

Behavioral Interventions for Obesity in Children and Adults: Evidence Base, Novel Approaches, and Translation Into Practice

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Obesity in adults has nearly doubled in the past 30 years and has risen similarly in children and adolescents. Obesity affects all systems of the body, and the serious health consequences of obesity include an increased risk for cardiovascular disease, such as Type 2 diabetes or high blood pressure, which are occurring at ever younger ages. The present article introduces traditional behavioral weight loss strategies designed to change energy-balance behaviors (i.e., dietary and physical activity behaviors) and the contexts within which these interventions have typically been delivered. The applicability of findings from behavioral economics, cognitive processing, and clinical research that may lead to more potent weight loss and weight loss maintenance interventions are also considered. Given the pervasiveness of obesity, this article concludes with a discussion of efforts toward wider scale dissemination and implementation of behavioral treatments designed to address obesity and to reduce the risk of cardiovascular disease.

Keywords: obesity, behavioral treatment, behavioral health, cardiovascular disease risk

Obesity is a serious and complex disease, affecting more than one third of U.S. adults and 17% of children (Ogden, Carroll, Kit, & Flegal, 2014). In adults, *obesity* is defined as a body mass index (BMI; kg/m²) of 30 and above, and in children, due to natural variation in body composition over development, it is defined as a BMI at or above the 95th percentile on growth curves based on age and sex (Kuc-

mariski et al., 2000). Notably, the prevalence of severe obesity in adults (i.e., BMI greater than 40) and children (i.e., BMI $\geq 120\%$ of the 95th percentile) continues to rise, along with the associated cardiovascular disease risks (Ogden et al., 2014; Skinner, Perrin, Moss, & Skelton, 2015). Obesity is a costly disease, both economically (e.g., increased medical care costs, impaired work productivity)

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Dorothy J. Van Buren, PhD, died shortly before publication of this article. She had recently retired in 2018 from the position of Associate Professor within the Department of Psychiatry at Washington University in St. Louis School of Medicine. For the past 27 years, she had served as a clinical psychologist, supervisor, and researcher in the field of childhood obesity and eating disorders.

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and psychosocially (e.g., increased depressive symptoms, stigmatization; DiBonaventura, Lay, Kumar, Hammer, & Wolden, 2015; Puhl & Heuer, 2010). Although pharmacological and surgical interventions are available for the treatment of obesity, they are recommended for use only after attempts to modify weight using behaviorally based interventions have failed; they are limited in their availability—applicability, particularly for children and adolescents; and they are accompanied by significant health risks (Alamuddin, Bakizada, & Wadden, 2016; Inge et al., 2004). Furthermore, ongoing changes in dietary and physical activity behaviors are still recommended for continued weight loss or weight loss maintenance with these medical interventions. Therefore, the availability of effective behavioral change interventions to promote healthier lifestyle behaviors and decrease obesogenic behaviors remains a consistent and critical need for both children and adults and is necessary to improve public health (Spring et al., 2013).

Behavioral Weight Loss Interventions

The primary focus of behavioral weight loss (BWL) programs is the modification of energy-balance behaviors to improve weight status (i.e., decreasing energy intake and increasing energy expenditure) using behavior modification strategies (Wadden, Brownell, & Foster, 2002; Wing, 2002). Cognitive strategies (e.g., self-monitoring for the identification of overeating triggers, behavior chains, problem solving, cognitive restructuring, relapse prevention), although not traditional, are also commonly used (Pimenta, Leal, Maroco, & Ramos, 2012; Wilfley, Kolko, & Kass, 2011). Examples of well-tested behavioral weight loss pro-

grams designed to reduce body weight and prevent the development of chronic diseases associated with obesity include the Diabetes Prevention Program (DPP; Diabetes Prevention Program Research Group [DPPRG], 2002) and the Look AHEAD study (Look AHEAD Research Group, 2014) for adults and family-based behavioral treatment (FBT) for children (Epstein, Paluch, Roemmich, & Beecher, 2007; Wilfley et al., 2007; Wilfley, Saelens, et al., 2017). Systematic reviews in this area have shown that adults participating in 12- to 26-session BWL programs lose approximately 6% of their body weight (Moyer & U.S. Preventive Services Task Force, 2012), whereas children participating in at least 26 sessions of BWL lose .2 zBMI (O'Connor et al., 2017), both clinically significant weight losses associated with multiple health improvements.

In addition to improvements in weight status, BWL treatment is also associated with improvements in other physiological and behavioral health-related outcomes. For example, BWL is associated with improvements in cardiometabolic outcomes (e.g., blood pressure, glucose, lipids) in both children (O'Connor et al., 2017) and adults (LeBlanc, O'Connor, Whitlock, Patnode, & Kapka, 2011), as well as improved diet quality (Hayes et al., 2016), physical activity (Unick et al., 2011), and sleep (Martin et al., 2016). Moreover, BWL has psychosocial benefits, such as improved quality of life (Williamson et al., 2009) and reduction in depressive symptoms (Fabricatore et al., 2011). One common concern for BWL programs is that “dieting,” particularly in children, may increase risk for eating disorder symptoms; however, in BWL programs that focus on healthy eating and activity behaviors, eating disorder pathology is not affected or is decreased (Balantekin et al., 2017; Macpherson-Sánchez, 2015). Reductions in symptomology may be due to active treatment components, such as promotion of flexible and moderate dietary restriction, gradual weight loss, and encouragement of social network support (Goldschmidt, Aspen, Sinton, Tanofsky-Kraff, & Wilfley, 2008). Furthermore, although adverse events are uncommon in BWL programs (LeBlanc et al., 2011; O'Connor et al., 2017), frequent monitoring promotes early identification of adverse events such as rapid weight loss and increased eating disorder pathology that can then be addressed. The following section reviews common BWL strategies, including goal setting, preplanning, self-monitoring, behavioral incentives, stimulus control, and social support.

Goal Setting, Preplanning, and Self-Monitoring

In obesity treatment, goals are typically set for weight, diet, and physical activity behaviors and are individualized to focus on specific behaviors most needing improvement. Adult weight loss programs generally aim for a loss of 5%–10% of body weight and include behavioral goals to support this change. For example, the DPP sets



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a goal of 7% body weight loss, and daily calorie and macronutrient goals vary based on initial weight, ranging from 1,200 kcal/day (33g of fat) for participants weighing 120–170 pounds to 2,000 kcal/day (55g of fat) for participants weighing over 250 pounds (DPPRG, 2002). The physical activity goal is 150 min of moderate intensity physical activity per week. Child obesity programs may strive for a loss of at least .25 zBMI points, a clinically significant outcome (Ford, Hunt, Cooper, & Shield, 2010), and in FBT, typical behavioral goals include 1,000–1,400 kcal/day, five servings of fruits and vegetables per day, fewer than 15 high-energy-density foods per week, 90 min of physical activity five times per week, and less than 2 hr of screen time a day (Epstein et al., 2007; Wilfley et al., 2007; Wilfley, Saelens, et al., 2017).

Preplanning meals and exercise in advance aids in goal achievement, because it allows one to prospectively outline the ways in which goals are to be attained (Mann, de Ridder, & Fujita, 2013). This may involve making a meal plan for the week or deciding when and where to exercise. Implementation intentions are a specific type of preplanning strategy that specify the when, where, and how of behaviors leading to goal attainment and are widely used for health behavior change (Gollwitzer & Sheeran, 2006). As such, they have shown promise for inclusion in weight loss interventions (Luszczynska, Sobczyk, & Abraham, 2007).

Self-monitoring involves recording weight as well as dietary (e.g., food consumption, calories) and physical activity (e.g., minutes spent active) behaviors over time to track progress toward goals and is a consistent predictor of

weight loss outcomes (Burke, Wang, & Sevvick, 2011). Increased frequency of self-monitoring has been associated with improved weight loss outcomes in both children (Mockus et al., 2011; Saelens & McGrath, 2003) and adults (Wadden et al., 2005) and has been shown to improve weight maintenance in both populations (Butryn, Phelan, Hill, & Wing, 2007; Wilfley et al., 2007). Goal-setting and self-regulatory skills have been shown to both predict and mediate weight outcomes in pediatric and adult populations (Teixeira et al., 2015; Wilfley, Saelens, et al., 2017).

