THE RELATIONSHIP OF INTERNALIZED WEIGHT BIAS TO WEIGHT CHANGE IN TREATMENT-SEEKING OVERWEIGHT ADULTS

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Abstract

Objective: The present study was designed to explore whether behavioral weight loss treatment is associated with changes in internalized weight bias among overweight and obese men and women. The relationship of internalized weight bias to treatment outcome was assessed, as well as its relationship to other psychological variables associated with weight change, including body image concern, self-esteem, anti-fat attitudes, depressive symptoms, anxiety and stress. **Method**: Participants were 106 overweight and obese men and women enrolled in a treatment outcome study using the *Lifestyle Balance Program*, a behavioral weight loss program emphasizing dietary change and increasing physical activity. Eligible participants were randomly assigned by treatment site to either a standard care condition following the *Lifestyle Balance Program*, or to a continuing care condition which included all elements of the *Lifestyle Balance Program*, plus 18 additional months of participant-led self-help. Participants completed measures of internalized weight bias, anti-fat attitudes, self-esteem, body image concern, depressive symptoms, anxiety and stress at the start of treatment, following completion of active treatment, and again at six-months post-treatment (i.e. follow-up). **Results**: Participants who completed treatment lost, on average, 5.22% of initial body weight at post-treatment with an additional loss of 0.50% of initial body weight from post-treatment to follow-up, with no significant differences between treatment conditions on measures of weight change and psychological functioning. Weight bias internalization was shown to significantly decrease over the course of treatment and again at follow-up and was associated with percent change in initial body

weight from baseline to six-month follow-up. Participants reporting low levels of internalized weight bias at baseline lost twice as much weight when compared to participants reporting high levels of internalized weight bias at baseline. Though significant correlations were found between percent change in initial body weight and measures of internalized weight bias, body image concern and self-esteem, regression models failed to identify significant predictors of weight change among the study variables. Internalized weight bias was additionally shown to be related to body image concern, anti-fat attitudes, depression and self-esteem. Baseline scores of internalized weight bias contributed to the prediction of change in body image scores from baseline to follow-up and from post-treatment to follow-up. **Discussion**: Findings from the present study indicate a relationship between internalized weight bias and weight change in the context of behavioral weight loss treatment. Elements of behavioral weight loss treatment, such as cognitive restructuring, may contribute to the reduction of bias demonstrated in the present study. Study results also indicate the importance of assessing baseline levels of internalized weight bias, as having higher levels of internalized weight bias was associated with poorer weight loss outcomes. Limitations of the present study are discussed, including methodological issues such as the use of self-report questionnaires and the clinical significance of the findings. Future research may design interventions to specifically target internalized weight bias, through such methods as cognitive restructuring or cognitive defusion techniques, particularly among those individuals evidencing greater internalized weight bias.

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The Relationship of Internalized Weight Bias to Weight Change in Treatment-Seeking Overweight Adults

Recent surveys in the United States indicate that more than 60% of the adult population is currently overweight (having a Body Mass Index (BMI) greater than 25 kg/m^2) or obese (BMI greater than 30 kg/m^2) by medical standards (Flegal, Carroll, Ogden, & Curtin, 2010; National Center for Health Statistics, 2004). A range of weight loss protocols has been developed to confront this "epidemic" (Hedley, Odgen, Johnson, Carroll, Curtin, & Flegal, 2004), including surgical interventions, commercial weight loss programs, drug treatments and behavioral weight loss programs. These varied programs have shown differing degrees of effectiveness in initiating and maintaining weight loss (Dansinger, Tatsioni Wong, Chung, & Balk, 2007; Dansinger, Gleason, Griffith, Selker, & Schaefer, 2005; Mann, Tomiyama, Westling, Lew, Samuels, & Chatman, 2007; Powell, Calvin & Calvin, 2007). Overall, studies of behavioral weight loss programs report an average of 6% of body weight lost after one year (Dansinger, Tatsioni Wong, Chung, & Balk, 2007), half of which is regained at three years (Wadden, Butryn, & Burn, 2004). Most studies report that by five years post-treatment a significant proportion of participants have either returned to or surpassed their baseline weight (Wadden, Butryn, & Burn, 2004). Despite seemingly modest improvement in weight status, however, studies have shown that even small amounts of weight loss (around 5%) are associated with clinically significant improvements in health markers, such as blood pressure and other cardiovascular risk factors (Powell, Calvin, & Calvin, 2007).

The hallmark components of behavioral weight loss treatments are improved diet, increased physical activity and behavior therapy, with measurable and specific goals and mechanisms for change (Wadden & Butryn, 2003). Behavior therapy in the context of weight loss treatment is aimed at changing behaviors which can contribute to the development of obesity, such as sedentary behavior, or identifying triggers which are associated with unwanted or unhealthy eating. These strategies may include modification of eating-related behaviors, such as the rate of eating or timing of meals, self-monitoring, exercise and the development of problem-solving and coping strategies (Wadden & Butryn, 2003). In addition to tracking weight loss as an outcome variable to determine the effectiveness of these protocols, researchers have also examined changes across a number of psychosocial variables.

Weight Loss and Body Image among the Overweight

One frequently studied psychological variable related to weight loss is body image concern. Though there is evidence that among overweight and obese women BMI and body image dissatisfaction are uncorrelated (e.g. Sarwer, Wadden, & Foster, 1998), several studies have also reported high levels of body image dissatisfaction among obese women seeking weight-loss treatment as compared to non-treatment seeking normative samples (Collings, Saules, & Saad, 2008; Foster, Wadden, & Vogt, 1997; Matz, Foster, Faith, & Wadden, 2002; Sarwer, Wadden, & Foster, 1998). These results point to the potential clinical significance of assessing body image concern in the context of treatment. Researchers studying the effects of weight-loss protocols have thus examined

whether changes in body weight correspond with improvements or deficits in body dissatisfaction.

Cross-sectional studies suggest that formerly overweight women appear to maintain "psychological vestiges" of overweight including poorer body image (Cash, Counts, & Huffine, 1990), overweight preoccupation and dysfunctional appearance investment (Annis, Cash, & Hrabosky, 2004). However, in examining only a single time point these findings cannot address the question of the relationship between changes in weight and changes in body image dissatisfaction. Additional studies have assessed changes in body image throughout the course of behavioral weight-loss treatment. For example, Cash (1994) reported significant improvements on several subscales of the Multidimensional Body-Self Relations Questionnaire (MBSRQ), including appearance evaluation, overall appearance satisfaction and body areas satisfaction among participants in a very-low-calorie diet program which included behavioral components to regulate eating. These changes were found to be significantly improved over baseline measurements at post-treatment and after six months of maintenance treatment. Baseline measurements of body image were not predictive of weight lost during treatment.

Foster, Wadden, and Vogt (1997) also examined changes in MBSRQ scores in a sample of 59 obese women across 48 weeks of weight loss treatment. After the first 24 weeks, participants showed significant improvements in appearance evaluation and body areas satisfaction. Interestingly, changes in the MBSRQ subscales from baseline to Week 24 were not related to changes in weight during that time period. At 48 weeks, changes in body image had lessened relative to scores at 24 weeks but these were still

significantly improved over baseline. Additional studies using measurement tools other than the MBSRQ have found similar results. A randomized controlled trial (n = 123) conducted by Wadden, Foster, Sarwer, Anderson, Gladis, Sanderson, et al., (2004) comparing a low-calorie diet plus meal replacement to a balanced deficit diet of 1200-1500 kilocalories per day and to a non-dieting program which discouraged restriction of diet found that across all three conditions, scores on the Body Shape Questionnaire (BSQ) and the Body Dysmorphic Disorder Examination (BDDE) were significantly improved over baseline after 40 weeks of treatment.

Ramirez and Rosen (2001) sought to directly address the issue of changes in body image during weight loss treatment by testing body image therapy against a behavioral weight control program. Sixty-five obese men and women were randomly assigned to a group behavioral weight control condition or to a behavioral weight control plus body image therapy condition. The body image therapy component was aimed at reducing appearance-related distress through cognitive restructuring of negative thoughts and beliefs, through exposure to previously avoided situations or activities that caused participants to be self-conscious about their appearance and by developing coping strategies to address perceived discrimination (Ramirez & Rosen, 2001). At post-treatment, participants in both conditions showed reductions in body image concern, as measured by the BSQ and the BDDE, and these improvements continued to be significant at 1-year follow-up.

Contrary to the finding of Foster, Wadden and Vogt (1997), Ramirez and Rosen (2001) found that across all participants, increases in body dissatisfaction observed

between three-month and one-year follow-up were associated with weight regain. Within the weight control plus body image therapy condition, however, there was no significant association between weight loss and changes in body image. The authors draw the conclusion that body image therapy adds no additional benefit to improving body dissatisfaction among the overweight since there were no significant differences between the conditions on changes in body image concern. Yet their finding that participants in the body image therapy condition experienced improvements regardless of weight loss does suggest that there may be multiple pathways to improved body image outcomes. Further research is needed to clarify the relationship between weight change and change in body image concern.

In summary, the majority of empirically tested weight loss protocols demonstrate weight loss to be associated with an improvement in body image immediately following treatment through a year of follow-up. These improvements have mainly been found among overweight women and do not appear to correlate with the actual amount of weight lost over treatment.

Weight Loss, Depression and Anxiety among the Overweight

In addition to studying changes in body image over the course of weight loss treatment, researchers have also examined changes in mood, most frequently depression, and anxiety. In their review of 20 years of research on the topic, Stunkard and Rush (1974) questioned the findings of a large number of studies which showed "untoward responses," such as depression, among obese people in outpatient weight loss treatment. They argued that the incidence of these negative outcomes was likely the by-product of

variables other than actual weight loss, such as higher baseline rates of emotional problems among treatment-seeking samples (Stunkard & Rush, 1974). Since that review, researchers have conducted more highly-controlled studies to understand the relationship between weight loss and depression among the overweight.

With few exceptions (e.g. Chaput, Drapeau, Hetherington, Lemieux, Provencher, & Tremblay, 2005), studies of non-surgical weight loss protocols have reported reduced symptoms of depression and anxiety among treatment-seeking samples of overweight and obese men and women relative to their baseline levels of functioning (Halyburton, et al., 2007; Foster, Wadden, Kendall, Stunkard, & Vogt, 1996; Wadden, Foster, & Letizia, 1994; Wadden, et al., 2004; Wadden & Stunkard, 1986; Wadden, Stunkard, & Smoller, 1986). A recent meta-analysis by Blaine, Rodman, and Newman (2007) of 117 weight loss treatment studies found that psychotherapy-based weight loss treatments (n = 89) produced moderate reductions in depression, with an average effect size of r = -0.29 for short-term effects and r = -0.32 for long-term effects.

