Published in final edited form as:

Cogn Behav Pract. 2013 May 1; 20(2): 147–161. doi:10.1016/j.cbpra.2012.04.001.

Cognitive Behavioral Treatment for Recurrent Binge Eating in Adolescent Girls: A Pilot Trial

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Abstract

There is a need for treatment interventions to address the high prevalence of disordered eating throughout adolescence and early adulthood. We developed an adolescent-specific manualized CBT protocol to treat female adolescents with recurrent binge eating and tested its efficacy in a small, pilot randomized controlled trial. We present lessons learned in recruiting adolescents, a description of our treatment approach, acceptability of the treatment for teens and parents, as well as results from the pilot trial. Participants in the CBT group had significantly fewer posttreatment eating binges than those in a treatment as usual/delayed treatment (TAU-DT) control group; 100% of CBT participants were abstinent at follow-up. Our results provide preliminary support for the efficacy of this adolescent adaptation of evidence-based CBT for recurrent binge eating. The large, robust effect size estimate observed for the main outcome (NNT=2) places this among the larger effects observed for any mental health intervention.

Keywords

adolescent; cognitive-behavioral; disordered eating; female; binge eating

The community prevalence of binge eating behavior among children and adolescents is high, with estimates ranging from 6% to 40% (Croll, Neumark-Sztainer, Story, & Ireland, 2002; French et al., 1997; Greenfeld, Quinlan, Harding, Glass, & Bliss, 1987; Johnson, Rohan, & Kirk, 2002; Neumark-Sztainer, Story, Resnick, & Blum, 1997). Evidence indicates clinically significant distress and impairment among individuals who engage in regular binge eating, even at thresholds lower than those required for a diagnosis of binge eating disorder (BED) or bulimia nervosa (BN; le Grange, Loeb, Van Orman, & Jellar, 2004; Wilson & Sysko, 2009). Experts have noted the possible deleterious trajectory for young women whose eating disorder symptoms go untreated (Johnson, Cohen, Kasen, & Brook, 2002; Striegel-Moore, Seeley, & Lewinsohn, 2003), and recent studies suggest that those who engage in dieting and disordered eating behaviors during adolescence are at increased risk for those behaviors 10 years later (Neumark-Sztainer, Wall, Larson, Eisenberg, & Loth, 2011). Binge eating increases the future risk for other psychiatric disorders, including anxiety disorders, depressive disorders, and substance abuse (Lewinsohn, Striegel-Moore, & Seeley, 2000).

Binge eating also increases the risk for future weight gain and onset of obesity in adolescent girls (Stice, Cameron, Killen, Hayward, & Taylor, 1999; Stice, Presnell, & Spangler, 2002). Hence, it is reasonable to predict that treating binge eating might also prevent obesity. Pediatric obesity is a significant public health concern, and few treatment studies have been able to demonstrate enduring effects on weight loss (Whitlock, O'Connor, Williams, Beil, & Lutz, 2010). As such, prevention has been suggested as an important approach to reducing the prevalence of obesity (Baur, 2008; Story, Sallis, & Orleans, 2009; Styne & Shaikh, 2009).

Despite a paucity of data on evidence-based treatments for adolescent binge-related disorders, the use of cognitive behavioral (CBT), family-based (FBT), and interpersonal (IPT) therapies have all received research attention. CBT has been shown to be an effective treatment for binge eating in adults (Brownley, Berkman, Sedway, Lohr, & Bulik, 2007; Striegel-Moore, Wilson, et al., 2010; Wilson, Grilo, & Vitousek, 2007) and is recommended as the psychological treatment of choice for BED and BN (National Collaborating Centre for Mental Health, 2004). Adolescent adaptation of the adult CBT protocol for binge eating–related disorders makes conceptual and clinical sense (Schmidt, 2009; Wilson & Sysko, 2006). In a case series report, Lock (2005) suggested that developmentally adapted CBT for adolescents with BN was acceptable to participants and resulted in outcomes similar to those reported in adult trials of CBT for BN (i.e., decreases in binge eating and purging and similar abstinence rates). This finding was replicated in another case series of adolescent females (Schapman-Williams, Lock, & Couturier, 2006).

Schmidt and colleagues (Schmidt et al., 2007) evaluated the efficacy of CBT-guided self-care compared to FBT for adolescents with BN or an eating disorder not otherwise specified (EDNOS). Binge eating was significantly reduced posttreatment for those receiving CBT compared to those randomized into FBT, although no differences between the conditions were observed at the 12-month follow-up. Despite the lack of sustained advantage, the authors noted that guided self-care CBT appeared to have three advantages over FBT: lower cost, faster reduction of binge eating episodes, and better acceptance by adolescents. Although the CBT condition did not require familial participation, it did require the involvement of a “close other” support person (a parent, another relative, or a patient-chosen “partner”) whose role was to assist and support the patient. Nearly 30% of adolescents who declined to participate in the study cited family involvement as their reason for refusal. However, le Grange, Crosby, Rathouz, and Leventhal (2007) showed that FBT was significantly more effective than supportive psychotherapy in reducing binge eating and purging among adolescents.

Finally, IPT has also demonstrated efficacy in reducing binge eating and associated psychopathology among adults (Tanofsky-Kraff et al., 2010; Wilson et al., 2007). Evidence suggests that IPT may have a weight-stabilizing effect for adults with BED who, without treatment, are expected to gain excess weight over time (Tanofsky-Kraff et al., 2007). Tanofsky-Kraff and colleagues (Tanofsky-Kraff et al., 2010) conducted a pilot study of IPT for decreasing loss-of-control eating (LOC) and preventing weight gain in adolescents at risk for obesity. The authors suggest that although full-syndrome BED is less common in youth than adults, the prevalence of LOC eating among overweight adolescents is substantial. This study, which compared a group-format IPT for prevention of excessive weight gain (IPT-WG) to a group-format standard health-education control, found that IPT-WG was acceptable to participants and that recruitment and intervention were feasible. Results suggested that those participants who endorsed LOC at baseline and received IPT-WG had significantly greater reductions in binge episodes than those in the control condition. Regardless of LOC status at baseline, significantly more IPT-WG participants experienced lower-than-expected weight gain at 1-year follow-up. Parents were not involved in the intervention.

