control or an educational control, or a comparison of active treatments that had similar parental involvement. Our comparison of interest was therefore specific, although we did allow for studies that included a no-treatment control group above and beyond the main randomized comparison of parental involvement. Articles were searched in Medline and PsycINFO, as well as in the references of review articles that addressed family-based treatment of pediatric obesity.17–20,32,91–95 Inclusion criteria of review articles that addressed family-based were searched in Medline and PsycINFO, as well as in the main comparison was a family-based treatment package versus no-treatment control or an educational control, or a comparison of active treatments that had similar parental involvement. Such heterogeneity makes a direct study-by-study comparison of findings challenging, as also noted in prior reviews of the broader pediatric obesity treatment literature.92 The mean±SD short-term, end-of-treatment assessment was 4.65±2.69 months, with a median of 4.0 months. The mean±SD long-term follow-up assessment was 27.84±38.51 months, with a median of 10.0 months. Only 2 (17%) of the 12 studies100,113 found significant short-term differences in child weight status outcomes among interventions that varied the degree or nature of parental involvement, and only 3 studies14,100,105 (ie, 25%) reported long-term differences. This provides limited support for the notion that greater parental involvement with their children in treatment leads to stronger outcomes. Indeed, although several prior reviews concluded that greater parental involvement enhanced obese children’s weight loss,17,18 not all reviews reached this conclusion.20,21

There are several potential explanations for these predominately null findings. First, it may be the case that additional parental involvement (as determined by the randomly assigned treatment group) did not have additive or incremental effects for PACs who already were sufficiently motivated to enroll in these intensive family-based treatments. It is possible that most of these families, irrespective of the condition to which they were randomized, were highly motivated to make changes. Second, there may be more meaningful and potentially nuanced indices of PAC involvement than attending versus not attending sessions together. As noted below, one need for future research is to develop better measures of refined parenting practices that predict treatment outcome. Third, it is possible that at certain developmental phases (eg, adolescence), greater parental involvement is less desirable as youth strive for greater autonomy. The finding by Brownell et al100 of superior outcomes for obese adolescents treated separately from their mothers supports this notion. Fourth, it is possible that null findings may have been caused by low statistical power given the relatively smaller sample sizes in these studies.

On the other hand, the 3 studies with the longest follow-up assessments did find significant between-group differences both at the end of treatment and at follow-up.14,100,105 Two studies found that greater PAC involvement in treatment can yield superior weight loss results for youths,14,105 whereas the
third study found the best results when parents and adolescents were both treated but in their own separate groups.\textsuperscript{100} Moreover, among the 3 studies that included a no-treatment control group, all active treatments, including those with greater PAC involvement, achieved better child outcomes than the no-treatment control group.\textsuperscript{97,98,106}

In summary, results from randomized clinical trials provide mixed support for the notion that greater PAC involvement