Behavioral Incentives, Behavioral Economics, and Stimulus Control

Behavioral incentives, derived from Skinner's (1963) work on operant conditioning, are used in BWL interventions to help reinforce commitment to goals and to aid in the achievement of the desired behavioral change targets (Pettry, 2000). Although there are many incentives intrinsic to weight loss that can reinforce behavior change (e.g., clothes feeling looser, finding it easier to breathe while walking upstairs), weight loss and its accompanying physical changes are often slow, and more immediate, material incentives may be more effective in reinforcing healthy behaviors (Levy, Finch, Crowell, Talley, & Jeffery, 2007). A number of strategies—including coupons—discounts for healthy foods, provision of free foods, direct cash payments, and deposit contracts in which money is deposited and refunded based on goal achievement—have been tested for adults. Although variations in incentives and incentive schemes make conclusions difficult, studies assessing the role of financial incentives generally demonstrate positive short-term outcomes for behavior change (Purnell, Gernes, Stein, Sherraden, & Knoblock-Hahn, 2014), though findings are mixed for weight loss and long-term outcomes (John et al., 2011; Sykes-Muskett, Prestwich, Lawton, & Armitage, 2015).

FBT programs for children often involve the use of incentive systems focused on positive reinforcement. To develop a family-based incentive system, parents and children work together to determine appropriate and appealing incentives for goal attainment. Ideal incentives are those that increase social support and reinforce the value of targeted behaviors, such as a family bike ride or a walk with friends. Children earn points for achieving their diet, physical activity, and behavioral goals and can exchange their points for incentives. Unfortunately, there has been limited research specifically examining the efficacy of behavioral incentives in childhood obesity treatment (Epstein, Paluch, Kilanowski, & Raynor, 2004), especially for older, racially diverse pediatric populations. One multiple-baseline pilot study of six African American youth found that contingent rewards for weight loss increased adolescent weight loss but only for youth whose parents were actively involved in the intervention (Hartlieb et al., 2017).



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Incentivizing behaviors consistent with weight loss may be particularly challenging because food is a powerful reinforcer. Individuals with higher levels of food reinforcement (i.e., those who are highly motivated by food and will work hard to obtain it) are more likely to experience obesity and also have poorer treatment outcomes (Best et al., 2012). Behavioral choice theories and behavioral economic research, which assesses the influence of psychological factors on economic decisions, applied to the design of obesity treatments have provided guidance concerning how to address this challenge (Jacques-Tiura & Greenwald, 2016). One way to do this is to increase the reinforcing value of other choices in the environment and subsequently make food less *relatively* reinforcing. For example, children participating in FBT who were positively reinforced through a point system to engage in behaviors other than eating reported more time spent on non-food-related activities and reported fewer eating episodes than did those in traditional FBT (Epstein, Roemmich, Stein, Paluch, & Kilanowski, 2005). Another way involves increasing the behavioral cost of obtaining unhealthy foods (i.e., increase how hard one must work to obtain food). One laboratory study showed that as women had to work harder to obtain desired snack foods, they were more likely to switch their choice from these foods to healthier, nonfood alternatives (Epstein et al., 2014).

The practical implications of these studies suggest that if high-calorie foods are not kept easily accessible and require more work to obtain, then healthier choices that require less effort will become more reinforcing. Changing the environment to increase the likelihood of engaging in desired behaviors is referred to as *stimulus control* (Terrace, 1966)

and assumes that behaviors are controlled by environmental antecedents, or cues. In obesity treatment, participants are encouraged to increase the number of cues for healthy behaviors within their environments (e.g., putting a bowl of fruit on the counter, keeping running shoes in plain view) and to decrease the number of cues for unhealthy behaviors (e.g., keeping unhealthy food choices out of the house, moving the TV out of the living room). Over time, the strength of the reinforcing value of these healthier alternatives will be increased through greater exposure via learning and conditioning (Epstein & Wrotniak, 2010). It is also important to consider the process of habituation when using stimulus control. Briefly, individuals may become less interested or motivated (i.e., habituated) to obtain foods after repeated exposure (Epstein et al., 2013). Thus, decreasing not only the amount but also the variety of unhealthy foods and sedentary activities in the environment may optimize the use of stimulus control within behavioral weight loss programs for both adults and children.

Social Support

Supportive individuals can play a key role in either helping or hindering behavior change, and social networks can influence weight loss success (Christakis & Fowler, 2007); therefore, social support in BWL treatment may help improve weight loss outcomes. Indeed, studies of BWL programs have identified support from family and friends as a predictor of greater weight loss and empirical tests of actively including a partner have been promising (Gorin et al., 2013; Wing & Jeffery, 1999; Winston et al., 2015). In one landmark study, participants were recruited either alone or with three support people (friends and/or family members) and were either given a social support intervention or were not. The combination of recruiting participants with support people and providing them with social support training was effective, and these participants had increased study retention and weight loss maintenance, compared to the group that was recruited alone, which had the poorest attendance and regained the most weight (Wing & Jeffery, 1999). In another study, Black and Hispanic adults who were overweight—obese enrolled in a weight loss study had greater weight loss when supported by their children and coworkers (Winston et al., 2015).

Other research has suggested that the positive benefit of including social support in treatment may only exist if social support members are successful at losing weight themselves. In a study in which BWL participants were invited to participate with up to three partners, those who had at least one support partner who successfully lost weight lost significantly more weight themselves than did those with no successful partners or without partners (Gorin et al., 2005). Similar results have been shown in African American



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adults, with social support weight loss predicting participant weight loss (Kumanyika et al., 2009).

For children, parental involvement is a critical component of effective obesity treatment programs (Young, Northern, Lister, Drummond, & O'Brien, 2007). Given their control over the home environment and their child's energy-balance behaviors, parents are included as active participants for their own weight loss and are taught to use positive parenting techniques, such as limit setting and positive reinforcement, to augment their child's weight loss (Epstein, 2003). In support of parent involvement, parental weight loss has shown to be the most robust predictor of child weight loss in FBT, and family and home environment have been shown to mediate weight outcomes (Goldschmidt et al., 2014; Wilfley, Saelens, et al., 2017; Wrotniak, Epstein, Paluch, & Roemmich, 2004). Peers may also serve as key sources of support for children and adolescents attempting to lose weight. A review of the influence of peers and friends on children's and adolescents' health behaviors concluded that involving peer networks in prevention and intervention programs is effective for modifying health behaviors (Salvy, De La Haye, Bowker, & Hermans, 2012). Furthermore, peer, as well as family, support has been found to be both a predictor and mediator for weight loss (Kulik, Valle, & Tate, 2016) and for weight loss maintenance (Wilfley et al., 2007; Wilfley, Staiano, et al., 2017) in youth.

Context of Behavioral Weight Loss Interventions

Although behavioral treatments for obesity have demonstrated efficacy, outcomes can be influenced by population, format, dose, duration, and setting. Indeed, these contexts

may be particularly important when considering dissemination and implementation of treatments into health care systems and clinical practice, because these should be maximally effective while at the same time be designed to minimize costs and burden (Brownson, Colditz, & Proctor, 2012).

Population

Obesity disproportionately affects minority populations compared to non-Hispanic White populations (Ogden et al., 2014), and some studies have indicated that BWL interventions may be less effective for certain minority groups (Fitzgibbon et al., 2012; Wadden et al., 2011). As such, consideration has been given to adapting interventions to meet the needs of different cultural and racial groups. Strategies can range from changing the program components to match observable features of a group (e.g., including racially or ethnically similar facilitators) to including content that accounts for the beliefs and values of a group (Kreuter, Lukwago, Bucholtz, Clark, & Sanders-Thompson, 2003). Although some of these studies have shown promising effects in African American (Kong, Tussing-Humphreys, Odoms-Young, Stolley, & Fitzgibbon, 2014) and Hispanic (Branscum & Sharma, 2011) groups, it is unclear whether they produce outcomes that are superior to nontargeted programs. More work is needed to determine the independent contribution that cultural adaptations make to weight loss and which targeting strategies are most successful.

Age should also be a consideration in obesity treatments. Obesity tracks across development from infancy and early childhood to adulthood (Brisbois, Farmer, & McCargar, 2012; Cunningham, Kramer, & Narayan, 2014). As such, early intervention for obesity during childhood is a form of targeted prevention for obesity in adulthood. Moreover, within childhood, treatments are more effective at reducing obesity in younger children (Reinehr, Kleber, Lass, & Toschke, 2010), potentially because weight changes necessary to normalize weight are much smaller at younger ages than at older ones (Goldschmidt, Wilfley, Paluch, Roemmich, & Epstein, 2013).

Dose and Duration

Effective doses of behavioral weight loss have been established for adults and children. A comprehensive review of the literature has shown that adults lose clinically significant amounts of weight (5%–10%) in programs with anywhere from 12 to 24 treatment sessions (Moyer & U.S. Preventive Services Task Force, 2012) and that children benefit from programs with more than 25 contact hours across at least six months (O'Connor et al., 2017).