Collectively, these studies reveal different ways of adapting binge eating treatment for adolescents. First, a central focus on eating behavior may result in more rapid and sustained changes. Thus, approaches such as CBT with a primary and explicit focus on changing eating patterns may be more appropriate for adolescents than interventions in which a more general focus on psychological support or family dynamics takes precedence. Nevertheless, we have seen promise in treatments that address deficits in interpersonal and social skills and focus on coping with subsequent negative emotions that may ultimately result in binge eating (Tanofsky-Kraff et al., 2010). Hence, a secondary focus on the developmental milestones of adolescence may be helpful. Finally, it is not clear from the trials conducted to date whether parental involvement enhances outcomes. Schmidt and colleagues (2007) suggested that requiring such involvement may reduce youth willingness to seek help. Treatment studies focusing on other mental health disorders, such as depression, demonstrate that adolescents are reluctant to have family involved in treatment (Brent et al., 1997). Accordingly, it appears reasonable to explore treatments that judiciously limit or minimize parental involvement.

The principal aim of this study was to develop and test an adolescent-specific, manualized CBT protocol to treat adolescents with BEDs based on the recommended treatment of choice for adults with such disorders (Wilson & Sysko, 2006). Our approach was further informed by our experiences in the prevention and treatment of adolescent depression (Brent et al., 2008; Clarke et al., 2005; Garber et al., 2009). Here we present lessons learned in recruiting adolescents for this trial, a description of our treatment approach, findings regarding the acceptability of the treatment for teens and parents, as well as results from an initial pilot examination of the efficacy of this intervention.

Method

Overall Study Design and Setting

This study was conducted within a large not-for-profit health maintenance organization (HMO) in the northwestern United States. After initial pilot work to refine the intervention approach, we randomized half of the recruited adolescents to CBT and half to a 6-month treatment as usual/delayed treatment (TAU-DT) control condition. All participants were permitted to use the full treatment resources offered through the HMO during the course of the study. Whereas HMO youth-appropriate eating and weight-related services are somewhat limited, it was important that teens were able to seek any health services that they or their health care providers believed were warranted. This also ensured a more

conservative, ecologically credible test of the relative benefits of the experimental intervention over TAU. All youth health care contacts within the HMO and all services referred outside the HMO are recorded in a single, comprehensive electronic medical record (EMR), which was employed to characterize TAU for participants.

Participants and Recruitment

All female adolescents enrolled in the HMO ages 12 to 18 were contacted for potential recruitment during a 10-month period (June 2007–March 2008). Simultaneously the EMR was routinely monitored for additional incident cases of binge-related eating disorders to invite identified youth, and the study was publicized within the HMO to allow physician- and self-referral. When girls were identified for potential recruitment, they were mailed a study brochure and invited to complete either a paper-and-pencil or online screening questionnaire (described below). Girls who endorsed diagnostically significant items on the screening questionnaire received a follow-up phone call to determine whether they met study inclusion criteria. The study inclusion criteria were designed to identify either those with recurrent binge eating only or those with recurrent binge eating and reported using of compensatory behaviors (self-induced vomiting, laxative use, or diuretic use). Inclusion criteria included the following: 12 to 18 years of age and not yet in college at time of enrollment; membership in the health plan; currently living with a parent; reporting objective binge eating episodes (OBEs) at a minimum average frequency of once a week for the preceding 3 months (recurrent binge eating).

We excluded individuals with diagnostic codes in the EMR that indicated psychosis or severe cognitive impairment, those with a Body Mass Index (BMI) lower than 18 or higher than 40, and those who were currently pregnant. All eligible participants were invited to enroll in the trial. Figure 1 shows the flow of participants through all study events. Those conducting the diagnostic assessments and the intervention for the study included master's-level counselors and doctoral-level clinical psychologists.

Measures

Randomized participants were assessed at baseline and 3 and 6 months post-randomization. Those randomized to the TAU-DT control condition were also assessed at baseline and months 3 and 6; in addition, they received 9- and 12-month assessments to measure their immediate and long-term outcomes following delayed treatment initiated after their 6-month assessment. Simultaneous with adolescent assessments, parents were asked to complete a brief questionnaire that included questions about their teen's demographic (e.g., age, ethnicity, income) and physical (e.g., current height and weight) characteristics, eating disorder symptoms, past eating disorder status (Nangle, Johnson, Carr-Nangle, & Engler, 1994), and non-study-related eating disorder treatment. Assessors were blinded to participant treatment condition.

Screening Questionnaire—To encourage response, the screening questionnaire was designed to simulate broad health quizzes found in popular magazines and written to appeal to a teen audience. Survey questions had a binary response format and included items such as: Do you feel bad about yourself because you don't like your appearance? Do you think teen girls are under more pressure to look like celebrities or models in magazines now than in the past? Embedded within these conversational and rapport-building questions were three screening items adopted from the eating disorder module of the Patient Health Questionnaire (PHQ) (Spitzer, Kroenke, & Williams, 1999), which focused on loss of control, binge eating, and purging. Our group's previous work suggests the utility of the PHQ for identifying binge-related disorders (Striegel-Moore, Perrin, et al., 2010). Participants who endorsed *any* of the key screening questions, an intentionally low

specificity threshold, were contacted for a secondary telephone screening to confirm that they had experienced at least one binge eating episode over the previous 3-month period and were otherwise study eligible. Consistent with the 4th edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*; American Psychiatric Association, 1994), binge eating episodes were defined as eating episodes that involved consuming more than what most people would eat under similar circumstances during a 2-hour period and experiencing a loss of control during the episodes.

We conducted baseline and follow-up assessments between 2007 and 2009, using the instruments described below.