<table>
<thead>
<tr>
<th>Study</th>
<th>Year of Study</th>
<th>Child Age Range, y</th>
<th>Total Sample Size (Parent-Child Dyads) Across All Treatment Conditions</th>
<th>Outcome Measure</th>
<th>Mean Change in Outcome Measure for Children Assigned to Enhanced Parental Involvement Treatment Condition(s)</th>
<th>Significant Between-Group Differences as a Function of Parental Involvement at End of Treatment?</th>
<th>Significant Between-Group Differences as a Function of Parental Involvement at Follow-Up?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aragona et al\textsuperscript{*}</td>
<td>1975</td>
<td>5–11</td>
<td>15</td>
<td>Weight</td>
<td>$-11.3$ lb</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Kingsley and Shapiro\textsuperscript{*}</td>
<td>1977</td>
<td>10–11</td>
<td>40</td>
<td>Weight</td>
<td>$-3.5$ lb</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Coates et al\textsuperscript{**}</td>
<td>1982</td>
<td>13–17</td>
<td>31</td>
<td>Percentage overweight</td>
<td>$-8.4%$</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Brownell et al\textsuperscript{**}</td>
<td>1983</td>
<td>12–16</td>
<td>42</td>
<td>Weight</td>
<td>During treatment: Mother and child treated separately: $-17.1% (-18.5$ lb); mother and child treated together: $-11.7$ lb 1-y Follow-up: Mother and child treated separately: $-20.5% (-17.0$ lb); mother and child treated together: $+6.6$ lb</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Kirschenbaum et al\textsuperscript{**}</td>
<td>1984</td>
<td>9–13</td>
<td>40</td>
<td>Percentage overweight</td>
<td>% Change in overweight after treatment: $-27.5%$ at 3 mo: $-27.2%$ at 1 y: $-22.6%$</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Epstein et al\textsuperscript{**}</td>
<td>1981, 1987, 1994</td>
<td>8–12</td>
<td>76</td>
<td>Percentage overweight</td>
<td>Parent-plus-child treatment condition after 5 y: $-12.7%$ Parent-plus-child treatment condition after 10 y: $-15.3%$</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Wadden et al\textsuperscript{**}</td>
<td>1990</td>
<td>12–16</td>
<td>36</td>
<td>Weight</td>
<td>Mother and child treated in the same session: $-8.2$ lb; mother and child treated in separate but concurrent sessions: $-6.8$ lb</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Israel et al\textsuperscript{**}</td>
<td>1994</td>
<td>8–13</td>
<td>34</td>
<td>Percentage overweight</td>
<td>7 of 9 children decreased in % overweight in the treatment condition, ranging from $-9.63%$ to $-32.77%$ % Change in overweight at week 26: $-15.55%$ at 1 y: $-5.78%$ at 3 y: $-4.81%$</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Golan et al\textsuperscript{**}</td>
<td>1998, 2004</td>
<td>14–19</td>
<td>60</td>
<td>Percentage overweight</td>
<td>$-14.6%$ at end of treatment: $-29%$ after 7 y</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Janicke et al\textsuperscript{**}</td>
<td>2008</td>
<td>8–13</td>
<td>93</td>
<td>BMI z score</td>
<td>During treatment: Parent-only treatment group: $-0.139$ SD; month 10 follow-up: parent-only treatment group: $-0.091$ SD</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Munsch et al\textsuperscript{**}</td>
<td>2008</td>
<td>8–12</td>
<td>56</td>
<td>Percent overweight</td>
<td>Baseline mean: 56.76% End-of-treatment mean: 54.29% Follow-up mean: 54.85%</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Boutelle et al\textsuperscript{**}</td>
<td>2010</td>
<td>8–12</td>
<td>80</td>
<td>Baseline mean: $-2.29$ SD (BMIz), 98.37%ile (BMI%ile), and 0.28 kg/m$^2$ (BMI) End-of-treatment mean: 54.29% Follow-up mean: 54.85% At 5 mo after treatment: $-0.01$ SD (BMIz), $-0.50%$ile (BMI%ile), and 0.28 kg/m$^2$ (BMI) After 6-mo follow-up: $-0.08$ SD (BMIz), $-0.50%$ile (BMI%ile), and 0.28 kg/m$^2$ (BMI)</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

SD indicates standard deviation; BMIz, body mass index z score; %ile, percentile; BMI\%ile, body mass index percentile; and BMI, body mass index.

*Children in all treatment groups showed greater reductions in overweight status than nontreatment control children.

In summary, results from randomized clinical trials provide mixed support for the notion that greater PAC involvement...
leads to better child weight control. The majority of studies did not report significantly better weight loss outcomes for children whose parents were more involved in treatment, a conclusion reached in certain prior reviews. Future studies need to identify the conditions under which, or the families for whom, greater parental involvement yields better child outcomes. Additionally, effects on short-term versus long-term outcomes are critical to assess. Identification of specific parenting practices that lead to better outcomes is critical for advancing the field. An important caveat to these conclusions is that the studies generally were conducted with self-selected, highly motivated families who were willing to undergo intensive counseling. White families also have been overrepresented in these studies; future studies must examine a more diverse range of families. Additionally, because most reports were conducted before 1990, there is a need for new family intervention studies conducted within the modern obesogenic environment.

Is Greater Parental Adherence to Core Behavior Change Strategies Associated With Better Child Outcomes?

A nonexperimental approach to evaluating whether greater PAC involvement in treatment predicts child outcomes is to examine indices of PAC adherence. For example, is greater use of role modeling by parents correlated with greater reductions in child overweight? Does having a child consistently involved in the preparation of a family meal encourage different eating habits?

Few studies have formally assessed PAC adherence to specific behavior change strategies. Epstein identified predictors of 5-year reductions in child percent overweight among families enrolled in 4 prior treatment studies. The analyses examined obese youths from 185 families who were 6 to 12 years old at baseline. Hierarchical regression models indicated that the greatest reductions in child percent overweight over 5 years were predicted by family selection of low-calorie meals, graphing weight, eating fewer high-calorie red light foods, and greater use of parental praise. Collectively, these 5 variables accounted for 23% of the variance at 5-year follow-up.

Wrotniak et al conducted a secondary analysis of 110 families enrolled in 2 family-based behavioral weight loss studies. Results indicated that the greatest 2-year reductions in child percent overweight were predicted by greater pre-planning of meals by children and role modeling of healthy behaviors by parents, accounting for 24.8% of the variance. The greatest 2-year reductions in parent percent overweight were predicted by greater self-monitoring of food intake and calories by children and role modeling of healthy habits by parents, which accounted for 14% of the variance.