Weight regain following treatment is a significant problem with current obesity treatments in both adults and



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children (Wing & Phelan, 2005); however, continued contact can positively impact long-term weight outcomes (Epstein, 2003; Wilfley et al., 2007; Wilfley, Saelens, et al., 2017). It has been theorized that longer treatment duration allows additional time for participants to establish consistent habits related to physical activity and healthy eating across contexts, such as at home and at work, and to experience ongoing support and coaching during these more repeated retrieval experiences (Bouton, 2002). Another option to enhance outcomes that may also reduce burden on participants and providers 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 (Epstein, McKenzie, Valoski, Klein, & Wing, 1994).

Format

BWL treatment may be administered in individual, “mixed” (i.e., individual and group), or group formats. Group formats provide unique therapeutic factors, such as universality, altruism, imitative behavior, and interpersonal learning (Yalom, 2005) and should cost less to deliver. Adult studies have shown that group formats produce similar or superior outcomes compared to individual treatments (Paul-Ebhohimhen & Avenell, 2009), whereas children may find increased benefit from family-based programs in a mixed format, which involve separate group sessions for parents and children as well as individual family sessions (Hayes, Altman, Coppock, Wilfley, & Goldschmidt, 2015).

Setting

Traditionally, BWL programs and FBT interventions have been offered in academic medical settings on an outpatient basis. More recently, treatments have been developed with consideration to increased access and reach in alternative settings. Specifically, community settings such as recreation centers (e.g., YMCA), schools, and churches; worksites; and clinical settings such as primary care have become additional settings for the delivery of weight management programs (Anderson et al., 2009; Quattrin et al., 2014; Sbrocco et al., 2005; Wadden, Butryn, Hong, & Tsai, 2014). Moreover, with technological advances, weight management programs with remote administration (e.g., phone, web, mobile app) are being tested (Neve, Morgan, Jones, & Collins, 2010; Williamson et al., 2006). Of note, as BWL programs and FBT interventions leave highly controlled academic medical centers, a significant risk of a decrease in the robustness of the outcomes exists (Brownson et al., 2012), and future work is needed to potentiate outcomes in these alternative settings.

Novel Approaches to Weight Loss

Although multicomponent weight loss programs are effective at improving weight status and other indices of physical and psychological health (Moyer & U.S. Preventive Services Task Force, 2012; O'Connor et al., 2017), some adults and children do not see clinically significant benefits from behavioral weight loss interventions (Unick et al., 2014), and a greater number have difficulty maintaining the losses that they do achieve (Epstein et al., 2007; Wing & Phelan, 2005). Poorer outcomes in some may be due to individual differences that make it more difficult to engage with traditional BWL programs—differences such as cognitive deficits, dysregulated reward pathways, and ambivalence regarding participation. As such, behavioral scientists seek ways to target potential barriers and develop more powerful and individualized interventions for obesity across the life span. The following section discusses three approaches. The first is *motivational interviewing* (MI), which has garnered an evidence base that demonstrates efficacy at enhancing weight loss, particularly when used in combination with a BWL program, whereas the other two, *executive function (EF)-related interventions* and *mindfulness-based interventions*, are in their infancy and do not have the evidence base to be included in current clinical care for obesity. Although these interventions have been tested as stand-alone treatments, the research has suggested they may be most beneficial for weight loss when included in the context of a BWL program.

Motivational Interviewing

Motivational interviewing (MI) is a therapeutic approach for individuals considering health behavior change used to

help them understand and articulate ambivalence toward lifestyle modifications necessary to reach health goals. MI focuses on helping clients identify motivating factors for treatment and can use objective feedback, such as weight or blood pressure, to help clients consider whether and why change should be made (DiLillo & Smith West, 2011). MI is primarily client-directed, and the provider's role is to guide the conversation, using reflective listening and highlighting inconsistencies to increase discomfort and encourage behavior change motivation, with the goal of negotiating behavior change without direct problem solving (DiLillo & Smith West, 2011). Through MI, clients can identify personalized reasons and goals for weight loss and generate their own treatment plans (Miller & Rollnick, 2012). Evidence has suggested the mechanisms by which MI exerts its effects likely include improving program engagement and adherence (DiLillo & Smith West, 2011; Miller & Rollnick, 2012).

MI has a sizable research base highlighting its efficacy to enhance weight loss in adults (Armstrong et al., 2011; Lundahl et al., 2013). MI interventions are often used in primary care settings, increasing access for individuals with overweight—obesity who may not seek out more intensive or specialized care. Results of MI interventions for adults in primary care specifically have shown mixed effects, with studies with more positive results providing treatment in an individual format, incorporating phone sessions and/or technology, and offering the MI intervention outside of regular primary care appointments (VanBuskirk & Wetherell, 2014). Notably, MI is found to have the most robust outcomes on weight when used in combination with or in addition to BWL programs with adult and pediatric populations (Armstrong et al., 2011; Naar-King et al., 2016).

Executive Function–Related Interventions

Executive functions (EFs) are a set of cognitive processes that aid in the selection and management of behaviors to align them with future goals (Diamond, 2013). EFs have been implicated as a necessary component of weight management, because they aid in the pursuit of long-term goals such as maintaining a healthy weight in a challenging, obesogenic environment, and lower EFs have been included in a cognitive profile of obesity (Jansen, Houben, & Roefs, 2015). Indeed, research has demonstrated that individuals with obesity have lower EF skills compared to individuals of healthy weight (e.g., Smith, Hay, Campbell, & Trollor, 2011). As such, EFs may have important implications for the treatment of obesity, and new treatment initiatives that target EF enhancement are being tested (Hayes, Eichen, Barch, & Wilfley, 2018). Computerized training of EFs for obesity treatment is an emerging area of research. In particular, research on *inhibitory control training* (ICT), which is made up of repeated computer trials of tasks that ask an

individual to inhibit a trained behavior in response to a cue, has shown individuals with obesity can immediately improve inhibitory control and engage in fewer dietary obesogenic behaviors than can individuals in control conditions in the laboratory (Jones et al., 2016). However, ICT has shown mixed results on weight in adults when used alone (Allom & Mullan, 2015; Velting, van Koningsbruggen, Aarts, & Stroebe, 2014) and has been infrequently tested in combination with existing BWL programs. One study in children found that EF training during inpatient BWL aided in short-term, but not long-term, weight loss maintenance following treatment (Verbeken, Braet, Goossens, & Van der Oord, 2013).

As noted in the Behavioral Incentives, Behavioral Economics, and Stimulus Control section, individuals with obesity have also been found to devalue larger rewards in the future for smaller, more immediate rewards, a time-related process known as *delay discounting* (DD; Weller, Cook, Avsar, & Cox, 2008). DD may be considered a “hybrid” construct that incorporates EF skills to exert top-down control over more automatic, bottom-up reward processing. Higher DD suggests a preference for immediate gratification and is related to poorer obesity treatment outcome (Best et al., 2012). *Episodic future thinking* (EFT), the vivid imagination of future events, was developed to help individuals with high DD shift their time perspective to the future, to promote the salience of a long-term goal and improve DD (Benoit, Gilbert, & Burgess, 2011). Laboratory studies have shown that EFT reduces DD and leads to less calorie intake (Daniel, Said, Stanton, & Epstein, 2015), but only a recent pilot study has shown the effect of EFT in combination with a BWL. The study assessed EFT as an adjunct to FBT and found that after a 4-week treatment, parents in the EFT group lost significantly more weight than did parents in the control group, and children in the EFT group showed trends toward reduction in calorie intake, but there were no differences in weight (Sze, Daniel, Kilanowski, Collins, & Epstein, 2015).

Mindfulness- and Acceptance-Based Interventions

Mindfulness is the practice of purposefully and nonjudgmentally paying attention to the present moment and has received increasing support as an avenue to reduce both psychological and physical distress (Kabat-Zinn, 2015). Mindfulness-based interventions are theorized to aid in improving eating behaviors and reducing weight by increasing awareness of food-related thoughts and feelings (e.g., understanding internal sensations and identifying triggers) and enhancing self-regulation (Kristeller, Wolever, & Sheets, 2014). A systematic review that included both stand-alone and adjunct mindfulness-based interventions identified positive effects of mindfulness-based interventions (interventions that included at least one training session of mindful-

ness skills) on weight in six out of eight peer-reviewed randomized controlled trials (RCTs; [Olson & Emery, 2015](#)). A more recent RCT found that a 5.5-month BWL program with a mindfulness training component for stress management, eating, and exercise did not produce differences in weight when compared to a standard BWL control group but did find differences on fasting glucose and triglyceride/HDL ratio, suggesting mindfulness training may have benefits above and beyond weight, potentially through stress-related pathways ([Daubenmier et al., 2016](#)).