Specific Eating Psychopathology—To interview eligible participants, we used a modified version of the Eating Disorder Examination (EDE; Fairburn & Cooper, 1993), a widely used semistructured interview for establishing *DSM-IV* diagnoses of eating disorders and dimensional eating behavior ratings (e.g., dietary restraint and concerns about weight, shape, and eating). The reliability and validity of the EDE have been well established (Fairburn, 2008), and it has been used in several studies to assess eating disorders among youth (Binford & le Grange, 2005; Binford, le Grange, & Jellar, 2005; Chen & le Grange, 2007; Eddy, Celio, Hoste, Herzog, & le Grange, 2008; le Grange et al., 2007; Schapman-Williams et al., 2006). We simplified the EDE's language to suit an adolescent audience and adopted the card sort task from the Child Eating Disorder Examination (chEDE; Bryant-Waugh, Cooper, Taylor, & Lask, 1996) as a more concrete means of assessing overvaluation of shape and weight. Although we did not determine interrater reliability of the diagnostic interviews for this study, the staff who conducted the diagnostic interviews were trained within the context of an earlier study in which high interrater reliability was found for EDE diagnoses as well as assessment of OBE days and number of OBEs (Striegel-Moore, Wilson, et al., 2010).

General Psychopathology—Because anxiety, depression, and substance abuse are associated with disordered eating in adolescents (Lewinsohn et al., 2000), we included self-report screening and symptom measures of these psychological constructs. These included the 41-item Screen for Child Anxiety Related Emotional Disorders (SCARED; Birmaher et al., 1997), the 21-item Beck Depression Inventory (BDI; Beck, Steer, & Brown, 1986), and the 6-item CRAFFT (Knight et al., 1999) to assess substance abuse. These instruments have demonstrated good reliability and validity in numerous adolescent studies (Arnau, Meagher, Norris, & Bramson, 2001; Beck, Steer, Ball, & Ranieri, 1996; Birmaher et al., 1997; Knight, Sherritt, Shrier, Harris, & Chang, 2002; Levy et al., 2004).

Psychosocial Functioning—We included a measure of adaptive functioning to examine possible secondary intervention effects. The 23-item Youth Social Adjustment Scale (Weissman, Orvaschel, & Padian, 1980) measures adjustment in school behavior, relations with friends, use of spare time, family behavior, and dating habits.

Treatment Process—We used the 8-item self-report Client Satisfaction Questionnaire (Larsen, Attkisson, Hargreaves, & Nguyen, 1979) to determine patient satisfaction with the treatment. Additionally, we collected ratings of patients' adherence to the intervention at each session, including attendance, daily monitoring record completion, and homework completion rates. These ratings, combined with responses on the Working Alliance Inventory–Short Form (Tracey & Kokotovic, 1989), a 12-item measure of therapeutic alliance, were included to provide an estimate of treatment acceptability and satisfaction among adolescents and families.

Use of Health Plan Services—For all participants, HMO service use during the 3 months post-randomization was extracted from the EMR and coded into four mutually exclusive categories: weight-related services, eating disorders–related services, medications for mental health problems, and all other services. We also created a category for receipt of anti-depressant medications and a composite category for all medications, including those for mental health.

Intervention

Developmental Adaptations—Consistent with evidence-based CBT for eating disorders in adults (Fairburn, 2008), the primary treatment focus was to help adolescents establish a regular pattern of moderate eating using self-monitoring, to learn self-control strategies, and to problem solve. Further, we built on our experience adapting CBT (Brent et al., 2008; Clarke et al., 2005; DeBar et al., 2004; DeBar & Stevens, 2007; Garber et al., 2009) as well as relevant recommendations provided by other research teams (Lock, 2005; Schapman-Williams et al., 2006) to ensure that our therapeutic approach was appropriately tailored to three specific issues deriving from adolescents' developmental needs: (a) limitations in abstract reasoning and executive functioning capacities that may cause adolescents to minimize the hazards of their behaviors, (b) increased need for autonomy, and (c) ambivalence about behavior change, particularly when the teens believe that the targeted behaviors (restrictive eating) are instrumental in getting the outcomes they want (weight control). Adaptations based on these developmental issues are discussed below.

First, our intervention minimized the abstract elements of CBT that can be especially difficult for younger or cognitively immature adolescents to master, such as cognitive restructuring. Increasing the focus on self-monitoring and behavioral experiments makes the intervention more applicable to a wider range of teens. We also worked hard to incorporate examples from the teens' own lives and to set up numerous concrete examples in our materials using language and scenarios relevant to adolescent culture. For example, our sample eating diary worksheets list meals and snacks that are commonly reported in the eating diaries of teens; the daily schedule is typical for a high school student; and the interpersonal issues are similar to those reported to us by teen patients. In our experience, such adaptations are important in ensuring a relevant and meaningful intervention for our adolescent participants.

Second, to respect adolescents' desire for increased autonomy, we limited parental involvement in the sessions to strategic treatment junctures (i.e., initial treatment orientation, information about supporting meal planning and purchasing, and adolescent-initiated requests for parental support of behavioral experiments and relapse prevention). We believe that these limitations help assure adolescents that their concerns are the primary focus and encourage them to be more forthcoming about how their eating behavior affects their lives. While we aimed for judicious parental involvement in the treatment, the rise in "mixed" households (that is, multiple households led by parents who are separated or living with relatives) necessitated some interaction with caregivers from every household to ensure adequate and consistent understanding and support for the teen's intervention-related eating changes.

Finally, adolescents are often ambivalent about changing eating behaviors that they believe are important in achieving or maintaining an idealized body weight and shape. Unlike adults with binge-related disorders, many teens have yet to experience the broader health and functional impairments resulting from their disordered eating practices. Thus, drawing on core CBT (Vitousek, Watson, & Wilson, 1998) and motivational interviewing principles (Miller & Rollnick, 2002), we focused on enhancing motivation to overcome this ambivalence toward change. We also took great care to destigmatize participation in the

intervention as much as possible. We designed our materials with an adolescent-tested look and feel that was consistent with their sensibilities. Because teens may be reluctant to carry treatment-related materials and may worry about the signals these materials might send to their peers, we designed the food logs as one section in colorful notebooks with sections for daily planning, notes, and other activities. We were similarly careful in the language we used; for example, we chose the term “program” instead of “treatment” and “personal health coach” rather than “therapist.” Further, rather than view the interventionist as a traditional therapist or counselor, youth were encouraged to view their personal health coach as a partner to help them achieve their health goals while developing realistic outcome expectancies, identifying roadblocks, and solving problems to overcome such obstacles.