Few other studies evaluated PAC adherence. In the study by Wadden et al of adolescent obesity treatment, greater attendance at treatment sessions by mothers was associated with greater weight loss by adolescents across all treatment groups. Heinberg et al recently reported that parental involvement in treatment, as assessed by the family’s case manager on a 4-point Likert scale (from 0 = none to 4 = extremely), predicted weight loss among 104 children enrolled in a 12-week intervention. Specifically, children with the lowest parental involvement were less likely to lose any weight or to have clinically significant weight loss (≥2 kg).

In summary, relatively few studies have tested whether greater adherence to core behavior change strategies by parents predicted greater reductions in child overweight. When focusing on an adult population, however, it has been found that individuals who were asked to consistently make 1 of 10 behavior changes for 3 months were more than 3 times more likely to lose weight if they were compliant 25 times per month than those who were compliant 20 times. In relating this to children, other studies suggest that greater adherence to these strategies is associated with better child weight outcomes after 2 and 5 years of treatment.

Research Gaps and Emerging Research Opportunities

This section reviews research gaps and emerging topics in the field. Such research is needed in light of the dearth of investigations and the inconsistency of prior findings. Investigations are needed to better understand why some parents are more influential and effective than others in helping their obese children achieve a healthier body weight and which strategies are most powerful. Knowing this, health professionals can implement more effective interventions, and parents can focus on those areas or interventions with which they feel the most competent. Obesity parenting who make lifestyle changes to help model healthy behaviors may offer greater empathy and insights than parents who are normal weight or overweight but weight stable. These newer studies are needed to document the best parenting approaches to help obese children learn how to sustain long-term energy balance behaviors. Table 5 provides a list of research gaps and emerging research opportunities for PAC-based treatments for childhood obesity. Below we highlight several of these opportunities in greater detail.

Research on Childhood Obesity Risk Perceptions by PACs

Many parents of obese children do not perceive their children to be obese and therefore may not be inclined to make changes. Evidence to support this comes primarily from focus group studies with parents from low-income families who were enrolled in the federal Special Supplemental Nutrition Program for Women, Infants, and Children. For example, Baughcum et al conducted focus groups with >600 low-income mothers of young children to assess their attitudes about child feeding. Results indicated 3 major themes, including (1) parental beliefs that a heavy child is a healthy child, (2) parental concerns that a child is not getting enough to eat, and (3) parental use of food to influence children’s behavior. Baughcum et al found that mothers with a high school education or less were less likely than mothers with education beyond high school to correctly identify their children as overweight. Other studies have confirmed that many parents of overweight or obese children lack concern about their child’s weight status or do not perceive a health problem. Strategies to enhance more accurate PAC perceptions of healthy weight ranges and knowledge of BMI
Table 5. Research Gaps and Emerging Opportunities for Childhood Obesity Treatments Targeting Parent and Adult Caregivers

Gaps/opportunities related to participant and family characteristics

- Evaluation of PAC-based treatments provided in ethnically/racially diverse populations, as well as in families across socioeconomic strata.
- Evaluation of PAC-based treatments provided to families residing in rural settings, for whom access to clinical care can be limited. For these families, frequency of clinical visits may be limited, and greater use of innovative technologies may be required (below).
- Evaluation of PAC-based treatments provided to families with infants at risk for obesity, as well as obese children who are 2–7 years of age. (Most studies to date have examined 8- to 12-year-old obese youth.)
- Evaluation of grandparents as potential agents of change for treating obese grandchildren.
- Evaluation of treatment programs enlisting additional/extended family members (eg, siblings, cousins) as agents of change for obese youth.
- Evaluation of child developmental status (chronological age, physical maturation, psychosocial development) as a potential influence on outcomes in PAC-based interventions.
- Evaluation of the extent to which PACs accurately perceive their child’s obesity status. Evaluation of strategies that can promote more accurate perceptions by PACs and whether this promotes enhanced treatment outcomes.
- Evaluation of whether broader family relationships and parental discipline practices influence treatment outcomes.

Gaps/opportunities related to measurement of refined parenting practices

- Development and validation of measures of refined parenting practices that influence obese children’s food intake, physical activity, and energy balance. Examples of such PAC practices include grocery store purchases, food portioning practices, and restricting/limiting child access to energy-dense foods at home.
- Research investigating the relationships among general parenting styles and specific feeding practices, as well as how these affect child weight-status outcomes.
- Assessment of specific parenting practices that encourage/discourage physical activity and screen time by obese children.

Gaps/opportunities related to research design

- Evaluation of longer-term outcomes (ie, 2 years and longer) of PAC-based interventions for pediatric obesity.
- Identification of specific PAC lifestyle behaviors and parenting practices that predict short-term and longer-term outcomes for obese children.
- Use of formative research, including focus groups with PACs in treatment, to identify most helpful components of treatment programs, specific barriers to adherence, and practical solutions to these barriers.
- Cost-effectiveness analyses to evaluate the relative costs of PAC-based treatments that differ in dose and intensity.