Mindfulness is also used in combination with other therapies such as *acceptance and commitment therapy* (ACT), which emphasizes contextual and experiential change strategies by focusing on the context and function rather than form and mechanism of psychological experiences. ACT differs from traditional BWL programs through its more intensive focus on internal motivation and self-regulatory skills. Participants in ACT are taught, in addition to mindfulness meditation, skills such as “urge surfing” or cognitive defusion (i.e., separation of the self from thoughts and emotions) to help endure the discomfort of their desires to engage in weight gain behaviors while persisting in their weight loss behaviors aligned with their values (e.g., be more active with children; [Forman & Butryn, 2015](#)).

Research on the efficacy of ACT for weight change and obesity treatment is in its infancy. ACT has been tested as a brief, stand-alone treatment, and results showed small but statistically significant weight loss ([Tapper et al., 2009](#)); however, outcomes may be related to program adherence ([Lillis, Hayes, Bunting, & Masuda, 2009](#)). Greater weight losses have been shown when ACT is used in combination with a BWL intervention. Specifically, in a recent RCT, a BWL intervention that incorporated strategies of acceptance-based strategies (Acceptance-based Behavioral Treatment; ABTs) was compared to a standard BWL ([Forman et al., 2016](#)). The ABT and BWL programs had shared components traditionally found in obesity treatment; however, the BWL treatment included cognitive-behavioral strategies, such as identification of cognitive distortions and cognitive restructuring, whereas the ACT strategies targeted ongoing commitment, mindful decision-making training, and distress tolerance. The ABT group lost significantly more of their body weight at 12 months, approximately 13%, than did the BWL group, which lost approximately 10% ([Forman et al., 2016](#)). Given the focus on internal experiences, it has been hypothesized that mindfulness- and acceptance-based approaches for obesity treatment may be particularly helpful for individuals who are highly responsive to eating cues and those who frequently engage in emotional eating, populations that typically struggle with BWL programs ([Forman & Butryn, 2015](#)). Future research should continue to explore the utility of mindfulness- and acceptance-based interventions for these subpopulations.

Translating Behavioral Weight Loss Interventions

Once the efficacy of a program is established, strategies to “scale up” behavioral treatments need to be identified. The field of dissemination and implementation (D&I) science seeks to identify evidence-based practices for translating research interventions for public use ([Brownson et al., 2012](#)). Primary outcomes for this type of research are often different from those typically considered in RCTs and include treatment acceptability, adoption, appropriateness, feasibility, fidelity, implementation cost, penetration, and sustainability ([Proctor et al., 2011](#)). In particular, given the chronic and complex nature of obesity and the recent classification of obesity as a disease ([American Medical Association, 2013](#)), one major future direction for D&I science in obesity research is integrating obesity treatment into health care systems. Specifically, there has been a call for obesity treatment within the framework of an integrated behavioral health care model ([Dietz et al., 2015](#); [Janicke, Fritz, & Rozensky, 2015](#)). Obesity treatment provided within a primary care practice medical home allows for taking a team approach to this complex and chronic problem ([Wilfley, Staiano, et al., 2017](#)). Such streamlining of care may make it easier for individuals to receive all the necessary treatments and has the great potential to improve access and reach of weight loss treatment. Despite mandates for coverage for obesity-related treatment services within primary care settings by the Centers for Medicare and Medicaid Services, few individuals are receiving this much-needed care, due to barriers such as restrictions on the type of provider (e.g., only primary care practitioners; [Wadden et al., 2014](#)). In children, despite recommendations, reimbursement and access are even more limited and inconsistent ([Wilfley, Staiano, et al., 2017](#)).

However, successful translation models exist. One example is the Diabetes Prevention Program (DPP; [Diabetes Prevention Program Research Group, 2002](#)), which has maintained effectiveness in helping participants reach clinically significant weight loss in alternative settings, including primary care and community settings ([Ali, Echouffo-Tcheugui, & Williamson, 2012](#)). Notably, effect sizes decrease in robustness, potentially due to changes in format (i.e., group vs. individual) and remote and/or web-based administration; however, it does appear that lay community educators (e.g., YMCA staff) with intensive training were just as effective at delivering the DPP as were health professionals. Accordingly, the Centers for Disease Control and Prevention has developed a standardized set of DPP curricula and a training system to allow for streamlined integration of the program into community settings while attempting to maintain the effectiveness of the original program ([Centers for Disease Control and Prevention, 2015](#)). Moreover, a commercial version of the program that has produced 4.2% body weight loss 2 years after program

completion is now available through many employers and health systems (Sepah, Jiang, & Peters, 2015).

For children, although there is preliminary data in support of the delivery of FBT within primary care practices to families with children 2–5 years of age who are overweight (Quattrin et al., 2014), the PLAN with Families program, a study funded by the National Heart, Lung, and Blood Diseases Institute (NCT02873715), will test the effectiveness of collocating a trained behavioral interventionist within primary care pediatric offices for child and parent weight loss, in addition to nonparticipating sibling weight loss to assess generalization of treatment response. The behavioral skills taught within the context of FBT also have the advantage of being adaptable to other health behavior problems seen by family practitioners (e.g., sleep schedule difficulties, depression) because similar targets and/or behavioral techniques can be applied across disorders or concerns, providing further justification for the integration of behavioral therapists and psychologists into medical practices.

Summary and Conclusions

Obesity is a significant public health problem that is associated with serious physical and psychological comorbidities that cause distress and impairment for individuals of all ages. Behavioral interventions have long played a role in the treatment of obesity and are effective in reducing weight and disease for individuals across the life span, particularly when employed at younger ages for prevention of adult obesity. New research in the psychological and cognitive sciences is currently being developed to inform and enhance current treatment interventions. As integrated care for complex behavioral health problems such as obesity becomes more common and a greater effort is made to scale interventions and tailor them to individual needs, psychologists with training in the development, testing, and implementation of behavioral therapies for obesity have an important role to play in the treatment of this disease.