In an important test of methodological issues, Wadden, Stunkard, and Smoller (1986) examined the effects of the frequency of assessment, time of assessment (concurrent versus recall), and method of assessment on reporting of depressive symptoms among women enrolled in a very-low-calorie diet and behavior therapy program. Interestingly, the authors found that while scores on both the Beck Depression Inventory (BDI) and the State Trait Anxiety Index (STAI) were significantly reduced from pre- to post-treatment, 54% of the participants had increased BDI scores and 57% of participants had increased STAI scores at some point during treatment. These results

suggest that while the overall effect of weight loss treatment may be a decrease in depression and/or anxiety, the protocols themselves can have the effect of worsening these symptoms while participants are actively engaged in treatment. Despite the fact that this increase in reported symptoms might interfere with participants' engagement in treatment, the majority of studies conducted since these findings were reported have not assessed changes in depressive symptoms and anxiety states during the course of treatment.

Blaine, Rodman and Newman (2007) reported that the average change in depressive symptoms among weight loss treatment studies is the equivalent of a reduction of 2.7 points on the BDI. This finding calls into question whether the statistical changes in depressive symptoms and anxiety demonstrated by psychotherapeutic weight loss treatments translate into clinically significant changes. For example, Foster, Wadden, Kendall, Stunkard, and Vogt (1996) found that among women enrolled in an 18-month energy restriction and behavior therapy program, BDI scores fell significantly from baseline to follow-up but that these changes were not clinically significant. In addition, the authors found that the changes in BDI scores were not related to changes in weight (Foster, Wadden, Kendall, Stunkard, & Vogt, 1996). This finding has been reported in other studies (Wadden, Foster, & Letizia, 1994; Wadden & Stunkard, 1986) and was found to be true in the Blaine et al., (2007) meta-analysis. Wadden and Stunkard (1986) reported that it was the participants' initial level of depression that correlated strongly with the changes in depression across treatment and follow-up. These findings echo those found in the body image literature, where there appears to be no linear relationship

between changes in weight and changes in body image. Taken together, the results suggest that it is not weight loss per se that causes the reduction of depressive symptoms or an improvement in body image but that other mechanisms may be at work.

Weight Loss and Self-Esteem among the Overweight

Within the last 10 years, research on the psychological consequences of weight loss among the overweight has also included an assessment of self-esteem. As with body image and depression, available studies suggest that weight loss treatment has a positive effect on self-esteem (Grilo & Masheb, 2005; Ramirez & Rosen, 2001; Wadden, et al., 2004) and that the effect size is moderate-to-large (Blaine, Rodman, & Newman, 2007). In a randomized control comparison of guided self-help cognitive behavioral therapy (CBT) and behavioral weight loss treatments for men and women with binge eating disorder, Grilo and Masheb (2005) reported that CBT was superior to a control condition in improving self-esteem, even when baseline self-esteem scores were held constant. Ramirez and Rosen (2001) reported that participants in both a weight control condition and a weight control plus body image therapy condition showed improvement over baseline scores of self-esteem. They also found, however, that between three-month follow-up and one-year follow-up, those participants who experienced weight gain showed decreases in self-esteem scores. And while Wadden et al., (2004) found that significant changes in self-esteem could be brought about using a non-dieting program, findings from a meta-analysis (Blaine, Rodman, & Newman, 2007) do suggest that actual weight loss needs to occur in order to see improvements in self-esteem. This study found that the effect size in studies whose treatment produced large weight losses was nearly

double that of studies whose treatment produced small or no weight loss (Blaine, Rodman, & Newman, 2007). This finding stands in contrast to the results suggesting that changes in body image and depression are not associated with changes in weight; additional research is needed to understand the relationships between these variables.

Weight Regain and Psychological Functioning among the Overweight

Available data demonstrates that while many participants in behavioral weight loss programs succeed in reducing their body weight over the course of treatment, weight regain following treatment is a common phenomenon. In a review, Wadden, Butryn, & Byrn (2004) have reported that within one year following treatment, participants in lifestyle modification programs regain, on average, 30-35% of their lost weight. Within five years, over half of those participants will have regained all of their lost weight (Wadden, Butryn, & Byrne, 2004). More recent studies (e.g. Weiss, et al., 2007) have shown similar results.

Several studies have explored whether there are baseline predictors of weight maintenance or regain (for a review, see Teixeira, Going, Sarhinha, & Lohman, 2005). There is also evidence that changes in psychological variables, like those reviewed here, are associated with weight regain or weight maintenance. For example, Ramirez and Rosen (2001) found that between three-month follow-up and one-year follow-up, increased body dissatisfaction and lowered self-esteem both corresponded with increased weight regain (average regain was 47% of weight lost).

An interesting finding in the Ramirez and Rosen (2001) study was that the relationship between body image change and weight change from post-treatment to one-

year follow-up was not significant among the participants in that study enrolled in the weight control plus body image therapy condition. This result suggests that improvements in body image concern over the course of treatment can be maintained despite weight regain. This contention is supported further by their finding that in the weight control condition, those participants who maintained only small losses relative to original weight lost showed the largest reductions in body image improvement during follow-up (Ramirez & Rosen, 2001). Foster, Wadden, and Vogt (1997) had found similar results among obese women enrolled in a behavioral weight loss program, where the group of participants that regained more than five kilograms of their lost weight showed more body dissatisfaction than those participants who either regained less than five kilograms or who lost weight during follow-up. These studies suggest that there is a relationship between weight regain and changes in psychological variables, particularly body image, and that it is possible to buffer an individual from possible negative psychological outcomes accompanying weight regain.

Weight Loss and Anti-fat Attitudes

Until recently, no studies had been undertaken to examine changes in attitudes about obesity among overweight participants engaged in weight loss treatment. Crerand, Wadden, Foster, Sarwer, Paster & Berkowitz (2007) tracked changes in anti-fat attitudes over the course of three types of weight loss treatment conditions. The study design included two dieting approaches (a meal replacement condition and a balanced deficit diet of 1200 to 1500 kilocalories per day condition) and one non-dieting approach, where participants were instructed not to reduce their caloric intake, made behavioral changes

such as eating every four hours, and were provided information on the causes of obesity, the role of weight in self-esteem and weight-related discrimination. When the groups were compared, results indicated that the non-dieting group had significantly more improved attitudes toward obese persons, as measured by the Attitudes Toward Obese Persons Scale, the Beliefs About Obese Persons Scale, and the Attitudes-United States Scale. Both conditions showed less negative personal views of overweight women over the course of treatment and follow-up. Contrary to the hypotheses of the authors, losing weight did not cause an increase in anti-fat attitudes, including any strengthening of the belief that weight is under personal control.

In addition to measuring levels of anti-fat attitudes, Crerand et al. (2007) assessed self-esteem, symptoms of depression, and level of body image concern and looked at the relationships between these variables and the measures of anti-fat attitudes. Overall, improvements in self-esteem and depressive symptoms were significantly correlated with improvements in anti-fat attitudes. The conclusions that can be drawn from these results about the impact of changing anti-fat attitudes on weight loss treatment are limited, however, as the authors only analyzed the relationships among the variables at individual time points (i.e. at post-treatment and then again at follow-up) rather than across time. They are also limited to the extent that anti-fat attitudes represent both the individual's beliefs about obese persons in general and the individual's beliefs about themselves as an obese person. Further research is needed to determine whether changes in anti-fat attitudes, about both selves and others, are related to treatment outcomes such as weight loss and improved psychosocial functioning.

Weight Loss and Internalized Weight Bias

Recent research has demonstrated the importance of examining levels of internalized weight bias among the overweight and obese and distinguishing these attitudes from traditional assessments of anti-fat attitudes. Internalized weight bias has been defined as the degree to which an overweight or obese person believes that negative stereotypes about obesity are applicable to themselves (Durso & Latner, 2008). It has been shown that internalized weight bias uniquely contributes to self-esteem, depressive symptoms, and body image concern over and above anti-fat attitudes (Durso & Latner, 2008). Even among non-overweight individuals, those who perceive themselves as overweight show similar levels of internalized weight bias to overweight individuals (Durso & Latner, 2011). It has also been shown that among the overweight and obese, internalized weight bias mediates the observed relationship between experiences of discrimination and eating disturbance (Durso, Latner, & Hayashi, 2011). Given the frequency with which overweight and obese individuals experience discrimination in their everyday lives (Carr & Friedman, 2005) and the significant proportion of overweight and obese individuals who report episodes of binge eating (French, Jeffery, Sherwood, & Neumark-Sztainer, 1999; Marcus & Wing, 1987) or who meet criteria for Binge Eating Disorder (Hsu et al., 2002), weight loss treatment protocols may acquire additional effectiveness by directly addressing internalized weight bias. Before that can be determined, however, it is important to know what changes in internalized weight bias, if any, occur during and after weight loss treatment.

To date, only one publication has examined the construct of internalized weight bias among overweight adults seeking behavioral weight loss treatment. Carels, Wott, Young, Gumble, Koball, and Oehlhof (2010) explored changes in explicit, implicit and internalized weight bias among fifty-four men and women who completed either of two, 14-week behavioral weight loss programs. Participants in the study completed measures of weight bias along with measures of depression, body image concern and binge eating and were assessed at baseline and post-treatment. Results of the study indicated that internalized weight bias significantly decreased over the course of treatment and was related to higher rates of binge eating and poorer body image (Carels et al., 2010). This paper provided a first step in understanding the relationship of internalized weight bias to weight change and to changes in other psychological and behavioral variables, such as body image and binge eating. It is important to expand upon this research, particularly by gathering follow-up data to assess for possible changes in internalized weight bias outside of the context of active treatment.

Interestingly, results from Carels et al. (2010) demonstrated that measures of weight bias were unrelated to change in weight in their sample. Therefore, available evidence suggests that behavioral weight loss treatment may cause changes in internalized weight bias, irrespective of weight loss. These changes may occur through other mechanisms, such as nonspecific treatment effects or through participants experiencing an increase in self-efficacy for making changes related to their eating and exercise habits. These findings mimic results presented earlier on changes in depressive symptoms and body image concern across behavioral weight loss treatment, where

changes in these variables occur without a direct relationship to weight change. Additional research is needed to further assess whether changes in internalized weight bias occur in the context of behavioral weight loss treatment and if these changes are truly unrelated to change in weight.