Gaps/opportunities related to treatment settings

- Evaluation of PAC-based treatments provided in primary care settings, where care is given by pediatricians, nurses, and other auxiliary staff.
- Evaluation of PAC-based treatments provided in community settings (eg, Head Start, WIC, YMCA, after-school programs).
- Evaluation of PAC-based treatments provided in school settings, including programs that are adjunctive to broader school-based obesity-prevention programs.
- Evaluation of PAC-based treatments provided in private business sector settings.

Gaps/opportunities related to treatment content/materials

- Evaluation of innovative self-monitoring technologies (eg, Internet, smart phones, instant messaging). Studies should evaluate the efficacy of these technologies when used by PACs or children.
- Evaluation of interactive media (eg, Dance Dance Revolution) and emerging “gaming” activities to incentivize physical activity at home.
- Evaluation of cultural tailoring of family-based treatments, to determine whether these strategies augment the efficacy of standard core behavior change strategies.
- Evaluation of MI strategies to enhance PAC adherence to intervention protocols and enhance child weight loss. Identification of specific MI strategies associated with better PAC and child outcomes in the short- and long-term.
- Evaluation of treatments restructuring the home environment to reduce child screen time and promote physical activity.
- Evaluation of PAC-based interventions using classic “family systems” theories, constructs, and treatment techniques.
- Evaluation of whether information on genetic risk can bolster the efficacy of PAC-based treatments. For example, when told that certain children are at greater/reduced risk for obesity on the basis of family history or specific genes, how does this affect treatment adherence? Does this information lead to greater PAC motivation or perceptions of helplessness? Do specific genes linked to childhood obesity (eg, FTO, MC4R) predict better or poorer response to PAC-based treatments?

PAC indicates parent/adult caregiver; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children; YMCA, Young Men’s Christian Association; and MI, motivational interviewing.

warrant greater research. For example, Perrin et al\textsuperscript{121} demonstrated that parents’ accuracy of recognizing their child’s overweight status was improved through a physician tool kit called “Starting the Conversation” that included a color-coded BMI chart.

Better Assessment of Family Relationships

One research gap has been understanding the influence of parent-child relationships in the treatment of childhood obesity.\textsuperscript{123} Might certain types of relationships lead to better child outcomes in family treatment? Kirschenbaum et al\textsuperscript{101}
reported that greater family support was associated with greater child weight loss, whereas families high in conflict were more likely to drop out of treatment. Golan et al.124 reported a trend among 32 Israeli families for mothers who were higher versus lower in authoritarianism to have children who showed better improvements in weight status after treatment. In 50 obese 8- to 12-year-old youths, increased paternal acceptance of their children was associated with a greater reduction in child percent overweight after treatment.125 Interestingly, epidemiological studies suggest that a more involved parenting style may be protective against childhood obesity onset.126 Also, a seminal study reported that mothers with an authoritative parenting style were less likely to have obese children than mothers with an authoritarian parenting style or laissez-faire style.127 Future research needs to identify family relationships and communication patterns that will lead to better improvements in child energy balance and weight status. To help guide future studies, Pritchett et al.128 have provided a comprehensive review of existing measures of family relationships within the domains of parent-child relationships, parental practices and discipline, parental beliefs, marital quality, global family functioning, and situation-specific measures. Within the category of parental practices and discipline, for example, the most commonly used assessment tools have been the Parenting Scale,129 the Parenting Daily Hassles Scale,130 and the Conflict Tactics Scale.131

Use of Innovative Self-Monitoring Technologies

The importance of self-monitoring in successful weight loss outcomes is well established,132–135 and more recently, studies have demonstrated the importance of parental self-monitoring for successful weight loss in children.136,137 However, adherence to self-monitoring is often less than ideal and declines over time.133,138,139 The advent of computer-based technology, including the Internet and handheld devices, has stimulated the development of several studies evaluating their use for self-monitoring, with the expectation that these devices will improve adherence. Indeed, the increased use of technology with dietary and exercise software programs may lessen the burden of self-monitoring and thus enhance adherence. The available software programs also permit one to record and save frequently eaten meals and recipes, which eliminates the need for repeated entry. The portability of handheld devices makes them easily accessible throughout the day, which is an advantage for the segment of the population that does not have access to the Internet through their mobile phone. Today, the personal digital assistant is incorporated into phones, and increasingly more of the dietary software programs are available for the “smart” phone and for the Internet.