Intervention: Developmental Adaptations to the Content—In addition to the approach modifications reviewed above, we addressed our participants’ developmental issues by augmenting the content of the intervention itself. Additional materials emphasized developing skills for healthy weight management, dealing with depressed moods and regulating emotions, and navigating relationships with peers and family members.

Perhaps the most substantive augmentation was the inclusion of a healthy weight management module. We have found that adolescent girls with eating disorders may be even more highly invested in controlling body shape and weight than their adult counterparts. While a “no dieting” approach can work well to treat eating disorders among adults, our experience is that adolescents are less likely to cooperate with such an approach and have a poorer understanding of the long-term risks of engaging in disordered eating patterns. Therefore, to successfully engage adolescents, we provided a general orientation to healthy weight management and offered alternatives to unhealthy eating patterns frequently reported by the teens. This approach is safe in both normative-weight and overweight teens and is entirely consistent with the eating principles that serve as the foundation for eating-disorder interventions (e.g., eating regular meals and snacks, not skipping breakfasts, keeping track of what is eaten, monitoring the circumstances under which food is eaten, and following flexible guidelines rather than rigid rules). In fact, research has consistently demonstrated that the adoption of supervised healthy weight control programs reduces bulimic symptoms in adolescent and young adult women (Burton & Stice, 2006; Groesz & Stice, 2007; Presnell & Stice, 2003; Stice, Martinez, Presnell, & Groesz, 2006; Stice, Presnell, Groesz, & Shaw, 2005). Although we believe it is appropriate and safe to address healthy weight-management techniques in a CBT intervention, it may be equally important for teens to understand and accept aspects of their physical appearance that cannot be changed by weight loss or shape control. Thus, our intervention also focused on helping the teens understand why rigid dieting and food avoidance are generally unsuccessful and unhealthy, minimize unhealthy concerns about body shape and weight, and limit body checking and avoidance.

To maximize the intervention’s effectiveness, we believed it was important to focus on developmental factors that may complicate interventions to treat binge-related disorders in adolescents. Thus, we included optional modules that focused on two adolescent-specific factors: mood lability and interpersonal issues of central concern to adolescents (social factors).

Adolescents in general seem to experience more intense and labile moods (Larson, Csikszentmihalyi, & Graef, 1980), and youth with eating disorders have been found to have very high rates of comorbid mood disorders (Lewinsohn et al., 2000). Subtyping studies suggest that 30% to 40% of people who seek treatment for clinical binge eating fit a “dietary depressive” subtype whose binge eating is typified by greater negative affect and more depressed mood (Grilo, 2004; Grilo, Masheb, & Berman, 2001; Grilo, Masheb, & Wilson, 2001; Stice, 2001; Stice & Agras, 1999). Clinical samples of adults who fit this

dietary depressive subtype report more severe eating disorder behavior (i.e., binge eating) and weight and shape concerns; they also have higher rates of other Axis I and II disorders, poorer social adjustment, and poorer response to treatment (Chen & le Grange, 2007; Grilo, 2004; Grilo, Masheb, & Berman, 2001; Grilo, Masheb, & Wilson, 2001; Stice, 2001; Stice & Agras, 1999). Accordingly, intervention components that help with monitoring and modulating one's mood could provide important secondary skills to help teens succeed in coping with binge eating. For this reason, we adapted skills training from our studies of depressed adolescents (Brent et al., 2008; Clarke et al., 2005; Garber et al., 2009) to help teens in this program build more adaptive emotion-regulation skills.

We found in our previous work that if we were more responsive to adolescents' concerns about interpersonal difficulties with peers, romantic partners, or family members, then teens would feel more motivated to participate fully in an intervention (Garber et al., 2009). Because interpersonal issues can be triggers for disordered eating, addressing such concerns can help keep the intervention on track. Typically, the modules on regulating emotions and building interpersonal skills were reserved for the latter part of treatment, after the core skills had been established. However, we implemented these modules earlier in the program if either domain were of primary concern and the interventionist believed that waiting to address them might derail the teen's ability to develop core skills taught in the program. The inclusion of emotional regulation and interpersonal modules is consistent with Fairburn's (2008) enhanced cognitive behavior therapy (CBT-E) that includes modules on both interpersonal issues problems and emotional regulation ("mood intolerance").

Pragmatic Implementation Issues—Finally, while giving primary attention to the efficacy of the intervention, we aimed to design an intervention that would be feasible for sustained delivery in a real-world practice setting. Accordingly, we held appointments at participants' general medical clinics rather than in a specialty mental health setting to minimize the burden of travel and reduce stigma. We also scheduled appointments at the family's convenience (typically after school or evenings) and provided phone sessions when in-person session attendance was not possible. Further, we developed comprehensive program facilitator materials for an approach that could be implemented by supervised master's-level counselors and health care professionals. This freed us from having to rely on more highly trained (and often unavailable or unaffordable) doctoral-level providers. Finally, we sought to ensure that the core foundational program was relatively brief (8 sessions) while allowing for supplemental sessions that would ensure attention to important concomitant issues when pertinent (e.g., emotional regulation and interpersonal issues). Table 1 provides an outline of the core and supplemental topics covered in the intervention as well as indicators of key points of parental contact. There are eight core sessions and four optional supplemental sessions as described in the Table.