References

- Alamuddin, N., Bakizada, Z., & Wadden, T. A. (2016). Management of obesity. *Journal of Clinical Oncology*, 34, 4295–4305. <http://dx.doi.org/10.1200/JCO.2016.66.8806>
- Ali, M. K., Echouffo-Tcheugui, J., & Williamson, D. F. (2012). How effective were lifestyle interventions in real-world settings that were modeled on the Diabetes Prevention Program? *Health Affairs*, 31, 67–75. <http://dx.doi.org/10.1377/hlthaff.2011.1009>
- Allom, V., & Mullan, B. (2015). Two inhibitory control training interventions designed to improve eating behaviour and determine mechanisms of change. *Appetite*, 89, 282–290. <http://dx.doi.org/10.1016/j.appet.2015.02.022>
- American Medical Association. (2013). *Business of the American Medical Association Host of Delegates 2013 Annual Meeting*. Retrieved 15 March, 2018, from https://www.ama-assn.org/sites/default/files/media-browser/public/hod/a13-csaph-reports_0.pdf
- Anderson, L. M., Quinn, T. A., Glanz, K., Ramirez, G., Kahwati, L. C., Johnson, D. B., . . . Task Force on Community Preventive Services. (2009). The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity: A systematic review. *American Journal of Preventive Medicine*, 37, 340–357. <http://dx.doi.org/10.1016/j.amepre.2009.07.003>
- Armstrong, M. J., Mottershead, T. A., Ronksley, P. E., Sigal, R. J., Campbell, T. S., & Hemmelgarn, B. R. (2011). Motivational interviewing to improve weight loss in overweight and/or obese patients: A systematic review and meta-analysis of randomized controlled trials. *Obesity Reviews*, 12, 709–723.
- Balantekin, K. N., Hayes, J. F., Sheinbein, D. H., Kolko, R. P., Stein, R. I., Saelens, B. E., . . . Wilfley, D. E. (2017). Patterns of eating disorder pathology are associated with weight change in family-based behavioral obesity treatment. *Obesity*, 25, 2115–2122. <http://dx.doi.org/10.1002/oby.22028>
- Benoit, R. G., Gilbert, S. J., & Burgess, P. W. (2011). A neural mechanism mediating the impact of episodic prospection on farsighted decisions. *Journal of Neuroscience*, 31, 6771–6779. <http://dx.doi.org/10.1523/JNEUROSCI.6559-10.2011>
- Best, J. R., Theim, K. R., Gredysa, D. M., Stein, R. I., Welch, R. R., Saelens, B. E., . . . Wilfley, D. E. (2012). Behavioral economic predictors of overweight children's weight loss. *Journal of Consulting and Clinical Psychology*, 80, 1086–1096. <http://dx.doi.org/10.1037/a0029827>
- Bouton, M. E. (2002). Context, ambiguity, and unlearning: Sources of relapse after behavioral extinction. *Biological Psychiatry*, 52, 976–986. [http://dx.doi.org/10.1016/S0006-3223\(02\)01546-9](http://dx.doi.org/10.1016/S0006-3223(02)01546-9)
- Branscum, P., & Sharma, M. (2011). A systematic analysis of childhood obesity prevention interventions targeting Hispanic children: Lessons learned from the previous decade. *Obesity Reviews*, 12(5), e151–e158. <http://dx.doi.org/10.1111/j.1467-789X.2010.00809.x>
- Brisbois, T. D., Farmer, A. P., & McCargar, L. J. (2012). Early markers of adult obesity: A review. *Obesity Reviews*, 13, 347–367. <http://dx.doi.org/10.1111/j.1467-789X.2011.00965.x>
- Brownson, R. C., Colditz, G. A., & Proctor, E. K. (Eds.). (2012). *Dissemination and implementation research in health: Translating science to practice*. New York, NY: Oxford University Press. <http://dx.doi.org/10.1093/acprof:oso/9780199751877.001.0001>
- Burke, L. E., Wang, J., & Sevvick, M. A. (2011). Self-monitoring in weight loss: A systematic review of the literature. *Journal of the American Dietetic Association*, 111, 92–102. <http://dx.doi.org/10.1016/j.jada.2010.10.008>
- Butryn, M. L., Phelan, S., Hill, J. O., & Wing, R. R. (2007). Consistent self-monitoring of weight: A key component of successful weight loss maintenance. *Obesity*, 15, 3091–3096. <http://dx.doi.org/10.1038/oby.2007.368>
- Centers for Disease Control and Prevention. (2015). *Centers for disease control and prevention diabetes prevention recognition program: Standards and operating procedures*. Atlanta, GA: Author.
- Christakis, N. A., & Fowler, J. H. (2007). The spread of obesity in a large social network over 32 years. *New England Journal of Medicine*, 357, 370–379. <http://dx.doi.org/10.1056/NEJMs066082>
- Cunningham, S. A., Kramer, M. R., & Narayan, K. V. (2014). Incidence of childhood obesity in the United States. *New England Journal of Medicine*, 370, 403–411. <http://dx.doi.org/10.1056/nejmoa1309753>
- Daniel, T. O., Said, M., Stanton, C. M., & Epstein, L. H. (2015). Episodic future thinking reduces delay discounting and energy intake in children. *Eating Behaviors*, 18, 20–24. <http://dx.doi.org/10.1016/j.eatbeh.2015.03.006>
- Daubenmier, J., Moran, P. J., Kristeller, J., Acree, M., Bacchetti, P., Kemeny, M. E., . . . Hecht, F. M. (2016). Effects of a mindfulness-based weight loss intervention in adults with obesity: A randomized clinical trial. *Obesity*, 24, 794–804. <http://dx.doi.org/10.1002/oby.21396>

- Diabetes Prevention Program Research Group. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New England Journal of Medicine*, 346, 393–403. <http://dx.doi.org/10.1056/NEJMoa012512>
- Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, 64, 135–168. <http://dx.doi.org/10.1146/annurev-psych-113011-143750>
- DiBonaventura, M., Lay, A. L., Kumar, M., Hammer, M., & Wolden, M. L. (2015). The association between body mass index and health and economic outcomes in the United States. *Journal of Occupational and Environmental Medicine*, 57, 1047–1054. <http://dx.doi.org/10.1097/JOM.0000000000000539>
- Dietz, W. H., Solomon, L. S., Pronk, N., Ziegenhorn, S. K., Standish, M., Longjohn, M. M., . . . Bradley, D. W. (2015). An integrated framework for the prevention and treatment of obesity and its related chronic diseases. *Health Affairs*, 34, 1456–1463. <http://dx.doi.org/10.1377/hlthaff.2015.0371>
- DiLillo, V., & Smith West, D. (2011). Motivational interviewing for weight loss. *Psychiatric Clinics*, 34, 861–869. <http://dx.doi.org/10.1016/j.psc.2011.08.003>
- Epstein, L. H. (2003). Development of evidence-based treatments for pediatric obesity. In A. E. Kazdin & J. R. Weisz (Eds.), *Evidence-based psychotherapies for children and adolescents* (pp. 374–388). New York, NY: Guilford Press.
- Epstein, L. H., Fletcher, K. D., O'Neill, J., Roemmich, J. N., Raynor, H., & Bouton, M. E. (2013). Food characteristics, long-term habituation and energy intake. Laboratory and field studies. *Appetite*, 60, 40–50. <http://dx.doi.org/10.1016/j.appet.2012.08.030>
- Epstein, L. H., Jankowiak, N., Fletcher, K. D., Carr, K. A., Nederkoorn, C., Raynor, H. A., & Finkelstein, E. (2014). Women who are motivated to eat and discount the future are more obese. *Obesity*, 22, 1394–1399. <http://dx.doi.org/10.1002/oby.20661>
- Epstein, L. H., McKenzie, S. J., Valoski, A., Klein, K. R., & Wing, R. R. (1994). Effects of mastery criteria and contingent reinforcement for family-based child weight control. *Addictive Behaviors*, 19, 135–145. [http://dx.doi.org/10.1016/0306-4603\(94\)90038-8](http://dx.doi.org/10.1016/0306-4603(94)90038-8)
- Epstein, L. H., Paluch, R. A., Kilanowski, C. K., & Raynor, H. A. (2004). The effect of reinforcement or stimulus control to reduce sedentary behavior in the treatment of pediatric obesity. *Health Psychology*, 23, 371–380. <http://dx.doi.org/10.1037/0278-6133.23.4.371>
- Epstein, L. H., Paluch, R. A., Roemmich, J. N., & Beecher, M. D. (2007). Family-based obesity treatment, then and now: Twenty-five years of pediatric obesity treatment. *Health Psychology*, 26, 381–391. <http://dx.doi.org/10.1037/0278-6133.26.4.381>
- Epstein, L. H., Roemmich, J. N., Stein, R. I., Paluch, R. A., & Kilanowski, C. K. (2005). The challenge of identifying behavioral alternatives to food: Clinic and field studies. *Annals of Behavioral Medicine*, 30, 201–209. http://dx.doi.org/10.1207/s15324796abm3003_4
- Epstein, L. H., & Wrotniak, B. H. (2010). Future directions for pediatric obesity treatment. *Obesity*, 18(Suppl. 1), S8–S12. <http://dx.doi.org/10.1038/oby.2009.425>
- Fabricatore, A. N., Wadden, T. A., Higginbotham, A. J., Faulconbridge, L. F., Nguyen, A. M., Heymsfield, S. B., & Faith, M. S. (2011). Intentional weight loss and changes in symptoms of depression: A systematic review and meta-analysis. *International Journal of Obesity*, 35, 1363–1376. <http://dx.doi.org/10.1038/ijo.2011.2>
- Fitzgibbon, M. L., Tussing-Humphreys, L. M., Porter, J. S., Martin, I. K., Odoms-Young, A., & Sharp, L. K. (2012). Weight loss and African-American women: A systematic review of the behavioural weight loss intervention literature. *Obesity Reviews*, 13, 193–213. <http://dx.doi.org/10.1111/j.1467-789X.2011.00945.x>
- Ford, A. L., Hunt, L. P., Cooper, A., & Shield, J. P. (2010). What reduction in BMI SDS is required in obese adolescents to improve body composition and cardiometabolic health? *Archives of Disease in Childhood*, 95, 256–261. <http://dx.doi.org/10.1136/adc.2009.165340>
- Forman, E. M., & Butryn, M. L. (2015). A new look at the science of weight control: How acceptance and commitment strategies can address the challenge of self-regulation. *Appetite*, 84, 171–180. <http://dx.doi.org/10.1016/j.appet.2014.10.004>
- Forman, E. M., Butryn, M. L., Manasse, S. M., Crosby, R. D., Goldstein, S. P., Wyckoff, E. P., & Thomas, J. G. (2016). Acceptance-based versus standard behavioral treatment for obesity: Results from the mind your health randomized controlled trial. *Obesity*, 24, 2050–2056. <http://dx.doi.org/10.1002/oby.21601>
- Goldschmidt, A. B., Aspen, V. P., Sinton, M. M., Tanofsky-Kraff, M., & Wilfley, D. E. (2008). Disordered eating attitudes and behaviors in overweight youth. *Obesity*, 16, 257–264. <http://dx.doi.org/10.1038/oby.2007.48>
- Goldschmidt, A. B., Best, J. R., Stein, R. I., Saelens, B. E., Epstein, L. H., & Wilfley, D. E. (2014). Predictors of child weight loss and maintenance among family-based treatment completers. *Journal of Consulting and Clinical Psychology*, 82, 1140–1150. <http://dx.doi.org/10.1037/a0037169>
- Goldschmidt, A. B., Wilfley, D. E., Paluch, R. A., Roemmich, J. N., & Epstein, L. H. (2013). Indicated prevention of adult obesity: How much weight change is necessary for normalization of weight status in children? *Journal of the American Medical Association Pediatrics*, 167, 21–26. <http://dx.doi.org/10.1001/jamapediatrics.2013.416>
- Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology*, 38, 69–119. [http://dx.doi.org/10.1016/S0065-2601\(06\)38002-1](http://dx.doi.org/10.1016/S0065-2601(06)38002-1)
- Gorin, A., Phelan, S., Tate, D., Sherwood, N., Jeffery, R., & Wing, R. (2005). Involving support partners in obesity treatment. *Journal of Consulting and Clinical Psychology*, 73, 341–343. <http://dx.doi.org/10.1037/0022-006X.73.2.341>
- Gorin, A. A., Raynor, H. A., Fava, J., Maguire, K., Robichaud, E., Trautvetter, J., . . . Wing, R. R. (2013). Randomized controlled trial of a comprehensive home environment-focused weight-loss program for adults. *Health Psychology*, 32, 128–137. <http://dx.doi.org/10.1037/a0026959>
- Hartlieb, K. B., Naar, S., Ledgerwood, D. M., Templin, T. N., Ellis, D. A., Donohue, B., & Cunningham, P. B. (2017). Contingency management adapted for African-American adolescents with obesity enhances youth weight loss with caregiver participation: A multiple baseline pilot study. *International Journal of Adolescent Medicine and Health*, 29(3), 20150091. <http://dx.doi.org/10.1515/ijamh-2015-0091>
- Hayes, J. F., Altman, M., Coppock, J. H., Wilfley, D. E., & Goldschmidt, A. B. (2015). Recent updates on the efficacy of group-based treatments for pediatric obesity. *Current Cardiovascular Risk Reports*, 9, 16. <http://dx.doi.org/10.1007/s12170-015-0443-8>
- Hayes, J. F., Altman, M., Kolko, R. P., Balantekin, K. N., Holland, J. C., Stein, R. I., . . . Wilfley, D. E. (2016). Decreasing food fussiness in children with obesity leads to greater weight loss in family-based treatment. *Obesity*, 24, 2158–2163. <http://dx.doi.org/10.1002/oby.21622>
- Hayes, J. F., Eichen, D. M., Barch, D. M., & Wilfley, D. E. (2018). Executive function in childhood obesity: Promising intervention strategies to optimize treatment outcomes. *Appetite*, 124, 10–23. <http://dx.doi.org/10.1016/j.appet.2017.05.040>
- Inge, T. H., Krebs, N. F., Garcia, V. F., Skelton, J. A., Guice, K. S., Strauss, R. S., . . . Daniels, S. R. (2004). Bariatric surgery for severely overweight adolescents: Concerns and recommendations. *Pediatrics*, 114, 217–223. <http://dx.doi.org/10.1542/peds.114.1.217>
- Jacques-Tiura, A. J., & Greenwald, M. K. (2016). Behavioral economic factors related to pediatric obesity. *Pediatric Clinics of North America*, 63, 425–446. <http://dx.doi.org/10.1016/j.pcl.2016.02.001>
- Janicke, D. M., Fritz, A. M., & Rozensky, R. H. (2015). Healthcare reform and preparing the future clinical child and adolescent psychology work-