It has been suggested above that because observed changes in psychosocial variables such as depressive symptoms and body image concern do not have a linear relationship with weight loss there may be additional mechanisms at work to influence these changes. Foster, Wadden and Vogt (1997) suggest that these changes might be due to the effect of undergoing treatment rather than losing weight. Evidence from Cash (1994) supports this contention, where it was shown that participants who did not drop out of treatment and who completed maintenance sessions experienced more favorable changes in body image, regardless of how much weight they had lost. An alternative explanation is that there are mediators of the relationship between weight loss and psychosocial outcomes, and it may be the case that internalized weight bias is among those mediators. Blaine, Rodman, & Newman (2007) suggest that the finding that actual weight loss appears necessary to induce positive changes in self-esteem is related to the social construction of the self. They argue that, "actual weight loss may moderate self-esteem responses to weight loss treatment because significant weight loss prompts us to internalize the more positive body-related appraisals we imagine others have of us (75)." Put another way, positive changes in self-esteem may only occur after losing a significant amount of weight because the loss of weight reinforces an individual's belief that their self-worth is determined, in part, by their shape and weight. This degree of belief may be

represented by the construct of internalized weight bias. Perhaps internalized weight bias is an intermediate variable which is predictive of changes in other psychological outcomes during periods of weight change. Assessing internalized weight bias may help explain the differing relationships observed between psychological factors and actual weight loss.

The Present Study

This study was designed to explore whether behavioral weight loss treatment is related to changes in internalized weight bias among the overweight and obese. As there is little available research to guide predictions of whether and how internalized weight bias will change among participants enrolled in behavioral weight loss treatment, this study took an exploratory approach and presents one formal research hypothesis and several research questions:

Central Hypothesis: Based on evidence from previous studies showing improvements in body image, depressive symptoms, self-esteem and anti-fat attitudes across weight loss treatment, and recent research which demonstrates that internalized weight bias decreases over the course of behavioral weight loss treatment, it is hypothesized that levels of internalized weight bias at post-treatment and follow-up will be significantly lower than baseline scores.

Research Question 1: As a significant proportion of participants are likely to experience a period of weight regain following treatment, what are the effects of weight regain on levels of internalized weight bias?

Research Question 2: Do baseline scores of internalized weight bias predict treatment outcome (e.g. amount of weight lost) and/or maintenance of treatment effects?

Research Question 3: Are changes in internalized weight bias predictive of changes in additional outcome measures, including changes in body image, depressive symptoms, anxiety or self-esteem?

Research Question 4: Does internalized weight bias mediate the relationship between weight loss and changes in body image, depressive symptoms, anxiety or self-esteem?

Methods

Participants and Procedures

Study participants. Participants for this study were 106 obese or overweight men and women between the ages of 20 and 77 (M = 49.52, SD = 12.93) who were part of a larger study of the effectiveness of a self-help component added to a standard behavioral weight loss program, whose principle findings will be reported elsewhere. To be considered for the study, participants were required to have a BMI between 27 and 40 kg/m^2. These participants were recruited from community organizations, such as Young Men's Christian Association clubs (YMCA), and local churches and other religious organizations. Persons enrolled in the study were randomized before the first treatment

session into two treatment conditions: 1.) a standard behavioral weight loss treatment protocol, called *The Lifestyle Balance Program*, modeled after the *Diabetes Prevention Program* (DPP; *n* = 46; Diabetes Prevention Program Manual of Operations, 1996; www.bsc.gwu.edu/dpp/index.html; Diabetes Prevention Program Research Group, 2002), or 2.) *The Lifestyle Balance Program* with an added continuing care component (*n* = 60). Participants were excluded from participation in the study if they were currently in another weight control program, if they had a current or past obesity-related or other medical health disorder (e.g., diabetes), if they were taking medications affecting weight and had not been on a stable dose for at least two months, if they had a current or past severe psychiatric disorder or if they were pregnant, had been pregnant in the past year or were planning to become pregnant in the two years following treatment. Participants who did not qualify for the study were provided with contact information for other community-based treatment options, such as Weight Watchers or Take Off Pounds Sensibly. Table 1 presents demographic data for the sample, including gender and ethnic background.

Table 1

Sample Characteristics

	n (% of sample)
Female	64 (60.4%)
Male	34 (32.1%)
Caucasian	31 (29.2%)

Mixed Ethnic Heritage	31 (29.2%)
Asian-American	21 (19.8%)
Native Hawaiian/Pacific Islander	10 (9.4%)
African-American	1 (0.9%)
Latino/a	1 (0.9%)

Study attrition. A participant was considered to have dropped-out of the study if he/she missed five consecutive sessions or eight or more sessions, inclusive of the final two sessions of the program. In total, 70.8% (n = 75) of the sample completed treatment. Pearson Chi-square analysis showed no significant differences between treatment conditions on the number of participants who dropped-out (Standard Care n = 15, Continuing Care n = 16; $\chi^2 = 0.44$, $p = 0.51$). Independent samples t-tests demonstrated no significant differences between participants who completed treatment and participants who dropped-out on any baseline measures of psychological functioning. There were no significant differences between the two groups on baseline BMI (mean baseline BMI of completers = 35.26; mean baseline BMI of drop-outs = 36.79; $t(99) = 0.87$, $p = 0.38$).

Treatment conditions. Participants enrolled in the study completed a 20-session intensive lifestyle intervention program (*The Lifestyle Balance Program*) over the course of six months (two hours per session). *The Lifestyle Balance Program* included several standard components of a behavioral weight loss program, including clearly defined weight-loss and physical activity goals, self-monitoring techniques and problem-solving strategies and coping skills to address challenges, manage stress and maintain motivation

(Diabetes Prevention Program Research Group, 2002). Participants in the standard care condition received the six month intervention followed by assessments at six, twelve and 18 months post-treatment.

For those centers randomized into the continuing care condition, participants received the six month intervention plus additional sessions comprising the self-help treatment component. Toward the end of the six month intervention, each center selected two peer leaders to moderate the group following the formal treatment phase. Following the completion of the six month active treatment phase, participants in the continuing care self-help condition attended weekly sessions moderated by these trained group members for an additional 18 months post-treatment. Peer leaders were trained and supervised to guide mutually supportive groups of their peers in their joint efforts to maintain lost weight. As with the standard care condition, participants were given follow-up assessments at six, twelve and 18 months post-treatment.

Although all participants were enrolled in the study for a total of two years, the present study presents data for the first year only. For the current study, data collection occurred at three main time points, described here.

Time 1 (Baseline). All individuals completed a consent form and a screening questionnaire asking for self-reported age, height and weight, if the individual was already undergoing weight loss treatment, taking medications or had ever been diagnosed with a psychological condition. Following these initial questions, those individuals interested in participating completed several health screening tools, focused on medical history and health-related quality of life. These are not reviewed here as they are not

central to the hypotheses of this project. The screening questionnaire also included the Weight Bias Internalization Scale (Durso & Latner, 2008), the main outcome measure of the present study. Once accepted into the weight loss treatment program and before the active treatment phase, participants completed the Antifat Attitudes Questionnaire (Crandall, 1994), the Rosenberg Self-Esteem Scale (Rosenberg, 1979), the Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995), and the Body Shape Questionnaire (Dowson & Henderson, 2001; Cooper, Taylor, Cooper, & Fairburn, 1987). Each measure is described in more detail below. Participant weight was measured using a digital scale (Tanita, Inc.) and height measured using a stadiometer.

Time 2 (Post-treatment) and Time 3 (Follow-up). Participants completed the measures at Time 1, then immediately post-treatment (Time 2) and at six-months post-treatment (Time 3). As at baseline, participant weight at post-treatment and follow-up was measured using a digital scale (Tanita, Inc.).

Measures. The Weight Bias Internalization Scale (WBIS; Durso & Latner, 2008) was designed to measure the degree to which a respondent believes that negative stereotypes and negative self-statements about being overweight or obese apply to him or her. Respondents are asked to rate their agreement with each item on a 7-point scale from “strongly disagree” to “strongly agree” (e.g. “As an overweight person, I feel that I am just as competent as anyone.”). The WBIS was found to have an internal consistency (Cronbach’s alpha) estimate of 0.90 in an overweight, community sample of adults (Durso & Latner, 2008). Convergent validity was demonstrated by significant relationships between internalized weight bias and measures of self-esteem, drive for

thinness and body image concern (Durso & Latner, 2008). Though related to anti-fat attitudes, internalized weight bias has been shown to be a unique construct which independently contributes to the prediction of these variables (Durso & Latner, 2008). Cronbach's alpha in the present sample was found to be 0.67.

To compare changes in internalized weight bias relative to changes in anti-fat attitudes, participants completed a traditional measure of anti-fat bias, the Antifat Attitudes Questionnaire (AAQ; Crandall, 1994). This scale is a 13-item measure reflecting dislike of obese persons, fear of fat and beliefs about the controllability of weight. Items include such statements as, "I have a hard time taking fat people too seriously," and respondents are asked to rate their agreement with the statements on a 0 to 9 Likert scale. The AAQ yields three subscale scores, *Dislike*, *Fear of Fat*, and *Willpower*. Crandall (1994) demonstrated construct validity of the scale through comparisons with expression of racist beliefs - holding politically conservative, authoritarian or racist views were shown to be correlated with the *Dislike* and *Willpower* subscales of the AAQ but not the *Fear of Fat* subscale. Internal consistency (Cronbach's alpha) in the present sample was found to be 0.75 for the total score, 0.79 for the *Dislike* subscale, 0.82 for the *Fear of Fat* subscale and 0.64 for the *Willpower* subscale.

Participants were given the Rosenberg Self-Esteem Scale (Rosenberg, 1979) and the Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995) to examine the relationships between weight change, internalized weight bias and self-esteem and depressive symptoms disturbance. The Rosenberg Self-Esteem Scale (RSE) is a widely used measure of self-esteem which asks for respondents' degree of agreement with 10

statements such as “I feel that I have a number of good qualities,” using a 4-point scale ranging from “Strongly Disagree” to “Strongly Agree.” Extensive research has been conducted on the psychometric properties of the RSE, including demonstrations of its discriminant and convergent validity (Lucas, Diener & Suh, 1996) and external validity (Schmitt & Allik, 2005). Cronbach’s alpha in the present sample was found to be 0.87.

The 21-item version of the Depression Anxiety Stress Scales (DASS) was used as a measure of participants’ depressive symptoms, level of anxiety and perceived stress. It consists of three subscales and also produces a total score reflecting core symptoms of depression, anxiety and stress. Respondents rate the degree to which each of the 21 statements applied to him/her over the past week. Item responses fall along a 4-point Likert scale, with agreement ranging from “Did not apply to me at all” to “Applied to me very much, or most of the time.” Cronbach’s alpha in an overweight, community sample of adults was found to be 0.92 (Durso & Latner, 2008). Previous research has demonstrated the concurrent validity of the 21-item version of the DASS by reporting significant associations between the DASS and established measures of depression and anxiety, such as the Beck Depression Inventory and the Beck Anxiety Inventory (Antony, Bieling, Cox, Enns & Swinson, 1998). The scale has also been shown to adequately distinguish between patients with depression or anxiety disorders and non-clinical samples (Antony, Bieling, Cox, Enns & Swinson, 1998). The sound psychometrics of the scale have also been shown to be maintained across different racial groups - African-American/Black, Caucasian, Hispanic or Latino(a) and Asian individuals (Norton, 2007).