Data Analysis

Comparisons between the TAU-DT and CBT groups at baseline were conducted using chi-square and *t*-tests. Repeated measures analysis of variance was used to test for differences between the TAU-DT and CBT groups across time for the primary and secondary outcomes. The randomization condition was included in the models as the between-subjects factor and time as the within-subjects factor. Because of the small sample size, we chose not to impute missing follow-up data but did include all subjects in the analyses consistent with intent-to-treat methodology. All participants had complete baseline data on the primary outcome with 84.6% of the total sample having data on the primary outcome at all time points (no difference between CBT and TAU-DT). The primary outcome was abstinence from binge eating (no OBEs at 3-month posttreatment or 6-month follow-up). Number needed to treat (NNT) effect sizes were computed at 6 months for the primary outcome (Kraemer & Kupfer,

2006). In the context of this study, NNT answers the question: “How many more patients would need to be treated with CBT to avoid one more failure (i.e., patient continues to binge eat) that would have occurred had the patient been treated as usual (the TAU-DT control condition)?” In addition, for the primary and secondary outcomes, Cohen’s d (Cohen, 1988) was computed using between-condition change from baseline to 6 months to estimate effect sizes. Finally, we present outcomes at 6- and 9-month follow-ups for those in the delayed treatment (see Table 3 and Figure 2) to allow comparisons of treatment response between the CBT and TAU-DT groups.

Results

Recruitment Flow and Preliminary Analyses

Figure 1 shows the flow of potential participants through the recruitment process and delineates reasons for ineligibility. Of those initially expressing interest in the study ($n = 1,653$ completing screening questionnaire), 1.6% ($n = 26$) were ultimately randomized into the pilot trial. The CONSORT figure (Figure 1) indicates reasons and numbers of youth who were not enrolled at each stage of the qualifying process. EMR data indicated that 37% of the study pool had both height and weight recorded within the past 2 years. Those youth electing to complete the primary screener had a higher age and gender-adjusted BMI percentile (73.41 vs. 69.35 $T = 4.10$, $p < 0.001$) and were more likely to be overweight (15% vs. 12%, $X^2 = 13.23$, $p < 0.001$) than those choosing not to respond to the mailed study materials.

Table 2 shows the baseline characteristics of adolescents enrolled in the trial. Because the CBT and TAU-DT groups did not differ on any baseline measures, characteristics are shown for the sample as a whole. Enrolled participants were well distributed across the eligible age group ($M = 15.1$, $SD = 1.9$, range 12–18), and the majority (67%, $n = 16$) were overweight or obese at study onset (age/gender-adjusted BMI 85 percentile). Fewer than 20% of participants reported purging, and only 2 (8%) met diagnostic criteria for BN, with the vast majority reporting symptoms consistent with a diagnosis of BED (52%) or recurrent binge eating (32%). A substantial proportion of the participants reported symptoms consistent with moderate-to-severe depression (54%), an anxiety disorder (71%), or substance abuse issues (17%).

Acceptability and Treatment Expectancies

The majority of the CBT group (77%) attended all 8 core sessions ($M = 9.38$ [$SD 1.89$] range 7–13 sessions), and all CBT group participants participated in at least 6 of the 8 core sessions (our minimal threshold for classifying participants as having received the allocated intervention). More than half ($n = 8$ of 13; 61.5%) of those in the CBT group received more than 8 sessions, suggesting that most participants had some exposure to the supplemental sessions (i.e., any beyond the 8th and final core session). When offered the delayed treatment, those in the TAU-DT condition attended somewhat fewer core sessions, with 70% attending at least 6 sessions ($M = 5.50$ [$SD 2.37$], range 2–9). Participants found the intervention very helpful for their eating disorder ($M = 4.33$, $SD = 0.62$, on a scale from 1 [*not at all helpful*] to 5 [*extremely helpful*]); they reported high posttreatment satisfaction, with an average overall summary score of 3.72 ($SD = 0.24$) on the Client Satisfaction Survey’s 4-point scale; and they reported excellent alliance with their health coaches on the 7-point Working Alliance Inventory–Short Form, with an average score of 6.56 ($SD = 0.54$).

Proportion Abstaining From Binge Eating

More individuals abstained from binge eating in the CBT condition compared to the TAU-DT condition across the first 6 months following randomization, $F(2, 42) = 9.30$, $p < .001$; see

Table 3. CBT participants had higher rates of abstinence from binge eating at month 3 (CBT=92.3%, TAU-DT=30.0%; $X^2=9.67$, $p<.01$, NNT=2) and at month 6 (CBT = 100%, TAU-DT = 50.0%; $X^2 = 7.22$, $p<.01$, NNT=2, Cohen's $d=1.467$). The NNT of 2 reflects a large effect: at both 3 and 6 months, one treatment failure was avoided (i.e., a patient continuing to binge eat) for every two patients treated with CBT (Kraemer & Kupfer, 2006).

Youth in the TAU-DT condition were offered the CBT program after month 6 of the study. This group also exhibited 100% abstinence from binge eating immediately after this delayed treatment (study time point 9 months) and 75% abstinence 3 months later, suggesting that treatment benefits were similar in both groups.

Secondary Outcomes

The CBT group showed more improvement at months 3 and 6 than the TAU-DT condition over time in the pattern of eating concerns, $F(2, 40)=3.63$, $p<.05$, $d=.80$; shape concerns, $F(2, 40)=7.33$, $p<.01$, $d=1.04$; and weight concerns, $F(2, 40)=6.57$, $p<.01$, $d=.64$ (see Table 3). Further, youth in the CBT condition reported a trend towards significantly greater reduction in depressive symptomatology at months 3 and 6 compared to those in the TAU-DT condition, $F(2, 39)=3.26$, $p=.051$, $d=.57$. However, the two groups did not differ significantly on change in age/gender-adjusted BMI percentile over time.

Finally, Table 4 presents the proportion of participants using health services during the 3 months following randomization. While there were no significant differences in service use patterns between the groups, it is worth noting that close to one quarter of all participants were receiving antidepressant medication. Some youth received health services either for weight management ($n=2$) or eating disorders specifically ($n=3$). Nearly all participants (92%) accessed some health services during the intervention period.