- force. *Journal of Clinical Child and Adolescent Psychology*, 44, 1030–1039. <http://dx.doi.org/10.1080/15374416.2015.1050725>
- Jansen, A., Houben, K., & Roefs, A. (2015). A cognitive profile of obesity and its translation into new interventions. *Frontiers in Psychology*, 6, 1807. <http://dx.doi.org/10.3389/fpsyg.2015.01807>
- John, L. K., Loewenstein, G., Troxel, A. B., Norton, L., Fassbender, J. E., & Volpp, K. G. (2011). Financial incentives for extended weight loss: A randomized, controlled trial. *Journal of General Internal Medicine*, 26, 621–626. <http://dx.doi.org/10.1007/s11606-010-1628-y>
- Jones, A., Di Lemma, L. C., Robinson, E., Christiansen, P., Nolan, S., Tudur-Smith, C., & Field, M. (2016). Inhibitory control training for appetitive behaviour change: A meta-analytic investigation of mechanisms of action and moderators of effectiveness. *Appetite*, 97, 16–28. <http://dx.doi.org/10.1016/j.appet.2015.11.013>
- Kabat-Zinn, J. (2015). Mindfulness. *Mindfulness*, 6, 1481–1483. <http://dx.doi.org/10.1007/s12671-015-0456-x>
- Kong, A., Tussing-Humphreys, L. M., Odoms-Young, A. M., Stolley, M. R., & Fitzgibbon, M. L. (2014). Systematic review of behavioural interventions with culturally adapted strategies to improve diet and weight outcomes in African American women. *Obesity Reviews*, 15(Suppl. 4), 62–92. <http://dx.doi.org/10.1111/obr.12203>
- Kreuter, M. W., Lukwago, S. N., Bucholtz, R. D., Clark, E. M., & Sanders-Thompson, V. (2003). Achieving cultural appropriateness in health promotion programs: Targeted and tailored approaches. *Health Education & Behavior*, 30, 133–146. <http://dx.doi.org/10.1177/1090198102251021>
- Kristeller, J., Wolever, R. Q., & Sheets, V. (2014). Mindfulness-Based Eating Awareness Training (MB-EAT) for binge eating: A randomized clinical trial. *Mindfulness*, 5, 282–297. <http://dx.doi.org/10.1007/s12671-012-0179-1>
- Kuczmarski, R. J., Ogden, C. L., Grummer-Strawn, L. M., Flegal, K. M., Guo, S. S., & Wei, R. (2000). *CDC growth charts for the United States: Methods and development*. Hyattsville, MD: National Center of Health Statistics.
- Kulik, N., Valle, C. G., & Tate, D. F. (2016). Friend and family support for weight loss in adolescent females. *Childhood Obesity*, 12, 44–51. <http://dx.doi.org/10.1089/chi.2015.0044>
- Kumanyika, S. K., Wadden, T. A., Shults, J., Fassbender, J. E., Brown, S. D., Bowman, M. A., . . . Wu, X. (2009). Trial of family and friend support for weight loss in African American adults. *Archives of Internal Medicine*, 169, 1795–1804. <http://dx.doi.org/10.1001/archinternmed.2009.337>
- LeBlanc, E. S., O'Connor, E., Whitlock, E. P., Patnode, C. D., & Kapka, T. (2011). Effectiveness of primary care-relevant treatments for obesity in adults: A systematic evidence review for the U.S. Preventive Services Task Force. *Annals of Internal Medicine*, 155, 434–447. <http://dx.doi.org/10.7326/0003-4819-155-7-201110040-00006>
- Levy, R. L., Finch, E. A., Crowell, M. D., Talley, N. J., & Jeffery, R. W. (2007). Behavioral intervention for the treatment of obesity: Strategies and effectiveness data. *American Journal of Gastroenterology*, 102, 2314–2321. <http://dx.doi.org/10.1111/j.1572-0241.2007.01342.x>
- Lillis, J., Hayes, S. C., Bunting, K., & Masuda, A. (2009). Teaching acceptance and mindfulness to improve the lives of the obese: A preliminary test of a theoretical model. *Annals of Behavioral Medicine*, 37, 58–69. <http://dx.doi.org/10.1007/s12160-009-9083-x>
- Look AHEAD Research Group. (2014). Eight-year weight losses with an intensive lifestyle intervention: The Look AHEAD study. *Obesity*, 22, 5–13. <http://dx.doi.org/10.1002/oby.20662>
- Lundahl, B., Moleni, T., Burke, B. L., Butters, R., Tollefson, D., Butler, C., & Rollnick, S. (2013). Motivational interviewing in medical care settings: A systematic review and meta-analysis of randomized controlled trials. *Patient Education and Counseling*, 93, 157–168. <http://dx.doi.org/10.1016/j.pec.2013.07.012>
- Luszczynska, A., Sobczyk, A., & Abraham, C. (2007). Planning to lose weight: Randomized controlled trial of an implementation intention prompt to enhance weight reduction among overweight and obese women. *Health Psychology*, 26, 507–512. <http://dx.doi.org/10.1037/0278-6133.26.4.507>
- Macpherson-Sánchez, A. E. (2015). Integrating fundamental concepts of obesity and eating disorders: Implications for the obesity epidemic. *American Journal of Public Health*, 105, e71–e85. <http://dx.doi.org/10.2105/AJPH.2014.302507>
- Mann, T., de Ridder, D., & Fujita, K. (2013). Self-regulation of health behavior: Social psychological approaches to goal setting and goal striving. *Health Psychology*, 32, 487–498. <http://dx.doi.org/10.1037/a0028533>
- Martin, C. K., Bhapkar, M., Pittas, A. G., Pieper, C. F., Das, S. K., Williamson, D. A., . . . Roberts, S. B. (2016). Effect of calorie restriction on mood, quality of life, sleep, and sexual function in healthy nonobese adults: The CALERIE 2 randomized clinical trial. *Journal of the American Medical Association Internal Medicine*, 176, 743–752. <http://dx.doi.org/10.1001/jamainternmed.2016.1189>
- Miller, W. R., & Rollnick, S. (2012). *Motivational interviewing: Helping people change*. New York, NY: Guilford Press.
- Mockus, D. S., Macera, C. A., Wingard, D. L., Peddecord, M., Thomas, R. G., & Wilfley, D. E. (2011). Dietary self-monitoring and its impact on weight loss in overweight children. *International Journal of Pediatric Obesity*, 6, 197–205. <http://dx.doi.org/10.3109/17477166.2011.590196>
- Moyer, V. A., & U.S. Preventive Services Task Force. (2012). Screening for and management of obesity in adults: U.S. Preventive Services Task Force recommendation statement. *Annals of Internal Medicine*, 157, 373–378. <http://dx.doi.org/10.7326/0003-4819-157-5-201209040-00475>
- Naar-King, S., Ellis, D. A., Idalski Carcone, A., Templin, T., Jacques-Tiura, A. J., Brogan Hartlieb, K., . . . Jen, K. L. C. (2016). Sequential multiple assignment randomized trial (SMART) to construct weight loss interventions for African American adolescents. *Journal of Clinical Child and Adolescent Psychology*, 45, 428–441. <http://dx.doi.org/10.1080/15374416.2014.971459>
- Neve, M., Morgan, P. J., Jones, P. R., & Collins, C. E. (2010). Effectiveness of web-based interventions in achieving weight loss and weight loss maintenance in overweight and obese adults: A systematic review with meta-analysis. *Obesity Reviews*, 11, 306–321. <http://dx.doi.org/10.1111/j.1467-789X.2009.00646.x>
- O'Connor, E. A., Evans, C. V., Burda, B. U., Walsh, E. S., Eder, M., & Lozano, P. (2017). Screening for obesity and intervention for weight management in children and adolescents: Evidence report and systematic review for the U.S. Preventive Services Task Force. *Journal of the American Medical Association*, 317, 2427–2444. <http://dx.doi.org/10.1001/jama.2017.0332>
- Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2014). Prevalence of childhood and adult obesity in the United States, 2011–2012. *Journal of the American Medical Association*, 311, 806–814. <http://dx.doi.org/10.1001/jama.2014.732>
- Olson, K. L., & Emery, C. F. (2015). Mindfulness and weight loss: A systematic review. *Psychosomatic Medicine*, 77, 59–67. <http://dx.doi.org/10.1097/PSY.0000000000000127>
- Paul-Ebhohimhen, V., & Avenell, A. (2009). A systematic review of the effectiveness of group versus individual treatments for adult obesity. *Obesity Facts*, 2, 17–24. <http://dx.doi.org/10.1159/000186144>
- Petry, N. M. (2000). A comprehensive guide to the application of contingency management procedures in clinical settings. *Drug and Alcohol Dependence*, 58, 9–25. [http://dx.doi.org/10.1016/S0376-8716\(99\)00071-X](http://dx.doi.org/10.1016/S0376-8716(99)00071-X)
- Pimenta, F., Leal, I., Maroco, J., & Ramos, C. (2012). Brief cognitive-behavioral therapy for weight loss in midlife women: A controlled study with follow-up. *International Journal of Women's Health*, 4, 559–567. <http://dx.doi.org/10.2147/IJWH.S35246>