Cronbach's alpha in the present sample was found to be 0.92 for the total score, 0.86 for the *Depression* subscale, 0.77 for the *Anxiety* subscale and 0.84 for the *Stress* subscale.

To examine the relationship of internalized weight bias to body image concern, participants completed the Short Version of the Body Shape Questionnaire (BSQ; Dowson & Henderson, 2001; Cooper, Taylor, Cooper, & Fairburn, 1987). The short version of the BSQ is a 14-item measure of satisfaction and concern with body shape using a 6-point response format ranging from *never* to *always* (sample item: "Have you felt ashamed of your body?"). Dowson and Henderson (2001) found good construct validity for the shortened version of the BSQ using a sample of women with disordered eating by reporting correlations with scores on the Eating Attitudes Test, the Bulimia Investigatory Test and the Beck Depression Inventory. Cronbach's alpha in the present sample was found to be 0.95.

These procedures were approved by the University of Hawai'i Institutional Review Board and all participants gave informed consent.

Statistical Analyses

Descriptive and Exploratory Analyses

Weight change at post-treatment and follow-up. Percent change in initial body weight (IBW) was used as the main measure of weight change across time. Percent change in initial body weight was calculated between baseline and post-treatment, between post-treatment and follow-up, and between baseline and follow-up. For analysis of weight-related variables, missing data were accounted for by Intent-to-Treat (ITT) analysis procedures using the last observation carried forward. Using Independent

Samples t-tests, ITT weight-loss data from dropouts were compared to data from treatment completers to assess differences between those participants who completed treatment and those participants who dropped out of the study. Intent-to-Treat weight-loss data was utilized for all other analyses.

Relationship of weight status and psychological functioning at baseline. Descriptive statistics were computed for all demographic variables and study measures. Pearson product-moment correlations were calculated between baseline BMI and baseline scores of internalized weight bias, body image concern, self-esteem, anti-fat attitudes, depressive symptoms, anxiety and stress. For those measures which were uncorrelated with BMI, a Repeated Measures Analysis of Variance (ANOVA) was conducted to test for changes between baseline, post-treatment and six months post-treatment (i.e. six month follow-up). For those measures which were shown to correlate with BMI, a Repeated Measures Analysis of Covariance (ANCOVA) was conducted to test for changes between baseline, post-treatment and six months post-treatment (i.e. six month follow-up). For these analyses, missing data were accounted for by replacing missing values with the series mean for each measure. Given the number of comparisons conducted for this analysis (n = 10), alpha level was adjusted using a Bonferroni correction and set to 0.005.

Descriptive analysis of change in internalized weight bias over time. Using data-analytic procedures outlined in Singer and Willett (2003), exploratory descriptive analyses were conducted to examine change in WBIS scores within subjects, across subjects and between conditions. Participants who completed the WBIS at all three

assessment time points were selected (n = 37) and empirical growth plots were graphed to examine change at the individual level across treatment and follow-up. Linear growth trajectories were fitted to each plot using Ordinary Least Squares Regression. These individual trajectories were plotted on a single graph to examine interindividual differences in change of WBIS scores as well as average rate of change for each treatment condition. Sample means and standard deviations of the slopes and intercepts of these regression models were calculated and compared between conditions. Pearson product-moment correlation coefficients were calculated between the intercepts and slopes to test whether baseline measures of WBIS scores were related to the rate of change observed. Finally, participants were grouped according to baseline level of internalized bias (by transforming the continuous WBIS variable into a categorical variable using a median split) and the rates of change between the groups were compared to assess the interaction between degree of weight bias and assessment time.

Inferential Statistics

Central hypothesis: Change in internalized weight bias over time. Following the statistical methods used by Crerand, Wadden, Foster, Sarwer, Paster and Berkowitz (2007), repeated measures Analysis of Variance (ANOVA) with Simple Contrasts was used to assess changes in internalized weight bias between baseline, post-treatment, and six month follow-up. Analyses were conducted using Assessment Time as the within-subjects factor (three levels) and Treatment Condition as the between-subjects factor (two levels).

Research questions 1 and 2: Relationship of internalized weight bias to weight change. For each of the study variables, specifically internalized weight bias, body image concern, self-esteem, anti-fat attitudes, depressive symptoms, anxiety and stress, change scores were calculated by subtracting participants' baseline scores from post-treatment scores (Time 2 minus Time 1), post-treatment scores from follow-up scores (Time 3 minus Time 2) and baseline scores from follow-up scores (Time 3 minus Time 1). These change scores were compared to percent change in IBW from baseline to post-treatment, percent change from post-treatment to follow-up and percent change from baseline to follow-up using Pearson's product-moment correlations. The data analytic plan also included calculating partial correlations between change in weight and change in the psychological variables controlling for treatment condition, if differences in weight change emerged between the treatment conditions. Independent samples t-tests were used to assess whether percent change in IBW differed significantly between those participants reporting a high baseline WBIS score and those participants reporting a low

baseline WBIS score at post-treatment and follow-up. Multiple linear regression using a block entry method was used to predict whether changes in weight bias internalization and/or changes in the other psychological measures included in the study (i.e. body image concern, self-esteem, anti-fat attitudes, depressive symptoms, anxiety and stress) were predictive of percent change in IBW at post-treatment, change at follow-up and change from baseline to follow-up. To assess for significant change in R^2 with the addition of internalized weight bias, WBIS scores were entered into the regression model as a separate block. Additional predictor variables used in the regression models were those identified through Pearson correlations as being significantly related to percent change in IBW.

Research questions 3 and 4: Relationship of internalized weight bias to psychological functioning. Finally, the relationship between body image concern, self-esteem, anti-fat attitudes, depressive symptoms, anxiety and stress, and levels of internalized weight bias was explored using Pearson product-moment correlations calculated at baseline, post-treatment and follow-up. From these results, multiple linear regression was used to assess whether baseline levels of internalized weight bias could predict changes in those psychological variables shown to be significantly related to internalized weight bias. The data analytic plan also included the intent to use multiple linear regression to test a mediation model, using the method outlined by Baron and Kenny (1986), if weight bias internalization was found to be related to both weight loss and changes in psychological functioning.

Results

Descriptive and Exploratory Analyses

Weight change at post-treatment and follow-up. To test for treatment effects on change in weight, percent change in initial body weight was calculated for treatment completers only and for the full sample using Intent-to-Treat analysis. Results indicate a significant change in body weight over time, with treatment completers losing, on average, 5.22% of initial body weight (% IBW; range = loss of 19.87% to gain of 3.39%) from baseline to post-treatment, and an additional 0.50% IBW (range = loss of 25.79% to gain of 12.46%) from post-treatment to follow-up. Using the Intent-to-Treat analysis (last observation carried forward), participants lost, on average, 3.87% IBW (range = loss of 19.87% to gain of 3.39%) from baseline to post-treatment and an additional 0.46% IBW (range = loss of 25.79% to gain of 12.46%) from post-treatment to follow-up. Overall, from baseline to follow-up, treatment completers lost 7.02% IBW (range = loss of 29% to gain of 12.21%), and the Intent-to-Treat sample lost 4.32% IBW (range = loss of 29% to gain of 12.21%).

Relationship of weight status and psychological functioning at baseline. Pearson product-moment correlations were calculated between baseline BMI and baseline assessments of internalized weight bias, body image concern, self-esteem, anti-fat attitudes, depressive symptoms, anxiety and stress to assess for significant relationships among these variables. As shown in Table 2, BMI was shown to be positively and significantly correlated with body image concern but no other psychological variable.

Table 2

Pearson Product-moment Correlations Among Baseline Body Mass Index and Baseline Measures of Psychological Functioning

	BMI	WBIS	BSQ	RSE	AAQ Total	AAQ Dislike	AAQ Fear of Fat	AAQ Willpower	DASS Total	DASS Depression	DASS Anxiety	DASS Stress
BMI	---											
WBIS	0.05	---										
BSQ	0.23*	0.51**	---									
RSE	-0.16	-0.46**	-0.47**	---								
AAQ Total	0.15	0.17	0.39**	-0.41**	---							
AAQ Dislike	-0.20	-0.05	-0.10	-0.05	0.67**	---						
AAQ Fear of Fat	0.19	0.45**	0.54**	-0.46**	0.72**	0.02	---					
AAQ Willpower	0.20	0.17	0.32**	-0.22*	0.58**	-0.01	0.36**	---				
DASS Total	0.16	0.21	0.28**	-0.43**	0.33**	0.16	0.38**	0.21	---			
DASS Depression	0.00	0.28*	0.25*	-0.45**	0.29*	0.18	0.28*	0.25*	0.88**	---		
DASS Anxiety	-0.03	0.1	0.11	-0.24	0.35**	0.29*	0.41**	0.11	0.85**	0.71**	---	
DASS Stress	0.21	0.16	0.27*	-0.31*	0.19	0.03	0.25*	0.15	0.86**	0.57**	0.56**	---

Note. Data presented are from the Intent-to-Treat analysis. BMI = Body Mass Index; WBIS = Weight Bias Internalization Scale; BSQ = Body Shape Questionnaire; RSE = Rosenberg Self-Esteem Scale; AAQ = Antifat Attitudes Questionnaire; DASS = Depression Anxiety Stress Scales

* = $p < 0.05$. ** = $p < 0.01$

Psychological functioning at post-treatment and follow-up. Repeated Measures Analysis of Variance (ANOVA) was used to test for changes in self-esteem, anti-fat attitudes, depressive symptoms, anxiety and stress across the study period. Assessment Time was entered as the within-subjects factor (3 levels) and Treatment Condition was entered as the between-subjects factor (2 levels). Using a Bonferroni corrected alpha level ($\alpha = 0.005$), no effect was found for the interaction of Assessment Time and Treatment Condition for change in RSE scores (Wilks' Lambda = 0.95; $F(2, 103) = 2.50$; $p = 0.09$.), AAQ Total scores (Wilks' Lambda = 0.99; $F(2, 103) = 0.39$; $p = 0.68$), AAQ Dislike scores (Wilks' Lambda = 0.21; $F(2, 103) = 0.21$; $p = 0.81$), AAQ Fear of Fat scores (Wilks' Lambda = 0.97; $F(2, 103) = 1.37$; $p = 0.26$), AAQ Willpower scores (Wilks' Lambda = 0.99; $F(2, 104) = 0.32$; $p = 0.73$), DASS Total scores (Wilks' Lambda = 0.98; $F(2, 103) = 1.04$; $p = 0.36$), DASS Depression scores (Wilks' Lambda = 0.99; $F(2, 103) = 0.75$; $p = 0.48$), DASS Anxiety scores (Wilks' Lambda = 0.98; $F(2, 103) = 1.11$; $p = 0.33$) and DASS Stress scores (Wilks' Lambda = 0.98; $F(2, 103) = 1.00$; $p = 0.37$).