Discussion

We found preliminary support for the efficacy of this adaptation of evidence-based CBT for recurrent binge eating among adolescents. Participants in the CBT group had significantly fewer posttreatment binge eating episodes than those in the TAU-DT control group, and 100% of the CBT participants were abstinent at follow-up. For those in the TAU-DT group who received delayed treatment, the effect was similar with all TAU-DT participants reaching abstinence at their posttreatment and 75% maintaining abstinence at the end of their study involvement. The intervention also produced significant improvement in other eating-related concerns. The large, robust effect size estimate observed for the main outcome (NNT=2) places this among the larger effects observed for any mental health intervention (Cuijpers, van Straten, Warmerdam, & Andersson, 2008; Hay, Bacaltchuk, Stefano, & Kashyap, 2009; Kraemer & Kupfer, 2006). Similar but lower-magnitude effects were observed for most secondary outcomes. Given that many aspects of this intervention were modeled after our previous youth depression programs (Brent et al., 2008; Clarke, DeBar, & Lewinsohn, 2003; Clarke et al., 2005; Clarke et al., 2002; Garber et al., 2009), we were not surprised that the CBT program appeared to significantly improve depression outcomes.

Participants reported a high degree of alliance with their health coaches, found the program very helpful and acceptable, and were highly satisfied with treatment. Further, parents did not find their judicious involvement to be unduly burdensome, nor did the teen participants find it intrusive. This was consistent with our goal of encouraging parents to both adequately support their daughters and respect their autonomy. The relatively brief treatment was acceptable to participants and parents, with youth attending an average of 84% of core sessions. This finding suggests that adolescents may benefit from fairly brief treatment; it is

also important because recent research suggests that adolescents most likely to respond to treatment are those who show marked improvement by the sixth session (le Grange, Doyle, Crosby, & Chen, 2008). Additionally, the intervention was carried out in a primary care setting by therapists with limited expertise in eating disorder interventions for adolescents, suggesting that successful implementation of this intervention may not require highly trained specialists. All these factors contribute to the potential transportability of this intervention into usual practice systems.

Despite these strengths, we encountered challenges in identifying and recruiting these youth. Because the health plan offers minimal resources for treating BN and binge eating, we hoped to receive a fair number of referrals from primary care providers whose adolescent patients were seeking treatment or had at least acknowledged treatable symptoms. But this referral method resulted in fewer than 10 recruits, which is consistent with extant literature indicating low rates of help-seeking among those with eating disorders (Hepworth & Paxton, 2007) and underdiagnosis of eating disorders by primary care providers—particularly when the disorder's duration is relatively brief, as it often is among adolescents (Currin, Waller, & Schmidt, 2009).

In addition to relying on provider referral for recruitment, we contacted all age-eligible adolescent females in the health plan, unselected for any risk factors or diagnoses. We purposely constructed broad primary screening questions, recognizing that the lack of specificity would lead to high false-positive rates and thus require secondary, confirmatory assessment. Only 9% of those eligible at the primary screening remained eligible when required to meet more precise diagnostic thresholds. We ultimately enrolled 26 participants, representing less than 2% of those who responded to our initial screener (which, again, addressed a variety of health topics and was not limited to eating issues). As this enrollment figure is smaller than prevalence estimates would have predicted, our sample may not be broadly representative of all youth with binge eating disorders.

Several reasons might account for this relatively low rate of enrollment. First, not all youth who meet binge eating criteria are willing to acknowledge having the problem. It is also the case that rates of enrollment in a randomized clinical trial—with all the attendant burdens of consent, periodic lengthy assessments, and only a 50% chance of receiving the active treatment right away—should not be used as an estimate for acceptability and engagement in such a program when offered in usual clinical practice. Further, teens enrolling in this study needed to agree that their parents would be notified about any unsafe behaviors (including purging), which may have discouraged some youth from participating. Finally, in contrast with most clinical studies, which rely only on self-referrals from an undefined population, we invited all teens in the health plan to complete the screener. As such, we are likely to have included those unmotivated to enroll in this type of study, even if they were willing to complete the initial screener. Nevertheless, our rate of recruitment (number of participants recruited per year) compares to that of other groups recruiting adolescents with binge-related disorders for randomized clinical trials (Hewell, Hoste, & le Grange, 2006).

Clinical presentation of enrolled participants was somewhat different than we had anticipated, with a high degree of psychiatric comorbidity. More than half the participants reported symptoms consistent with moderate-to-severe depression, and nearly three-quarters reported symptoms consistent with an anxiety disorder. Further, close to one quarter of all participants were on usual-care antidepressant medications during the active treatment period. These high rates of comorbidity among adolescents with EDNOS are consistent with what others have reported (Lewinsohn et al., 2000; Schmidt et al., 2008). We had anticipated enrolling participants with compensatory behaviors, but few of our participants fit this profile. Enrolled participants tended to describe behaviors consistent with BED or recurrent

binge eating rather than BN, and the majority (68%) were overweight. This is in contrast to other trials of treatment for adolescent eating disorders in which the majority of recruited participants met full or partial criteria for BN and were not overweight (le Grange et al., 2007; Schmidt et al., 2007). Given that past studies were similarly liberal in their inclusion of adolescent participants with EDNOS, we suspect that the differences in participant characteristics were related to our recruitment within the health plan and aggressive outreach and screening.