- Proctor, E., Silmere, H., Raghavan, R., Hovmand, P., Aarons, G., Bunger, A., . . . Hensley, M. (2011). Outcomes for implementation research: Conceptual distinctions, measurement challenges, and research agenda. *Administration and Policy in Mental Health and Mental Health Services Research*, 38, 65–76. <http://dx.doi.org/10.1007/s10488-010-0319-7>
- Puhl, R. M., & Heuer, C. A. (2010). Obesity stigma: Important considerations for public health. *American Journal of Public Health*, 100, 1019–1028. <http://dx.doi.org/10.2105/AJPH.2009.159491>
- Purnell, J. Q., Gernes, R., Stein, R., Sherraden, M. S., & Knoblock-Hahn, A. (2014). A systematic review of financial incentives for dietary behavior change. *Journal of the Academy of Nutrition and Dietetics*, 114, 1023–1035. <http://dx.doi.org/10.1016/j.jand.2014.03.011>
- Quattrin, T., Roemmich, J. N., Paluch, R., Yu, J., Epstein, L. H., & Ecker, M. A. (2014). Treatment outcomes of overweight children and parents in the medical home. *Pediatrics*, 134, 290–297. <http://dx.doi.org/10.1542/peds.2013-4084>
- Reinehr, T., Kleber, M., Lass, N., & Toschke, A. M. (2010). Body mass index patterns over 5 y in obese children motivated to participate in a 1-y lifestyle intervention: Age as a predictor of long-term success. *American Journal of Clinical Nutrition*, 91, 1165–1171. <http://dx.doi.org/10.3945/ajcn.2009.28705>
- Saelens, B. E., & McGrath, A. M. (2003). Self-monitoring adherence and adolescent weight control efficacy. *Children's Health Care*, 32, 137–152. http://dx.doi.org/10.1207/S15326888CHC3202_5
- Salvy, S.-J., de la Haye, K., Bowker, J. C., & Hermans, R. C. (2012). Influence of peers and friends on children's and adolescents' eating and activity behaviors. *Physiology & Behavior*, 106, 369–378. <http://dx.doi.org/10.1016/j.physbeh.2012.03.022>
- Sbrocco, T., Carter, M. M., Lewis, E. L., Vaughn, N. A., Kalupa, K. L., King, S., . . . Cintrón, J. A. (2005). Church-based obesity treatment for African-American women improves adherence. *Ethnicity & disease*, 15, 246–255.
- Sepah, S. C., Jiang, L., & Peters, A. L. (2015). Long-term outcomes of a web-based diabetes prevention program: 2-year results of a single-arm longitudinal study. *Journal of Medical Internet Research*, 17(4), e92. <http://dx.doi.org/10.2196/jmir.4052>
- Skinner, B. F. (1963). Operant behavior. *American Psychologist*, 18, 503–515. <http://dx.doi.org/10.1037/h0045185>
- Skinner, A. C., Perrin, E. M., Moss, L. A., & Skelton, J. A. (2015). Cardiometabolic risks and severity of obesity in children and young adults. *New England Journal of Medicine*, 373, 1307–1317. <http://dx.doi.org/10.1056/NEJMoa1502821>
- Smith, E., Hay, P., Campbell, L., & Trollor, J. N. (2011). A review of the association between obesity and cognitive function across the lifespan: Implications for novel approaches to prevention and treatment. *Obesity Reviews*, 12, 740–755. <http://dx.doi.org/10.1111/j.1467-789X.2011.00920.x>
- Spring, B., Ockene, J. K., Gidding, S. S., Mozaffarian, D., Moore, S., Rosal, M. C., . . . Lloyd-Jones, D. (2013). Better population health through behavior change in adults: A call to action. *Circulation*, 128, 2169–2176. <http://dx.doi.org/10.1161/01.cir.0000435173.25936.e1>
- Sykes-Muskett, B. J., Prestwich, A., Lawton, R. J., & Armitage, C. J. (2015). The utility of monetary contingency contracts for weight loss: A systematic review and meta-analysis. *Health Psychology Review*, 9, 434–451. <http://dx.doi.org/10.1080/17437199.2015.1030685>
- Sze, Y. Y., Daniel, T. O., Kilanowski, C. K., Collins, R. L., & Epstein, L. H. (2015). Web-based and mobile delivery of an episodic future thinking intervention for overweight and obese families: A feasibility study. *JMIR mHealth and uHealth*, 3(4), e97. <http://dx.doi.org/10.2196/mhealth.4603>
- Tapper, K., Shaw, C., Ilesley, J., Hill, A. J., Bond, F. W., & Moore, L. (2009). Exploratory randomised controlled trial of a mindfulness-based weight loss intervention for women. *Appetite*, 52, 396–404. <http://dx.doi.org/10.1016/j.appet.2008.11.012>
- Teixeira, P. J., Carraça, E. V., Marques, M. M., Rutter, H., Oppert, J. M., De Bourdeaudhuij, I., . . . Brug, J. (2015). Successful behavior change in obesity interventions in adults: A systematic review of self-regulation mediators. *BMC Medicine*, 13, 84. <http://dx.doi.org/10.1186/s12916-015-0323-6>
- Terrace, H. S. (1966). Stimulus control. In W. K. Honig (Ed.), *Operant behavior: Areas of research and application* (pp. 271–344). New York, NY: Appleton-Century-Crofts.
- Unick, J. L., Beavers, D., Jakicic, J. M., Kitabchi, A. E., Knowler, W. C., Wadden, T. A., & Wing, R. R. (2011). Effectiveness of lifestyle interventions for individuals with severe obesity and type 2 diabetes: Results from the Look AHEAD trial. *Diabetes Care*, 34, 2152–2157. <http://dx.doi.org/10.2337/dc11-0874>
- Unick, J. L., Hogan, P. E., Neiberg, R. H., Cheskin, L. J., Dutton, G. R., Evans-Hudnall, G., . . . The Look AHEAD Research Group. (2014). Evaluation of early weight loss thresholds for identifying nonresponders to an intensive lifestyle intervention. *Obesity*, 22, 1608–1616. <http://dx.doi.org/10.1002/oby.20777>
- VanBuskirk, K. A., & Wetherell, J. L. (2014). Motivational interviewing with primary care populations: A systematic review and meta-analysis. *Journal of Behavioral Medicine*, 37, 768–780. <http://dx.doi.org/10.1007/s10865-013-9527-4>
- Veling, H., van Koningsbruggen, G. M., Aarts, H., & Stroebe, W. (2014). Targeting impulsive processes of eating behavior via the Internet. Effects on body weight. *Appetite*, 78, 102–109. <http://dx.doi.org/10.1016/j.appet.2014.03.014>
- Verbeken, S., Braet, C., Goossens, L., & van der Oord, S. (2013). Executive function training with game elements for obese children: A novel treatment to enhance self-regulatory abilities for weight-control. *Behaviour Research and Therapy*, 51, 290–299. <http://dx.doi.org/10.1016/j.brat.2013.02.006>
- Wadden, T. A., Berkowitz, R. I., Womble, L. G., Sarwer, D. B., Phelan, S., Cato, R. K., . . . Stunkard, A. J. (2005). Randomized trial of lifestyle modification and pharmacotherapy for obesity. *New England Journal of Medicine*, 353, 2111–2120. <http://dx.doi.org/10.1056/NEJMoa050156>
- Wadden, T. A., Brownell, K. D., & Foster, G. D. (2002). Obesity: Responding to the global epidemic. *Journal of Consulting and Clinical Psychology*, 70, 510–525. <http://dx.doi.org/10.1037/0022-006X.70.3.510>
- Wadden, T. A., Butryn, M. L., Hong, P. S., & Tsai, A. G. (2014). Behavioral treatment of obesity in patients encountered in primary care settings: A systematic review. *Journal of the American Medical Association*, 312, 1779–1791. <http://dx.doi.org/10.1001/jama.2014.14173>
- Wadden, T. A., Neiberg, R. H., Wing, R. R., Clark, J. M., Delahanty, L. M., Hill, J. O., . . . The Look AHEAD Research Group. (2011). Four-year weight losses in the Look AHEAD study: Factors associated with long-term success. *Obesity*, 19, 1987–1998. <http://dx.doi.org/10.1038/oby.2011.230>
- Weller, R. E., Cook, E. W., III, Avsar, K. B., & Cox, J. E. (2008). Obese women show greater delay discounting than healthy-weight women. *Appetite*, 51, 563–569. <http://dx.doi.org/10.1016/j.appet.2008.04.010>
- Wilfley, D. E., Kolko, R. P., & Kass, A. E. (2011). Cognitive-behavioral therapy for weight management and eating disorders in children and adolescents. *Child and Adolescent Psychiatric Clinics of North America*, 20, 271–285. <http://dx.doi.org/10.1016/j.chc.2011.01.002>
- Wilfley, D. E., Saelens, B. E., Stein, R. I., Best, J. R., Kolko, R. P., Schechtman, K. B., . . . Epstein, L. H. (2017). Dose, content, and mediators of family-based treatment for childhood obesity: A multisite randomized clinical trial. *Journal of the American Medical Association Pediatrics*, 171, 1151–1159. <http://dx.doi.org/10.1001/jamapediatrics.2017.2960>
- Wilfley, D. E., Staiano, A. E., Altman, M., Lindros, J., Lima, A., Hassink, S. G., . . . The Improving Access and Systems of Care for Evidence-Based Childhood Obesity Treatment Conference Workgroup. (2017).