A main effect was not found for Treatment Condition for change in RSE scores ($F(1, 104) = 2.79$; $p = 0.10$), AAQ Total scores ($F(1, 104) = 0.15$; $p = 0.70$), AAQ Dislike scores ($F(1, 104) = 0.41$; $p = 0.52$), AAQ Fear of Fat scores ($F(1, 104) = 0.73$; $p = 0.40$), AAQ Willpower scores ($F(1, 104) = 0.01$; $p = 0.92$), DASS Total scores ($F(1, 104) = 3.20$; $p = 0.08$), DASS Depression scores ($F(1, 104) = 0.82$; $p = 0.37$), DASS Anxiety scores ($F(1, 104) = 6.57$; $p = 0.01$) and DASS Stress scores ($F(1, 104) = 4.58$; $p = 0.04$). As such, data were collapsed across Treatment Conditions and are presented for

the sample as a whole (Table 3). As shown in Table 3, a significant main effect was found for Assessment Time for these study measures.

Table 3

Mean Scores of All Study Measures

Measure	Baseline	Post-treatment	Six Month Follow-up	F (*df*1, *df*2)
BMI (Completers)	35.66 (7.67)[a]	32.43 (6.67)[b]	31.92 (6.13)[bc]	20.19 (2, 60)[*]
BMI (ITT)	35.66 (7.67)[a]	34.73 (7.91)[b]	34.21 (7.99)[c]	25.30 (1.72, 169.74)[*†]
WBIS	3.83 (1.05)[a]	3.55 (0.72)[b]	3.40 (1.30)[c]	9.71 (1.79, 185.89)[*†]
BSQ	3.61 (1.11)[a]	2.86 (1.14)[a]	2.95 (1.18)[a]	0.26 (1.88, 184.12)[†]
RSE	3.12 (0.51)[a]	3.31 (0.51)[b]	3.23 (0.54)[b]	13.10 (1.81, 187.68)[*†]
AAQ Total	2.80 (1.13)[a]	2.76 (1.40)[a]	1.99 (1.26)[b]	52.58 (2, 208)[*]
AAQ Dislike	1.46 (1.19)[a]	1.23 (1.45)[b]	0.48 (0.57)[c]	58.30 (2, 208)[*]
AAQ Fear of Fat	4.93 (2.18)[a]	4.74 (2.33)[a]	3.81 (3.04)[b]	24.00 (1.79, 186.63)[*†]
AAQ Willpower	4.68 (1.77)[a]	4.66 (1.88)[a]	3.69 (2.02)[b]	45.52 (1.70, 176.34)[*†]
DASS Total	0.57 (0.44)[a]	0.49 (0.44)[a]	1.02 (0.62)[b]	58.50 (2, 208)[*]
DASS Depression	0.64 (0.51)[a]	0.46 (0.50)[b]	0.98 (0.67)[c]	47.44 (2, 208)[*]
DASS Anxiety	0.53 (0.43)[a]	0.35 (0.40)[b]	0.84 (0.61)[c]	45.12 (2, 208)[*]
DASS Stress	0.83 (0.51)[a]	0.67 (0.60)[b]	1.25 (0.72)[c]	44.60 (2, 208)[*]

Note. Values with overlapping superscripts are not significantly different. BMI = Body Mass Index; %IBW = Percent change in initial body weight; ITT = Intent-to-Treat; WBIS = Weight Bias Internalization Scale; BSQ = Body Shape Questionnaire; RSE = Rosenberg Self-Esteem Scale; AAQ = Antifat Attitudes Questionnaire; DASS = Depression Anxiety Stress Scales

* $p < 0.005$

† Greenhouse-Geisser correction applied due to violation of the assumption of sphericity

Based on the significant correlation found between baseline BMI and body image concern, Repeated Measures Analysis of Covariance (ANCOVA) using baseline BMI as a covariate was used to test for changes in body image concern across the study period. As in prior analyses, Assessment Time was entered as the within-subjects factor (3 levels) and Treatment Condition was entered as the between-subjects factor (2 levels). Baseline BMI was entered as the covariate. Holding baseline BMI constant, no significant main effect was found for Assessment Time (Wilks' Lambda = 0.84; $F(2,97) = 1.00$, $p = 0.77$) or for Treatment Condition ($F(1, 98) = 1.79$; $p = 0.18$). No interaction effect was found for the interaction of Assessment Time and Treatment Condition (Wilks' Lambda = 0.84; $F(2,97) = 0.98$, $p = 0.42$) or the interaction of Assessment Time and Baseline BMI (Wilks' Lambda = 0.97; $F(2,97) =$, $p = 0.19$). Data were collapsed across conditions and are presented in Table 3.

Descriptive analysis of change in internalized weight bias over time. In total, 37 participants completed the WBIS at all three assessment points and this subsample was used to complete basic exploratory analyses of change in internalized weight bias over time at the individual level. Simple scatter plots were used to show mean WBIS scores at baseline, post-treatment and follow-up for each individual participant. The majority of cases showed a linear growth pattern, with the exception of 7 cases whose plots suggested a U-shaped pattern of change. Figure 1 shows growth plots for each individual participant, with linear trajectories fitted using Ordinary Least Squares regression. Combining these growth plots into one graph, visual inspection indicates a downward trend in WBIS scores from baseline to post-treatment and follow-up (Figure

2). Using the intercepts and slopes for each individual plot, the average rate of change for the sample as a whole was found to be -0.21 (range=-1.27 to 0.91) indicating that at each assessment point, WBIS scores decreased by 0.21 units. To assess whether the rate of change was significantly related to baseline WBIS scores, Pearson product-moment correlations were calculated between the estimated intercepts and slopes. The estimated rate of change was found to be significantly correlated with the estimated intercept (r = -0.62; $p<0.01$), indicating that higher baseline scores were related to more strongly negative rates of change.

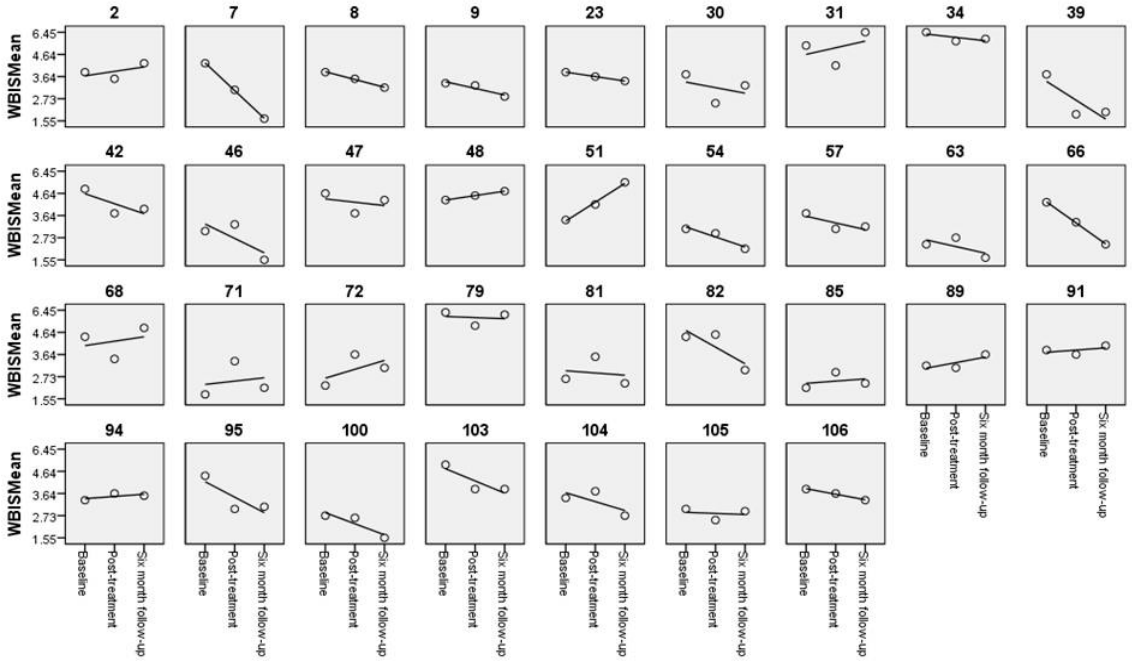

Figure 1. Weight Bias Internalization Scale Mean Scores at Baseline, Post-Treatment and Follow-up for Individual Participants with Fitted OLS Regression Lines

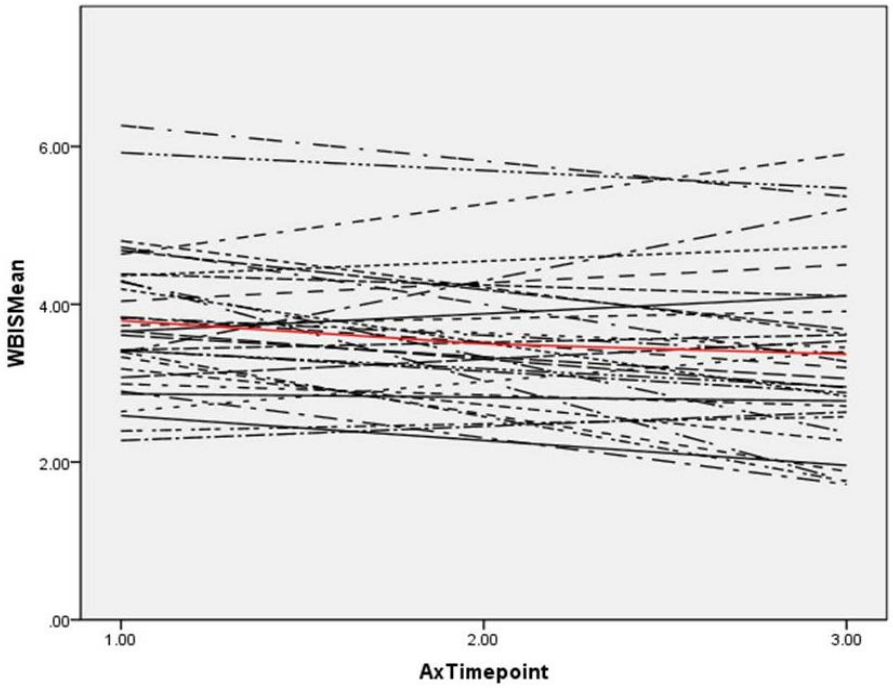

Figure 2. Fitted OLS Regression Lines for Weight Bias Internalization Scale scores of all Participants. WBIS = Weight Bias Internalization Scale. AxTimepoint 1.00 = Baseline. AxTimepoint 2.00 = Post-treatment. AxTimepoint 3.00 = Follow-up.