In the past 10 years, several reports of Internet-based behavioral weight loss programs with adults have been published,140–145 as well as studies using personal digital assistants for self-monitoring,146–149; however, data from family-based studies with children have been very limited.150,151 One pediatric pilot study examined the acceptability of a mobile phone intervention, adherence, and attrition in a 3-group design study.152 Fifty-eight children, 5 to 13 years of age and their parents were randomized to a mobile phone with short messaging service (SMS), a paper diary, or no diary control condition. Each child-parent dyad was given a phone to share and use solely for the purpose of the study. They were instructed to send 2 SMS messages per day (1 from the parent and 1 from the child) for the 8-week study, and they would each receive an immediate, automated SMS feedback message from the investigators regardless of the time of day. Additionally, participants in the SMS and paper diary group were to record daily the number of steps noted on the provided pedometer, the number and size of beverages consumed, and the hours of screen time for that day. Self-monitoring adherence was significantly higher in the SMS group (43.0%) than in the paper diary group (19.0%). There also was a significant difference in screen time in the SMS group compared with the other 2 groups, but there were no between-group or within-group differences in exercise or beverages consumed.

Research Integrating the Relationships Among General Parenting Styles and Specific Feeding Practices

General parenting style refers to “the broad pattern of attitudes and practices that provide the emotional background in which parent behaviors are expressed and interpreted by children.”153 Stemming from the seminal work of Baumrind,154–156 recent research has linked childhood obesity to permissive and neglectful parenting styles,127 yet very few studies have examined the causal relationship between parenting styles and specific feeding practices that might lead to caloric overconsumption.153,157–159 For example, Blissett and Haycraft160 reported that a more permissive parenting style was associated with greater restrictive feeding practices by mothers. It is important to better understand the nature of these associations to guide future intervention development. To the extent that they are unrelated traits, it might not be necessary to address general parenting style when remediating specific feeding practices. Alternatively, if feeding practices are largely driven by more global parenting dispositions, then treatments might need to address these more global traits to leverage specific feeding patterns. These issues also may depend on sociodemographic variables, issues that remain to be addressed.

Research on Grandparents as Agents of Change

In many families, grandparents determine the home food environment and significantly influence eating attitudes and values of the family. Indeed, children are increasingly residing in households with a grandparent present. A recent report from the Pew Research Center indicates that as of 2008, 49 million Americans, or 16.1% of the total US population, lived in a multigenerational household, with nearly half of these households consisting of ≥3 generations of family members and 6% being “skipped” generation (households made up of a grandparent and grandchild, but no parent).161 Hispanics, blacks, and Asians are significantly more likely than whites to live in a multigenerational family household.

There is a significant relationship between grandparent and grandchild BMI, as well as physical activity and television
viewing. Grandmothers have also been found to have a strong influence on parents’ feeding decisions for children in infancy and early childhood and potentially into late adolescence. A study of low-income black mothers participating in the Special Supplemental Nutrition Program for Women, Infants, and Children showed that having a grandmother in the household was associated with lower food insecurity. Despite these data, very few studies have examined grandparents as agents of change for grandchild obesity treatment. “Project Healthy Grandparents” enlisted 22 black grandparents to engage in a nutrition and physical activity program composed of ten 15-minute sessions based on the National Heart, Lung, and Blood Institute’s “We Can!” program. Respondents’ nutrition and physical activity knowledge increased after treatment, with improvements noted in use of hands to judge portion sizes and reducing screen time. Ganthavorn and Hughes reported on an 8-session behavioral modification program that targeted custodial grandparents and their 9- to 12-year-old grandchildren that was designed to increase fruit and vegetable intake and physical activity. Sixty percent of grandparents and 67% of grandchildren reportedly improved the number of times they ate green salad during the past week, among other changes reported.

Cultural Tailoring of Family-Based Treatments

There is growing interest in identifying culturally appropriate family-based interventions to meet the needs of these high-risk families. Although quality interventions to prevent or treat obesity in minority children have been conducted, families and parents were not the primary target. One set of interventions that involved parents as agents of change was the Girls Health Enrichment Multi-Site Studies (GEMS), the aim of which was to develop and pilot test a series of culturally appropriate weight gain prevention interventions for black preadolescent girls. As part of GEMS, Beech et al reported that 8- to 10-year-old girls receiving either parent-targeted or child-targeted treatment showed smaller 3-month gains in BMI and waist circumference than girls in a self-esteem enhancement comparison group. Few other obesity interventions in minority children have focused specifically on obesity-related parenting behaviors.

Understanding How Family Risk and Genetics

Childhood obesity has a significant genetic component, as do several eating behaviors that may contribute to obesity onset. Examples include rapid eating rate, poorer recognition of internal satiety cues, greater responsiveness and eating in response to environmental cues, and a heightened tendency to eat in the absence of hunger when exposed to palatable foods. Genes also influence habitual physical activity levels. Indeed, genes also may influence children’s improvements in weight status in response to a family-based treatment. Multinational efforts to identify specific obesity-promoting genes are ongoing, despite challenges with nonreplication and small effect sizes.

That family history of obesity and genetics put certain children at greater risk than others for becoming obese is generally accepted. How this information influences parents’ perceptions of their obese children, and potentially could guide novel parenting interventions, is less clear and suggests new research opportunities. Might knowing that one’s child has increased susceptibility to obesity enhance PAC motivation for behavior change? Or might this lead to a decreased sense of self-efficacy or hopelessness? Research with adults has begun to examine the impact of providing personal obesity risk information on motivation to eat more healthily. These questions are of emerging importance in the boarder medical and public health literatures. Answers to these questions might inform the conceptualization of new family-based interventions.