- Improving access and systems of care for evidence-based childhood obesity treatment: Conference key findings and next steps. *Obesity*, 25, 16–29. <http://dx.doi.org/10.1002/oby.21712>
- Wilfley, D. E., Stein, R. I., Saelens, B. E., Mockus, D. S., Matt, G. E., Hayden-Wade, H. A., . . . Epstein, L. H. (2007). Efficacy of maintenance treatment approaches for childhood overweight: A randomized controlled trial. *Journal of the American Medical Association*, 298, 1661–1673. <http://dx.doi.org/10.1001/jama.298.14.1661>
- Williamson, D. A., Rejeski, J., Lang, W., Van Dorsten, B., Fabricatore, A. N., Toledo, K., & Look AHEAD Research Group. (2009). Impact of a weight management program on health-related quality of life in overweight adults with type 2 diabetes. *Archives of Internal Medicine*, 169, 163–171. <http://dx.doi.org/10.1001/archinternmed.2008.544>
- Williamson, D. A., Walden, H. M., White, M. A., York-Crowe, E., Newton, R. L., Jr., Alfonso, A., . . . Ryan, D. (2006). Two-year Internet-based randomized controlled trial for weight loss in African-American girls. *Obesity*, 14, 1231–1243. <http://dx.doi.org/10.1038/oby.2006.140>
- Wing, R. R. (2002). Behavioral weight control. In T. A. Wadden & A. J. Stunkard (Eds.), *Handbook of obesity treatment* (pp. 301–317). New York, NY: Guilford Press.
- Wing, R. R., & Jeffery, R. W. (1999). Benefits of recruiting participants with friends and increasing social support for weight loss and maintenance. *Journal of Consulting and Clinical Psychology*, 67, 132–138. <http://dx.doi.org/10.1037/0022-006X.67.1.132>
- Wing, R. R., & Phelan, S. (2005). Long-term weight loss maintenance. *American Journal of Clinical Nutrition*, 82(1, Suppl.), 222S–225S. <http://dx.doi.org/10.1093/ajcn/82.1.222S>
- Winston, G. J., Phillips, E. G., Wethington, E., Devine, C., Wells, M., Peterson, J. C., . . . Charlson, M. (2015). Social network characteristics associated with weight loss among Black and Hispanic adults. *Obesity*, 23, 1570–1576. <http://dx.doi.org/10.1002/oby.21155>
- Wrotniak, B. H., Epstein, L. H., Paluch, R. A., & Roemmich, J. N. (2004). Parent weight change as a predictor of child weight change in family-based behavioral obesity treatment. *Archives of Pediatrics & Adolescent Medicine*, 158, 342–347. <http://dx.doi.org/10.1001/archpedi.158.4.342>
- Yalom, I. D. (2005). *The theory and practice of group psychotherapy* (5th ed.). New York, NY: Basic Books.
- Young, K. M., Northern, J. J., Lister, K. M., Drummond, J. A., & O'Brien, W. H. (2007). A meta-analysis of family-behavioral weight-loss treatments for children. *Clinical Psychology Review*, 27, 240–249. <http://dx.doi.org/10.1016/j.cpr.2006.08.003>

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