To explore whether the change in WBIS scores over time was related to Treatment Condition, growth plots were created for the Standard Care and Continuing Care conditions, presented in Figure 3. Visual inspection suggested that there were no differences between the two conditions and the mean estimated slope of both lines was found to be -0.21. To assess whether a participant's baseline WBIS score was related to the rate of change in WBIS score over time, participants were coded as having either a low baseline score or high baseline score using a median split (where the median score equaled 3.82). OLS regression lines for both the low baseline and high baseline groups are presented in Figure 4. The mean estimated slope of the low baseline group was found

to be -0.14, where the mean estimated slope of the high baseline group was found to be -0.29, indicating a rate of change approximately twice that of the low baseline group.

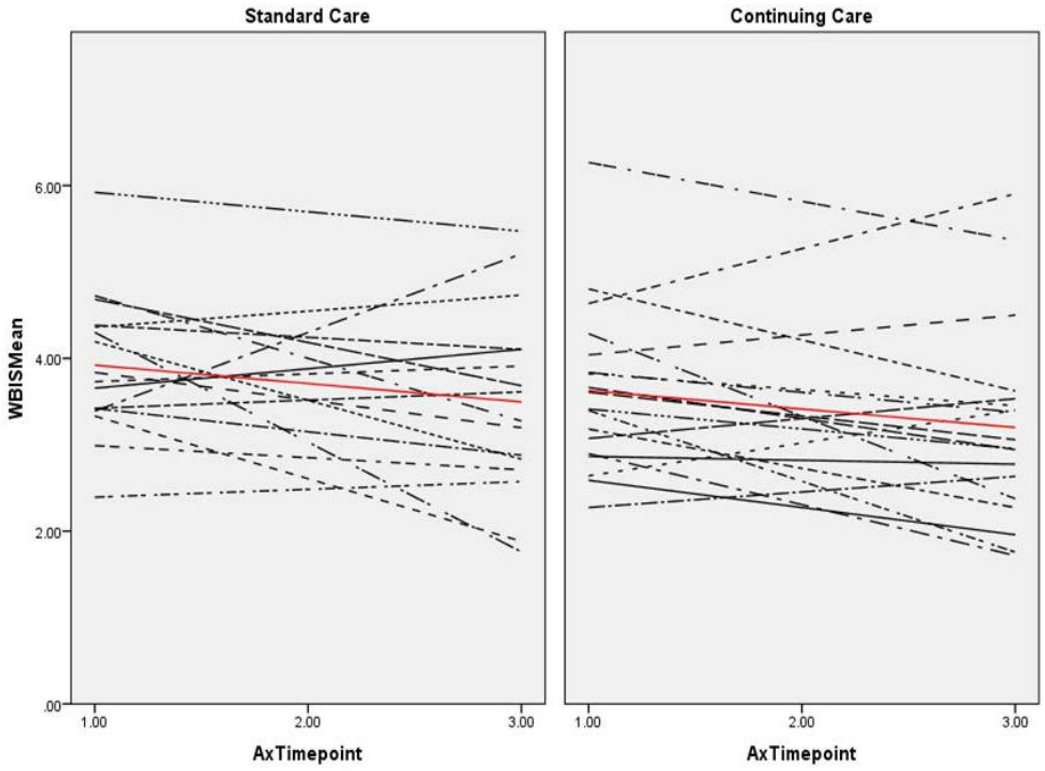

Figure 3. Fitted OLS Regression Lines for mean Weight Bias Internalization Scale Scores for the Standard Care (left panel) and Continuing Care Treatment Conditions (right panel). WBIS = Weight Bias Internalization Scale. AxTimepoint 1.00 = Baseline. AxTimepoint 2.00 = Post-treatment. AxTimepoint 3.00 = Follow-up.

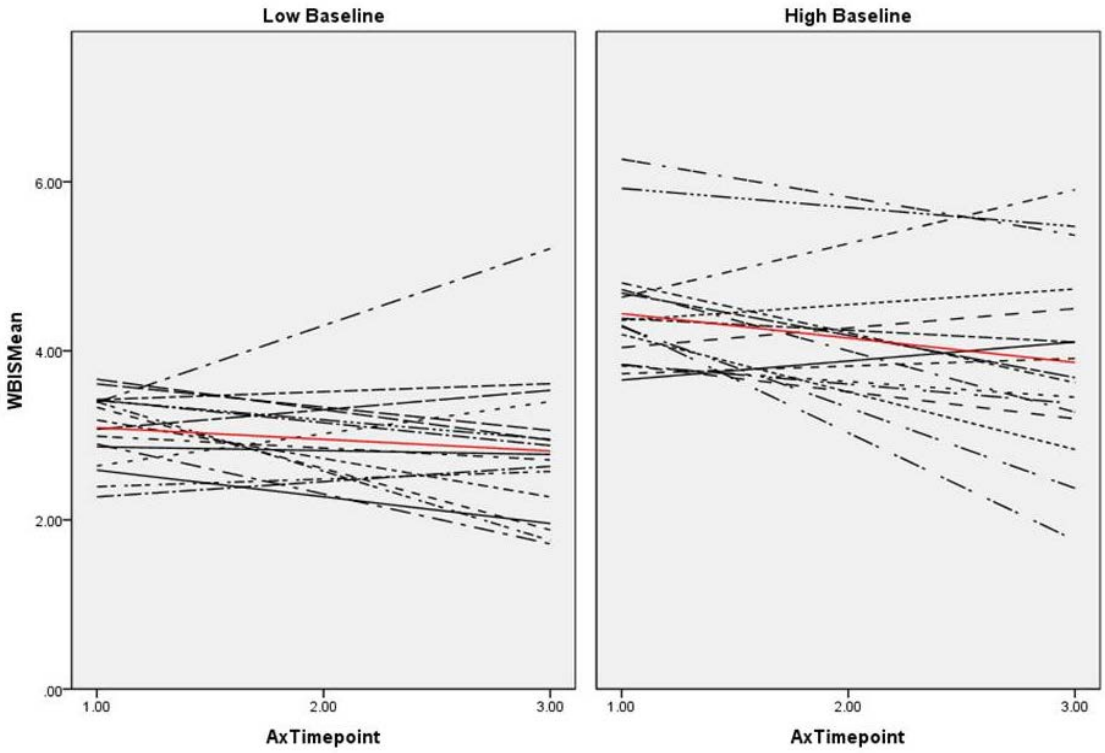

Figure 4. Fitted OLS Regression Lines for Participants with Low Weight Bias Internalization Scale Baseline Scores (left panel) and High Weight Bias Internalization Scale Baseline Scores (right panel). WBIS = Weight Bias Internalization Scale. AxTimepoint 1.00 = Baseline. AxTimepoint 2.00 = Post-treatment. AxTimepoint 3.00 = Follow-up.

Central Hypothesis: Does Internalized Weight Bias Change Over Time?

To address this study's central hypothesis, that WBIS scores would decline from baseline to post-treatment and follow-up, Repeated Measures ANOVA was used to assess the effect of Assessment Time (3 factors) and Treatment Condition (2 factors). Cell means are presented in Table 3. Multivariate test indicated a main effect for Assessment Time (Wilks' Lambda = 0.84; $F(2,103) = 9.71$, $p < 0.001$) but no main effect for Treatment Condition ($F(1, 104) = 1.24$; $p = 0.27$) or interaction effect for the interaction of Assessment Time and Treatment Condition (Wilks' Lambda = 0.99; $F(2,103) = 0.49$, p

=0.61). Mauchley's Test of Sphericity was found to be significant ($\chi^2 = 13.05$; $p = 0.001$), indicating that the assumption of sphericity was violated. Therefore, Greenhouse-Geisser and Huyn-Feldt corrections were applied to the data. Tests of within-subject effects using a Greenhouse-Geisser correction indicate a significant effect for Assessment Time ($F(1.78, 185.89) = 12.05$, $p < 0.001$). Tests of within-subject effects using a Huyn-Feldt correction indicate a significant effect for Assessment Time ($F(1.83, 190.74) = 12.05$, $p < 0.001$). Simple contrasts demonstrated that WBIS scores declined significantly between baseline and post-treatment ($F(1,104) = 8.10$, $p = 0.005$), between post-treatment and follow-up ($F(1,104) = 5.18$, $p = 0.03$), and overall from baseline to follow-up ($F(1,104) = 19.40$, $p < 0.001$). The effect size (Cohen's *d*) for the observed change in WBIS mean scores between baseline and post-treatment was found to be 0.27. Cohen's *d* for the observed change in WBIS mean scores between post-treatment and follow-up was found to be 0.14. Finally, Cohen's *d* for the observed change in WBIS mean scores between baseline and follow-up was found to be 0.33. All effect sizes are considered to be small (Cohen, 1988).

Given the observed differences in the rate of change of internalized weight bias between participants reporting low baseline WBIS scores and high WBIS scores, a second analysis was done using Assessment Time x Median Split Score (low or high baseline). Multivariate test indicated a significant interaction effect between Assessment Time and Median Split Score (Figure 5; Wilks' Lambda = 0.65; $F(2, 103) = 28.13$, $p < 0.001$). Test of within-subjects contrasts indicate significant differences in WBIS change

between baseline and post-treatment ($p < 0.001$) and between baseline and follow-up ($p < 0.001$) but not between post-treatment and follow-up ($p = 0.17$).

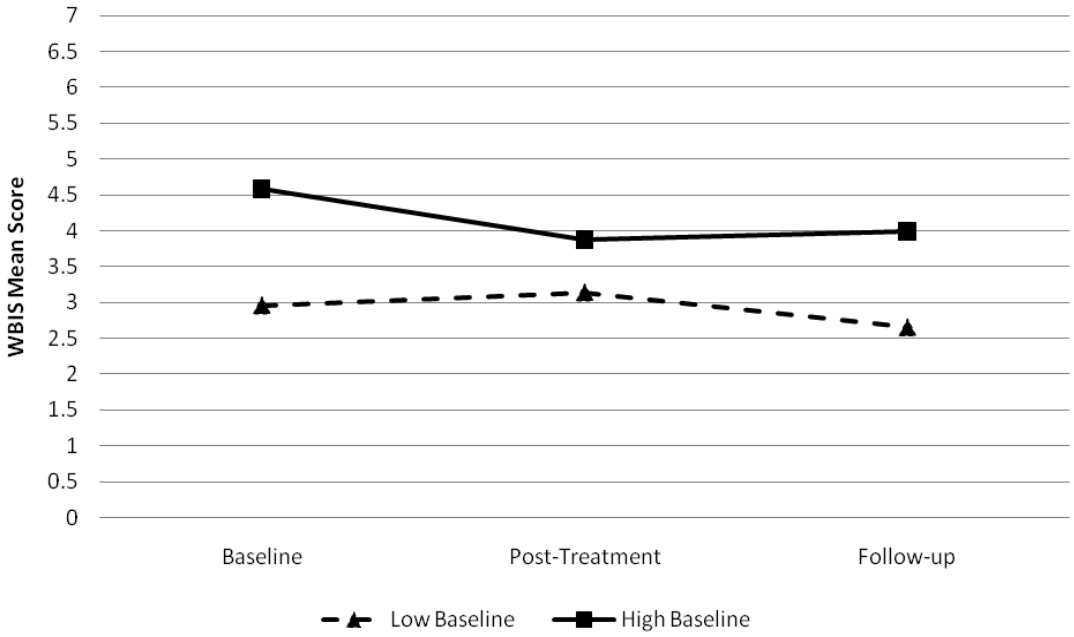

Figure 5. Change in Weight Bias Internalization Scale (WBIS) scores From Baseline to Post-Treatment and Follow-up for participants reporting low baseline WBIS scores and those reporting high baseline WBIS scores.