Evaluation of Child Developmental Status

The efficacy of PAC treatment strategies may depend on a child’s developmental status, including chronological age, physical maturation, and psychosocial development. Most treatments for pediatric obesity have focused on 8- to 12-year-old youths, with less work conducted in younger children and almost none with infants and toddlers. An understanding of effective parenting strategies for these younger ages needs to be addressed. Regarding physical maturation, early adiposity rebound has been linked to greater adulthood obesity risk, which potentially could make family treatments more challenging. Pubertal status may influence treatment outcomes, although this has not been assessed as a moderator variable in most treatment studies. Regarding psychosocial development, obese children tend to have fewer friends. There is evidence that bolstering peer support may enhance lifestyle interventions for childhood obesity, and this may be a novel component to address in future parenting interventions.

Structuring the Home Environment to Reduce Child Screen Time and Promote Physical Activity

Given the strong link between television viewing and pediatric obesity, there is a need to identify strategies to reduce screen time and increase physical activity in the home environment. This is especially challenging for obese youth, for whom television viewing and video-game playing are highly reinforcing and pleasurable activities. Limiting a child’s weekly allotted screen time through the TV Allowance, a television time management device, has been associated with improvements in child overweight status, although there can be challenges to implementing these within families in which there are multiple televisions. Compared with children with no television set in their bedroom, those with a television set in their bedroom are at increased risk for being obese, and this is therefore an avenue for potential intervention. Indeed, earning access to television has been used to incentivize physical activity in obese youth. There also is emerging research on home-based interactive media games to bolster the reinforcing value of physical activity in obese youth. The assessment of specific parenting practices that encourage or discourage physical activity and screen time will be important for assessing such treatments. Several parent-reported measures...
of these traits have been developed, but more research in this area is needed.

Assessing Refined Parenting Practices and Profiles

There is a great need for the development, validation, and use of measures of refined parenting practices that influence obese children’s food intake, physical activity, and energy balance. Such measures could be observational or intervention tests, behavioral observation, or laboratory-based procedures or questionnaires that assess refined parenting phenotypes and ultimately can be used to develop more potent family interventions and better understand mediators of treatment outcome. Ensuring adequate psychometric rigor, including reliability and validity, is critical for any new assessment tools. Examples of potential refined phenotypes for further investigations include the following:

- Grocery store purchasing practices. Because grocery store purchases by PACs influence the home environment, being able to measure this behavior reliably and evaluate its determinants may be highly relevant for childhood obesity treatment. Methods to assess this behavior are beginning to appear in the literature. Using an experimental paradigm, Epstein et al compared the effects of taxing less healthy foods versus reducing the price of more healthy foods in a laboratory-based “supermarket” in which student subjects were instructed to hypothetically shop for 1 week’s worth of groceries. Results indicated taxing less healthy foods was more effective than subsidizing healthier foods for reducing the net calories of purchased foods. These studies were hypothetical and involved student subjects shopping in an artificial environment. In marked contrast to this are studies that assessed eating behaviors in restaurants and a large-scale field study in supermarkets. In the 3-month supermarket study, it was found that a 10% tax on the less healthy foods had no impact on purchases, but a 10% subsidy on healthier foods shifted shoppers toward more of all types of foods – both healthy and less healthy – when it was subsidized. Identical findings were shown when taxing or subsidizing foods at lunch.

Other methods to assess food purchases in the free-living environment have been developed, such as grocery receipts and coupon redemptions. One recent study assessed how shoppers track the amount of money they spend while shopping.

- Portioning behavior. Portion size is a strong determinant of child food intake, and reducing portion size is a common recommendation for childhood obesity treatment. However, the action of food portioning per se by PACs has rarely been studied, and the controls of this behavior are poorly understood. Measures for this behavior need to be developed and validated. However, insights can be gleaned from a growing number of experiments that examined how the size or shape of dinnerware, glasses, and utensils can unknowingly bias how much a person serves themselves and consumes. For instance, it has been shown in field and laboratory studies that when people are given a tall versus a wide glass that holds an equal volume, most people—

- Limiting energy-dense foods. Portion size and energy density independently contribute to overeating in children. Parents’ ability to limit or reduce obese children’s intake of these foods, whether by reducing portion size provided to children, limiting access within the home environment, or influencing food selections when eating out, needs to be measured reliably. The determinants of these parenting skills (ie, why some PACs are better than others with regard to these abilities) currently are poorly understood.