The most common reason for ineligibility was failing to report large enough food consumption to meet the overeating threshold for binge episodes (46%). There is controversy about whether the threshold for overeating is relevant for diagnosis (Mond, Latner, Hay, Owen, & Rodgers, 2010; Wolfe, Baker, Smith, & Kelly-Weeder, 2009). Adolescents reporting only subthreshold binge episodes (involving relatively small amounts of food) have been found to have similar impairment (le Grange et al., 2004) but perhaps more psychiatric comorbidity (Schmidt et al., 2008) than their counterparts meeting the full diagnostic threshold for binge eating. Further, emerging evidence suggests that loss-of-control (LOC) eating appears to be a more salient indicator of binge eating distress for youth than absolute amount of food (Bravender et al., 2007; Marcus & Kalarchian, 2003; Shomaker et al., 2010), and that LOC may also be a predictor of body weight gain (Tanofsky-Kraff et al., 2009). Accordingly, it may be appropriate to relax size thresholds for binge episodes when recruiting adolescents and focus more on LOC eating episodes. Finally, youth responding to our study invitation were more likely to be overweight than nonrespondents, leading us to suspect that respondents may have been more motivated to seek help because the maladaptive eating behaviors they were using for weight management were not helping them lose weight. Other researchers have also suggested that overweight, treatment-seeking youth may present with LOC and other binge-related behaviors (Doyle, le Grange, Goldschmidt, & Wilfley, 2007; Goossens, Braet, Van Vlierbergh, & Mels, 2009). Thus, a more successful and efficient means of identifying teens motivated and willing to engage in treatment may be to focus on those youth who are overweight or at risk for overweight. Such an approach may help to focus resources on those who may most benefit: overweight or at-risk-of-overweight youth, for whom interrupting the LOC and/or binge eating cycle may help prevent further weight gain. As for the lack of significant intervention effects on BMI in this pilot study, we believe that our ability to detect such effects may have been limited by several factors, including our short follow-up, small sample, inclusion of some participants with low baseline BMI, and the receipt by some in the TAU-DT condition of weight-related, usual-care health plan services.

Other study limitations include the lack of a formal measure of therapist adherence to the protocol, lack of restriction on participants' receipt of antidepressant medication (only one youth altered medication use during the trial), unstable effect size estimates inherent in pilot studies with small sample sizes (Kraemer, Mintz, Noda, Tinklenberg, & Yesavage, 2006), and the relatively homogeneous, generally nonminority sample. It would be important for future research to expand the treatment settings to ensure that the treatment approach is appropriate for a broader range of adolescents, including youth of color. Finally, one might argue that conducting this trial within a health plan limits the generalizability of our findings. However, we believe that our intervention's placement in the setting where it is likely to be adopted is a key strength—not to mention consistent with deployment-focused models of intervention development that anticipate real-world delivery of care (Glasgow & Emmons, 2007; Glasgow, Lichtenstein, & Marcus AC, 2003; Green & Ottosen, 2004; Weisz, Donenberg, Han, & Weiss, 1995; Weisz & Jensen, 1999, 2001).

In summary, we designed an intervention that incorporates the developmental considerations of adolescents as well as the maintaining and risk factors of adolescent binge eating. While

we focused primarily on our teen participants, we involved parents in the intervention when it was practical and prudent to do so. We observed a robust effect of the intervention on episodes of binge eating, related eating pathology, and depressive symptoms. The intervention was acceptable to participants and parents and was designed to enable implementation in nonspecialty, usual-care health practice settings. Because adolescents rarely seek binge eating treatment on their own, identifying and recruiting them continues to be a challenge. However, our finding that a large proportion of our participants were overweight may lead to an enriched sample enrollment procedure in future trials. Two additional findings point to an important next step in this line of research: motivating youth with eating disorders to engage in treatment by appealing to their desire to manage their weight, and emphasizing the evidence that decreasing LOC eating may stabilize weight or prevent future weight gain.

Acknowledgments

This work was supported by the National Institutes of Health grant MH073796 and was registered prior to participant enrollment in the trial (Clinicaltrials.gov Identifier: NCT00522769). We wish to thank the adolescents and the families that participated in the CLAIRE study. We thank Dana Foley and Jonathan Fine for their helpful comments on previous versions of this article.^f

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Figure 1.
CONSORT Diagram.

¹ * Other reasons included: no longer health plan member, teen current pregnancy, cognitive impairment, no longer in high school, getting CBT treatment elsewhere, and involved in other research study

Figure 2.
Abstinence rates at follow ups.

Table 1

Content of Adolescent-adapted CBT Manual for Binge Eating-related Disorders

RECOMMENDED SEQUENCE OF SESSIONS AND TOPICS		
Session(s)	Topic(s)	Review with Parent
<i>CORE SESSIONS^a</i>		
1	Introduction to Eating Diary and Weekly Weighing	
2	Beginning a Practice of Regular Eating	
3	Weight Control: What Doesn't Work and Why	
4	Identifying Behavioral Alternative to Binge Eating	<i>b</i>
5	Healthy Ways of Managing Your Weight	
6 & 7	Body Checking and Avoidance: Action and Acceptance	
8	Where Are You At?: Reviewing Progress and Pitfalls	
<i>SUPPLEMENTAL SESSIONS</i>		
Supp A	Food and Mood: Behavioral Activation	
Supp B	Food and Mood: Emotional Regulation	
Supp C	Interpersonal Relationships with Family: Communications, Problem-solving, and Assertiveness Training	
Supp D	Interpersonal Relationships with Peers: Communications, Problem-solving, and Assertiveness Training	

^a One additional session consistently allocated for additional content emphasis (domain as needed);

^b brief mid-treatment check-in with the parent(s) at end of session only.

Table 2**Baseline Characteristics of Study Sample by Treatment**

	Randomized Sample (N=25) ^a
Teens	
Demographics/Anthropometrics	
Mean age (SD; range) in years	15.12 (1.86; 12–18)
Non-Hispanic White: % (<i>n</i>)	70.83% (17)
BMI	26.60 (5.71; 19.85–38.54)
% Overweight or Obese (85th BMI age/gender adjusted percentile)	66.67% (16)
ED Diagnosis % (<i>n</i>)	
Binge Eating Disorders	52.00% (13)
Recurrent Binge Eating	32.00% (8)
Bulimia Spectrum Disorders ^b	16.00% (4)
Psychiatric Comorbidity % (<i>n</i>); <i>M</i> (<i>SD</i>)	
Moderate to severe depression (BDI-II) ^c	54.17% (13); <i>M</i> =22.58 (<i>SD</i> 10.72)
Anxiety Disorder (SCARED) ^d	70.83% (17); <i>M</i> =32.67 (<i>SD</i> 14.70)
Substance use problem (CRAFT) ^e	16.67% (4); <i>M</i> =0.50, <i>D</i> =1.28
Other	
Social Functioning (YSAS)	1.40 (0.45; 0.43–2.30)
Recency of eating disorder onset (years)	3.14 ; <1 – 10
Parent Respondents	
Mother or female guardian: % (<i>n</i>)	83.33% (20)
Physical custody	
<i>Intact family or stable single parent household</i>	87.50% (21)
Education (Some college): % (<i>n</i>)	75.00% (18)
Income (\$50 K or more): % (<i>n</i>)	63.64% (14)
Parent's BMI	28.83 (7.15; 17.47–53.40)
Current or Hx of ED (QEWPR)	12.50% (3)

Note.