Research Question 1: How is Internalized Weight Bias Related to Weight Gain?

To explore the relationship between weight regain and internalized weight bias, Pearson product-moment correlations were calculated for percent change in IBW at post-treatment and follow-up with change in WBIS scores at post-treatment and follow-up (Table 4). Weight change from post-treatment to follow-up was found to be significantly related to change in WBIS scores from post-treatment to follow-up ($r = 0.47$, $p = 0.004$), indicating that across this time period, internalized weight bias scores increased among participants who gained weight. Percent change in IBW and change in WBIS scores

were unrelated between pre- and post-treatment assessments. As there were only 24 participants whose weight-related data indicated weight regain following treatment, additional analyses comparing participants who gained weight following treatment to those who lost or maintained weight were not performed due to low power.

Table 4

Pearson Product-moment Correlations Among Percent Change in Body Weight and Change in WBIS Scores

	% Change in Body Weight at Post-treatment	% Change in Body Weight at Follow-up	% Change in Body Weight Overall
Baseline WBIS	0.14	0.22*	0.26*
Post-treatment WBIS	0.19	0.11	0.21
Follow-up WBIS	0.32*	0.26	0.46**
Change in WBIS (Post-treatment)	-0.05	-0.24	-0.20
Change In WBIS (Follow-up)	0.46**	0.47**	0.67**
Change in WBIS (Overall)	0.20	0.01	0.17

Note. Data presented are from the Intent-to-Treat analysis. WBIS = Weight Bias Internalization Scale; Change in WBIS (Post-treatment) = Change from baseline to post-treatment; Change in WBIS (Follow-up) = Change from post-treatment to follow-up; Change in WBIS (Overall) = Change from baseline to follow-up

* $p < 0.05$. ** $p < 0.01$

Research Question 2: Do Levels of Internalized Weight Bias Predict Weight Change?

In order to test whether baseline WBIS scores were predictive of changes in weight over time, Pearson product-moment correlations were calculated between study

measures and percent change in IBW from baseline to post-treatment and percent change in IBW from baseline to follow-up. As shown in Table 5, between baseline and post-treatment, percent change in IBW was significantly related to baseline RSE scores. From baseline to follow-up, percent change in IBW was significantly related to baseline WBIS, RSE and BSQ scores. These variables were retained as predictors of weight change in a test of several regression models.

Table 5

Pearson Product-moment Correlations Among Percent Change in Body Weight and Baseline Internalized Weight Bias and Psychological Functioning

	% Change in Body Weight at Post-treatment	% Change in Body Weight Overall
Baseline BMI	0.13	0.10
Baseline WBIS	0.14	0.26**
Baseline BSQ	0.16	0.22*
Baseline RSE	-0.21*	-0.28**
Baseline AAQ Total	0.02	-0.02
Baseline AAQ Dislike	-0.03	-0.03
Baseline AAQ Fear of Fat	0.01	0.13
Baseline AAQ Willpower	0.03	-0.15
Baseline DASS Total	0.15	0.20
Baseline DASS Depression	0.05	0.11
Baseline DASS Anxiety	0.00	0.07
Baseline DASS Stress	0.22	0.22

Note. Data presented are from the Intent-to-Treat analysis. BMI = Body Mass Index; WBIS = Weight Bias Internalization Scale; BSQ = Body Shape Questionnaire; RSE = Rosenberg Self-Esteem Scale; AAQ Total = Antifat Attitudes Questionnaire Total Score; AAQ Dislike = Antifat Attitudes Questionnaire Dislike subscale; AAQ Fear of Fat = Antifat Attitudes Questionnaire Fear of Fat subscale; AAQ Willpower = Antifat Attitudes Questionnaire Willpower subscale; DASS Total = Depression Anxiety Stress Scales Total Score; DASS Depression = Depression Anxiety Stress Scales Depression subscale; DASS Anxiety = Depression Anxiety Stress Scales Anxiety subscale; DASS Stress = Depression Anxiety Stress Scales Stress subscale; % Change in Body Weight at Post-treatment = Percent change in initial body weight from baseline to post-treatment; % Change in Body Weight Overall = Percent change in initial body weight from baseline to follow-up

* $p < 0.05$. ** $p < 0.01$

To assess for differences in amount of weight lost for participants reporting low baseline versus high baseline levels of internalized weight bias, Independent samples t-tests using an Intent-to-Treat analysis were conducted. These analyses demonstrated no significant difference in percent change in IBW from baseline to post-treatment between participants reporting a low baseline WBIS score (M = 4.50%) and those reporting a high baseline WBIS score (M = 3.54%). There was also no significant difference between these two groups in percent change in body weight from post-treatment to follow-up (Figure 6). Participants reporting a low baseline WBIS score had a mean additional loss of 1.54% of IBW at follow-up whereas participants reporting a high baseline WBIS score had a mean gain of 0.33% of IBW.

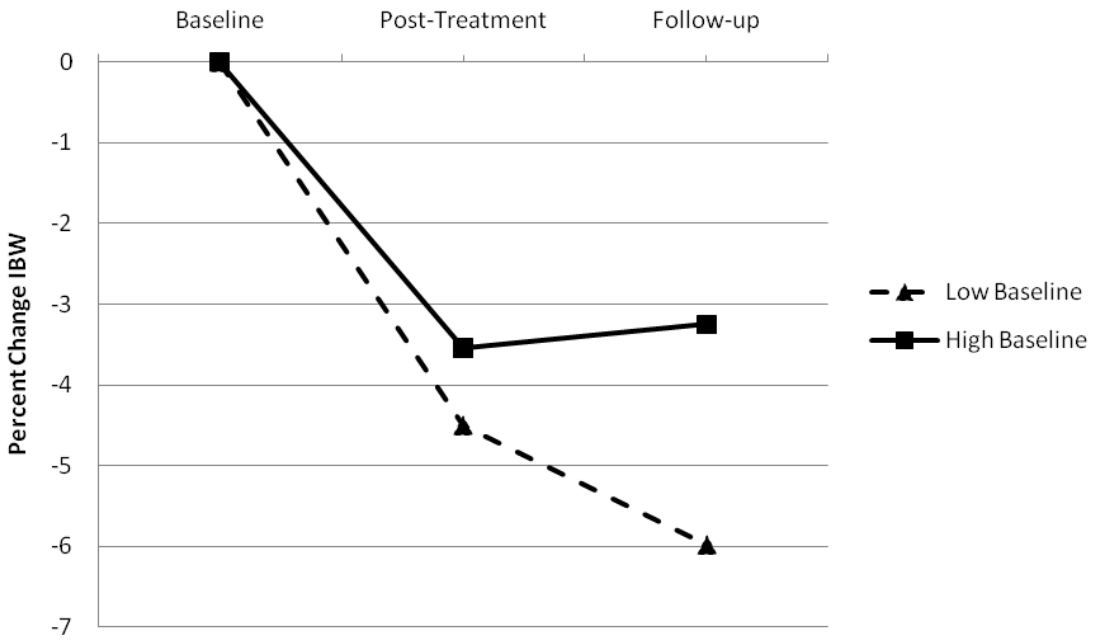

Figure 6. Using the Intent-to-Treat analysis, figure represents the percent change in initial body weight at post-treatment and follow-up for participants reporting low baseline Weight Bias Internalization Scale scores and those reporting high baseline Weight Bias Internalization Scale scores. IBW = Initial Body Weight.

However, when considering the overall study period from baseline to follow-up, participants reporting a low baseline WBIS score showed a mean loss of 5.98% of IBW and participants reporting a high baseline WBIS score showed a mean loss of 3.26% of IBW. This difference was significantly different ($t(95) = 2.13$, $p = 0.036$). These findings held true when the analysis was conducted using only those participants who completed treatment. Among treatment completers, participants with low baseline WBIS scores had a mean loss of 10.03% of IBW from baseline to follow-up where participants with low baseline WBIS scores had a mean loss of 4.97% of IBW (Figure 7; $t(42) = 2.44$, $p = 0.02$).

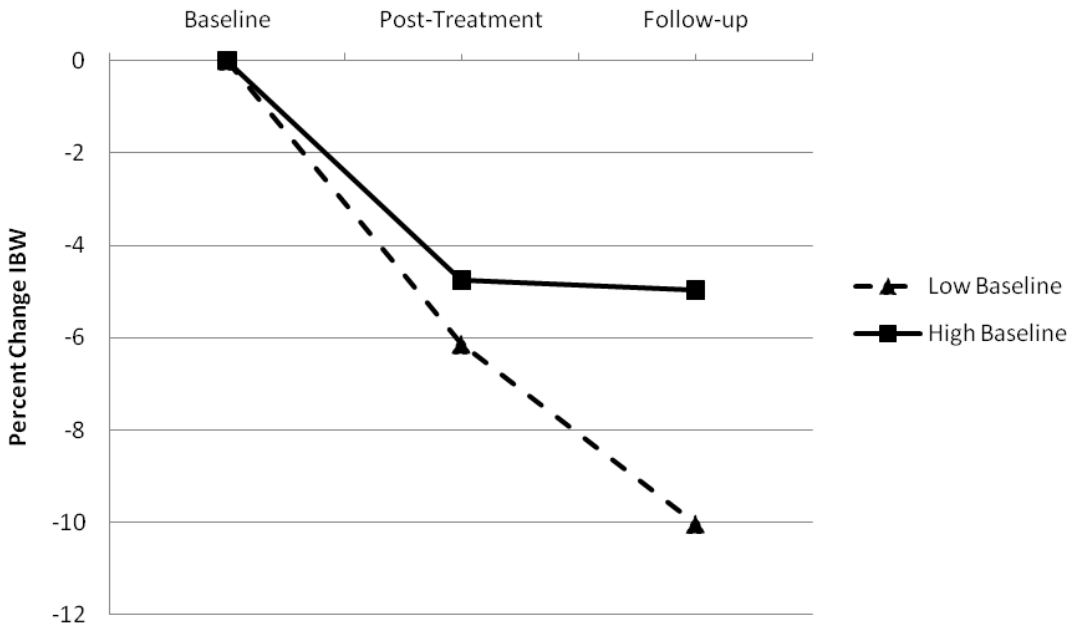

Figure 7. Using treatment completers only, figure represents the percent change in initial body weight at post-treatment and follow-up for participants reporting low baseline Weight Bias Internalization Scale scores and those reporting high baseline Weight Bias Internalization Scale scores. IBW = Initial Body Weight.