Indeed, many behaviors that parents believe lead to good eating habits may have the opposite effect. In a study of the consequences of the “clean plate club,” parents of preschoolers were asked to indicate the extent to which they insisted their child clean their plate. The following day at school, the children were presented with presweetened cereal for a morning snack. Those children whose parents insisted they clean their plate at home poured 44% more cereal than those who had more latitude over how much they ate at home. Although the “clean your plate” parents believed they were helping their child eat healthier, this was not correct.

Methods to modify these behaviors may lead to better childhood obesity treatments. Psychological variables, such as self-efficacy, may be determinants of a PAC’s ability to set appropriate limits within the home food environment. For example, Campbell et al recently described a 4-item measure of parents’ “self-efficacy for limiting noncore foods.” There is a need to better understand factors that impede a PAC’s success in limiting access to certain foods when presented with this behavioral prescription.

Proposed Conceptual Model for Studying Determinants of Parental Feeding and Physical-Activity Parenting Practices

There is a need to better understand the controls of parental feeding and activity-related parenting practices. For example, to what extent are feeding practices influenced by how one was fed growing up, education, characteristics of one’s own children, or other factors? And how might any of these factors affect family-based interventions that teach the core behavior strategies that have been described in this statement? There is a striking paucity of information on this important question.

To guide new research on this topic, we propose a conceptual model based on Belsky’s seminal work in developmental psychology. This model posits 3 categories of potential influences on parental feeding and activity-related parenting practices: (1) parent attributes, (2) child attributes, and (3) environmental and contextual factors (Figure 2).
Parent attributes refers to past or current characteristics of the PAC and can include personal food and feeding history, obesity status and weight history, demographic characteristics, and beliefs and perceptions. Personal food and feeding history includes the manner in which the PAC was fed by his or her own parents, food insecurity, and other aspects of one’s personal history. The extent to which PACs use the same feeding strategies with which they were raised is highly understudied. Obesity status and weight history includes current weight status, weight loss history, weight cycling history, and the timing of obesity onset in the PAC. Any of these factors could influence the home food environment, lifestyle habits of the PAC, and the index obese child. For example, obese adults who successfully lost at least 30 pounds and maintained the weight loss for ≥1 year did so, in part, by consistently self-reporting food intake and monitoring their dietary selections. These lifestyle habits might influence parenting practices and thereby child health in a way that has not yet been investigated. Demographic characteristics could influence parenting practices, because racial/ethnic differences in parental feeding practices have been documented. Beliefs and perceptions represent another illustrative category. Perceptions that a child is (not) obese may influence grocery purchases by PACs or the desire to promote or restrict their child’s intake of certain foods.

Child attributes refers to past or current characteristics of the obese youth and can include BMI trajectories and obesity status, eating patterns, and temperament. Child BMI trajectories and obesity status may influence parenting practices. For example, children with relatively lower BMIs may be more likely to elicit encouragement from PACs to eat more food, whereas relatively heavier children may be more likely to elicit prompts to restrict food intake or be more physically active. Regarding child eating patterns, there is evidence that overeating by children elicits restrictive feeding prompts by parents. Regarding temperament, negative emotion has been linked to parental feeding practices and child weight status. Infants perceived as fussy were more likely to be fed complementary solid foods at 4 months of age.

Environment and contextual factors refer to attributes of the environment that influence how parents feed their children, including configuration of the home food environment. Examples include availability and access to healthy foods, cup and bowl sizes, arrangement of foods in cupboards, and prompts and visual cues that might drive PAC feeding practices with or without their awareness.

It is noteworthy that different aspects of the model can be tested by observational (correlational) designs, whereas others are more amenable to experimental manipulations. For example, the relationship between the PAC’s ethnicity and current feeding practices can only be tested by correlational methods. By contrast, the PAC’s thoughts and perceptions or configurations of the home food environment can be manipulated experimentally. Thus, the model lends itself to a range of research designs to establish causal inference.

**Conclusions**

This scientific statement reports limited and inconsistent evidence from randomized controlled trials that greater compared with less parental involvement necessarily promotes better weight-related outcomes for obese children receiving family-based treatment. At the same time, better PAC compliance with core behavior strategies was predictive of better child outcomes in several studies. Thus, a new generation of research is needed to identify specific parenting strategies or approaches that empower PACs to be more effective agents of change for obese children. This may require revisiting classic concepts such as the energy balance model, which may interact with genotype or other biological phenomena on which interventions could be tailored. This also may require refined analyses of the home and built food environments. Understanding strategies to engage PACs in a way that is more meaningful to them may bolster the potency and sustainability of family-based treatments. Finally, an empirically grounded understanding of the determinants of basic parenting practices, including how parents feed their children and foster physical activity, may guide novel parenting interventions.

**Appendix**

The following are links to obesity treatment resources for health professionals and parents and adult caregivers of obese youth. The core behavior change strategies reviewed in this statement are incorporated into these materials.