^a one participant excluded from analysis as reported purging but no OBEs at baseline;

^b participants reported purging;

^c 20 on BDI-II screening criteria for moderate depression (Beck et al., 1996; Kumar, Steer, Teitelman, & Villacis, 2002; Osman, Barrios, Gutierrez, Williams, & Bailey, 2008).

^d 15 on SCARED screening criteria for anxiety disorder (Birmaher et al., 1997).

^e 2 on CRAFT screening criteria for substance use problem (Knight et al., 2002).

Table 3
Main and Secondary Outcomes by Treatment Condition and Assessment Timepoint

	Baseline	Month 3	Month 6	Test statistic	p-value	Cohen's Effect size	Month 9	Month 12
	M (SD) or % (n)	M (SD) or % (n)	M (SD) or % (n)				M (SD) or % (n)	M (SD) or % (n)
% OBEs Abstinent								
TAU-DT	0% (0)	30.00% (3)	50.00% (5)	9.30	.001	1.467	100% (6)	71.43% (7)
CBT	0% (0)	92.31% (12)	100% (10)				-	-
# of OBEs								
TAU-DT	15.75 (5.46)	4.30 (5.25)	3.30 (6.17)	.21	.815	.653	0% (0)	0.43 (0.79)
CBT	12.15 (6.76)	1.46 (5.27)	0 (0)				-	-
# of SBEs								
TAU-DT	5.08 (6.33)	2.30 (3.68)	4.80 (6.97)	1.53	.239	.108	0.67 (1.63)	3.14 (7.45)
CBT	7.62 (8.41)	1.62 (3.40)	1.82 (2.96)				-	-
% reporting Purging								
TAU-DT	16.67% (2)	0% (0)	0% (0)	.95	.394	.090	0% (0)	0% (0)
CBT	15.38% (2)	15.38% (2)	0% (0)				-	-
EDE Restraint								
TAU-DT	1.25 (1.38)	0.88 (0.56)	1.14 (0.98)	1.10	.343	.333	0.53 (0.55)	0.74 (0.88)
CBT	1.32 (.768)	0.71 (0.94)	0.56 (0.74)				-	-
EDE Eating Concerns								
TAU-DT	2.08 (1.15)	1.26 (1.03)	1.52 (1.12)	3.63	.036	.801	0.47 (0.86)	1.14 (1.61)
CBT	1.83 (1.31)	0.57 (0.73)	0.29 (0.41)				-	-
EDE Shape Concerns								
TAU-DT	3.77 (0.95)	3.39 (1.05)	3.05 (1.09))	7.33	.002	1.035	2.13 (2.14)	2.02 (2.20)
CBT	3.63 (1.11)	2.00 (1.23)	1.67 (1.49)				-	-
EDE Weight Concerns								
TAU-DT	3.15 (1.25)	2.86 (1.34)	2.04 (0.98)	6.57	.003	.637	1.50 (1.48)	1.69 (1.75)
CBT	2.92 (1.17)	1.45 (1.26)	1.62 (1.67)				-	-
BDI-II								
TAU-DT	23.00 (10.75)	13.00 (7.27)	17.10 (12.70)	3.23	.051	.565	9.17 (7.44)	13.42 (12.67)
CBT	22.23 (11.12)	9.77 (8.86)	6.36 (4.84)				-	-
YSAS								

	Baseline		Month 3		Month 6		Test statistic	p-value	Cohen's Effect size	Month 9		Month 12	
	M (SD) or % (n)		M (SD) or % (n)		M (SD) or % (n)					M (SD) or % (n)		M (SD) or % (n)	
TAU-DT	1.29 (0.48)		0.89 (0.30)		0.97 (0.49)		1.90	.163	.058	0.72 (0.29)		1.07 (0.54)	
CBT	1.49 (0.42)		1.00 (0.60)		0.74 (0.36)					-		-	
BMI Percentile													
TAU-DT	82.73 (15.10)		81.32 (17.28)		79.10 (19.65)		.39	.678	.161	79.99 (20.19)		79.47 (21.17)	
CBT	78.99 (23.54)		78.19 (23.72)		79.44 (20.57)					-		-	
CRAFT													
TAU-DT	0.27 (0.90)		0.00 (0.00)		0.60 (1.35)		2.41	.103	.222	0.00 (0.00)		0.00 (0.00)	
CBT	0.85 (1.52)		0.38 (1.12)		0.18 (0.40)					-		-	
SCARED													
TAU-DT	31.73 (14.65)		18.50 (9.97)		17.40 (7.96)		0.33	.721	.075	12.17 (6.18)		14.86 (8.09)	
CBT	33.46 (15.30)		21.00 (14.55)		19.73 (15.03)					-		-	

Table 4

Receipt of Health Plan Services During Intervention Period (Baseline Through 3 Months)

	TAU-DT (N=12)	CBT (N=13)	Chi-Square	<i>p</i> -value
Weight-Related	8.33% (1)	0.00% (0)	1.129	.288
ED-Related	8.33% (1)	7.69% (1)	0.004	.953
Antidepressant Rx	16.67% (2)	23.08% (3)	0.160	.689
Total Rx	66.67% (8)	84.62% (11)	1.102	.294
All other services	83.33 (10)	46.15 (6)	3.744	.058
Total	100.00% (12)	84.62% (11)	2.007	.157