**Resources for All Ages**

Integrated programs (able to be used both by clinicians or directly by patients, have resources for parents to use with children, Web-based interactive applications, handouts [dietary, exercise, and behavioral], and self-monitoring tools):

- US Department of Agriculture: Choose my plate
  - Overall site: http://www.choosemyplate.gov/
  - Self-monitoring site: https://www.choosemyplate.gov/SuperTracker/
— Pregnancy and breast feeding: http://www.choosemyplate.gov/pregnancy-breastfeeding.html
— Preschool: http://www.choosemyplate.gov/preschoolers.html
— Ages 6 to 11: http://www.choosemyplate.gov/children-over-five.html

● The President’s Challenge
— http://www.presidentschallenge.org

Professional programs (these may include patient education material, Web-based interactive applications, handouts [dietary, exercise, and behavioral], and self-monitoring tools and are designed to help clinicians motivate their patients):

● American Association of Family Practitioners Americans in Motion–Healthy Interventions (AIM-HI) program

Other resources (tools for managing obesity and risk factors):

● National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) National Diabetes Education Program
— http://www.ndep.nih.gov/

● NIDDK Weight-control Information Network

● US Centers for Disease Control and Prevention’s Division of Nutrition, Physical Activity, and Obesity

Resources for Adults
Integrated programs (able to be used both by clinicians and directly by patients, Web-based interactive applications, and self-monitoring tools):

● American Heart Association: Heart 360
— https://www.heart360.org/

● American Heart Association: Life’s Simple 7 (Heart Health Factors)
— http://mylifecheck.heart.org/

Professional programs (these may include patient education material, Web-based interactive applications, handouts [dietary, exercise, and behavioral], and self-monitoring tools and are designed to help clinicians motivate their patients):

● US Department of Veterans Affairs/National Center for Health Promotion & Disease Prevention’s MOVE! Weight Management Program

● American Medical Association Roadmaps for Clinical Practice Series: Assessment and Management of Adult Obesity

Less comprehensive programs that can be used directly by patients (which may include handouts, Web links for patients, and often, monitoring tools) and contain good resources for clinicians:

● US Department of Health and Human Services Dietary Guidelines for Americans

● US Department of Health and Human Services, National Institutes of Health, National Heart, Lung, and Blood Institute’s Obesity Education Initiative

Other resources (tools for managing obesity and risk factors):

● American Heart Association Lifestyle Resources
— http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/CookbooksandHealthGuides/Healthy-Lifestyle-Guides_UCM_303873_TabbedPage.jsp

● Centers for Disease Control and Prevention: Fruits and Veggies Matter
— http://www.fruitsandveggiesmatter.gov/

Resources for Pediatric/Adolescent Ages
Integrated programs (able to be used both by clinicians or directly by patients, have resources for parents to use with children, Web-based interactive applications, curricula handouts [dietary, exercise, and behavioral], and self-monitoring tools):

● US Department of Health and Human Services, National Institutes of Health, National Heart, Lung, and Blood Institute’s We Can! (Ways to Enhance Children’s Activity & Nutrition)

Other parent/teacher/school/professional resources (tools for managing obesity and risk factors):

● American Heart Association children’s health resources
— http://www.heart.org/HEARTORG/GettingHealthy/HealthierKids/Healthier-Kids_UCM_304156_SubHomePage.jsp

● American Heart Association and Clinton Foundation Alliance for a Healthier Generation
— http://www.healthiergeneration.org/default.aspx

● US Department of Agriculture Team Nutrition
— http://teammnutrition.usda.gov/library.html

● International Food Information Council’s Internet site designed to get children and youth more active (while on the Internet)
— http://www.kidnetic.com

● Texas Department of Agriculture’s Web site geared to provide parents, teachers, and children with information and activities to promote healthy eating and physical activity
— http://www.squaremeals.org
## Disclosures

### Writing Group Disclosures

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<tr>
<th>Writing Group Member</th>
<th>Employment</th>
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*Modest.
†Significant.
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| Significant |

References

25. Gidding SS, Demison BA, Birch LL, Daniels SR, Gillman MW, Lichtenstein AH, Rattay KT, Steinberger J, Stetler N, Van Horn L; American Heart Association. Dietary recommendations for children and...


46. Wansink B. From mindless eating to mindlessly eating better. Physiol Behav. 2010;100:454–463.


131. Strauss MA. Manual for the Conflicts Tactics Scales (CTS) and Test Forms for the Revised Conflict Tactics Scale (CTS2). Durham, NH: Family Research Laboratory, University of New Hampshire; 1995.


144. Tate DF, Jackvony EH, Wing RR. A randomized trial comparing human e-mail counseling, computer-automated tailored counseling, and no counseling in an Internet weight-loss program. Arch Intern Med. 2006;166:1620–1625.


190. Wansink B, van Ittersum K, Painter JE. Ice cream illusions: bowls, entrees are greater with large portions than with age-appropriate or recommended portion sizes. Am Econ Rev. In press.


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