To further assess the predictive value of levels of internalized weight bias, multiple linear regression with a block entry method was used to predict change in IBW from baseline to post-treatment. Though baseline WBIS scores were not found to significantly relate to change in IBW from baseline to post-treatment, WBIS was included in the model as it was this study's main variable of interest. Block 1 included baseline BMI and RSE scores as the predictor variables and Block 2 added baseline WBIS as a predictor variable. The model was not found to be significant (Table 6). The same method was used to predict percent change in IBW from baseline to follow-up, with baseline BMI, RSE and BSQ scores entered in Block 1 and baseline WBIS scores entered in Block 2. Again the model was not found to be significant (Table 6). That these models were non-significant precluded further analysis of whether WBIS scores mediated

the relationship between changes in psychological functioning and weight change (Research Question 4).

Table 6

Summary of Multiple Regression Analyses Predicting Change in Body Weight

Dependent Variable	Block	Independent Variables	Model R^2	F	R^2 Change	F Change	Standardized Beta
% Change IBW Post-treatment	1	Baseline BMI	0.05	1.42	0.05	2.14	0.08
		Baseline RSE					-0.18
	2	Baseline WBIS			0.00	0.03	0.02
% Change IBW Overall	1	Baseline BMI	0.09	2.09	0.08	2.48	0.05
		Baseline BSQ					0.07
		Baseline RSE					-0.17
	2	Baseline WBIS			0.01	0.90	0.12

Note. Data presented are from the Intent-to-Treat analysis. % Change IBW = Percent change in initial body weight from baseline to post-treatment (% Change IBW Post-treatment) and from baseline to follow-up (% Change IBW Overall); BMI = Body Mass Index; RSE = Rosenberg Self-Esteem Scale; WBIS = Weight Bias Internalization Scale; BSQ = Body Shape Questionnaire

* $p < 0.05$. ** $p < 0.01$

Research Question 3: Do Levels of Internalized Weight Bias Predict Psychological Functioning?

Correlation between internalized weight bias and psychological functioning. As shown in Tables 7 and 8, Pearson product-moment correlations were calculated to assess for the strength of the relationships between internalized weight bias and measures of body image concern, self-esteem, anti-fat attitudes, depressive symptoms, anxiety and

stress. Table 7 shows the correlations between concurrent assessments (e.g. baseline WBIS scores correlated with baseline body image concern (BSQ)) and Table 8 shows the correlations between assessments of internalized weight bias with change scores for the psychological measures (e.g. baseline WBIS correlated with change in body image concern from baseline to post-treatment.) As shown in Table 7, WBIS scores were significantly and positively correlated with baseline BSQ scores, Fear of Fat scores and Depression scores and negatively correlated with baseline RSE scores. Baseline WBIS scores were significantly and positively correlated with post-treatment BSQ scores and Fear of Fat scores and negatively correlated with post-treatment RSE scores. Post-treatment WBIS scores were significantly and positively correlated with post-treatment BSQ scores, AAQ Total scores, AAQ Dislike scores, AAQ Fear of Fat scores, DASS Total scores and DASS Depression scores. Post-treatment WBIS scores were significantly and negatively correlated with post-treatment RSE scores. Baseline and post-treatment WBIS scores were significantly and negatively correlated with follow-up RSE scores.

Table 7

Pearson Product-moment Correlations Among Internalized Weight Bias Scores at Baseline, Post-treatment and Follow-up and Psychological Functioning

	Baseline WBIS	Post-Treatment WBIS	Follow-up WBIS
Baseline Scores			
BMI	0.05	0.13	0.01
BSQ	0.51**	0.48**	0.67**
RSE	-0.46**	-0.65**	-0.69**

AAQ Total	0.17	0.50**	0.54**
AAQ Dislike	-0.05	0.18	0.17
AAQ Fear of Fat	0.45**	0.40**	0.48**
AAQ Willpower	0.17	0.21	0.46**
DASS Total	0.21	0.50**	0.61**
DASS Depression	0.28*	0.52**	0.51**
DASS Anxiety	0.10	0.37*	0.37*
DASS Stress	0.16	0.35*	0.46**
Post-treatment Scores			
BMI	0.07	0.15	0.06
BSQ	0.53**	0.60**	0.72**
RSE	-0.41**	-0.67**	-0.65**
AAQ Total	0.19	0.57**	a.
AAQ Dislike	-0.07	0.37*	a.
AAQ Fear of Fat	0.37*	0.66**	a.
AAQ Willpower	0.11	0.21	0.11
DASS Total	0.19	0.30*	0.25
DASS Depression	0.23	0.43**	0.37*
DASS Anxiety	0.25	0.21	0.20
DASS Stress	0.06	0.15	0.11
Follow-up Scores			
BMI	0.12	0.18	0.15

BSQ	0.28	0.15	[a.]
RSE	-0.47**	-0.35*	[a.]
AAQ Total	[a.]	[a.]	[a.]
AAQ Dislike	[a.]	[a.]	[a.]
AAQ Fear of Fat	[a.]	[a.]	[a.]
AAQ Willpower	[a.]	[a.]	[a.]
DASS Total	0.03	0.11	[a.]
DASS Depression	0.13	0.25	[a.]
DASS Anxiety	-0.06	-0.08	[a.]
DASS Stress	0.02	0.10	[a.]

Note. Data presented are from the Intent-to-Treat analysis. Cells containing the [a.] superscript had an *n* of less than 30. BMI = Body Mass Index; WBIS = Weight Bias Internalization Scale; BSQ = Body Shape Questionnaire; RSE = Rosenberg Self-Esteem Scale; AAQ Total = Antifat Attitudes Questionnaire Total Score; AAQ Dislike = Antifat Attitudes Questionnaire Dislike subscale; AAQ Fear of Fat = Antifat Attitudes Questionnaire Fear of Fat subscale; AAQ Willpower = Antifat Attitudes Questionnaire Willpower subscale; DASS Total = Depression Anxiety Stress Scales Total Score; DASS Depression = Depression Anxiety Stress Scales Depression subscale; DASS Anxiety = Depression Anxiety Stress Scales Anxiety subscale; DASS Stress = Depression Anxiety Stress Scales Stress subscale

* $p < 0.05$. ** $p < 0.01$

As shown in Table 8, baseline WBIS scores were not found to be significantly correlated with change in any psychological variable from baseline to post-treatment. Baseline WBIS scores were significantly and negatively correlated with change in BSQ scores from baseline to follow-up but no other psychological measure. Similarly, post-

treatment WBIS scores were found to be significantly and negatively related to change in BSQ scores from post-treatment to follow-up but no other psychological measure.

Table 8

Pearson Product-moment Correlations Among Internalized Weight Bias Scores at Baseline, Post-treatment and Follow-up and Change in Psychological Functioning

	Baseline WBIS	Post-Treatment WBIS	Follow-up WBIS
Change Scores: Baseline to Post-Treatment			
BMI	0.08	0.10	0.18
% Change IBW	0.14	0.19	0.32*
BSQ	0.07	0.24	0.23
RSE	0.24	0.01	0.00
AAQ Total	-0.14	0.28	a.
AAQ Dislike	a.	a.	a.
AAQ Fear of Fat	-0.06	0.46*	a.
AAQ Willpower	-0.2	0.10	a.
DASS Total	-0.04	-0.13	-0.33
DASS Depression	-0.16	-0.11	a.
DASS Anxiety	0.15	-0.02	a.
DASS Stress	-0.12	-0.09	-0.32
Change Scores: Post-Treatment to Follow-up			
BMI	0.22*	0.14	0.27
% Change IBW	0.22*	0.11	0.26

BSQ	-0.35*	-0.40*	-0.42*
RSE	-0.13	0.24	0.08
AAQ Total	a.	a.	a.
AAQ Dislike	a.	a.	a.
AAQ Fear of Fat	a.	a.	a.
AAQ Willpower	a.	a.	a.
DASS Total	-0.33	-0.17	0.05
DASS Depression	-0.18	-0.15	0.02
DASS Anxiety	-0.47**	-0.24	a.
DASS Stress	-0.23	-0.07	a.
Change Scores: Baseline to Follow-up			
BMI	0.25*	0.19	0.43**
% Change IBW	0.26**	0.21	0.46**
BSQ	-0.37*	-0.22	a.
RSE	-0.02	0.23	a.
AAQ Total	a.	a.	a.
AAQ Dislike	a.	a.	a.
AAQ Fear of Fat	a.	a.	a.
AAQ Willpower	a.	a.	a.
DASS Total	-0.27	a.	a.
DASS Depression	-0.03	a.	a.
DASS Anxiety	-0.22	a.	a.

DASS Stress	-0.30	[a.]	[a.]

Note. Data presented are from the Intent-to-Treat analysis. Cells containing the [a.] superscript had an *n* of less than 30. BMI = Body Mass Index; % Change IBW = Percent change initial body weight; WBIS = Weight Bias Internalization Scale; BSQ = Body Shape Questionnaire; RSE = Rosenberg Self-Esteem Scale; AAQ Total = Antifat Attitudes Questionnaire Total Score; AAQ Dislike = Antifat Attitudes Questionnaire Dislike subscale; AAQ Fear of Fat = Antifat Attitudes Questionnaire Fear of Fat subscale; AAQ Willpower = Antifat Attitudes Questionnaire Willpower subscale; DASS Total = Depression Anxiety Stress Scale Total Score; DASS Depression = Depression Anxiety Stress Scales Depression subscale; DASS Anxiety = Depression Anxiety Stress Scales Anxiety subscale; DASS Stress = Depression Anxiety Stress Scales Stress subscale

* $p < 0.05$. ** $p < 0.01$

Regression models to predict change in psychological functioning. To further assess whether baseline WBIS scores were predictive of change in psychological functioning, multiple linear regression models were tested using a block entry method (Table 9). Baseline WBIS scores were used to predict change in BSQ change scores from baseline to follow-up. Block 1 included baseline BMI and baseline BSQ score; baseline WBIS score was entered in Block 2. This model was shown to be significant, though WBIS did not emerge as a significant independent predictor. A second model was tested to predict change in BSQ scores from post-treatment to follow-up using post-treatment WBIS scores as a predictor variable. In this model, Block 1 included post-treatment BMI and post-treatment BSQ scores and Block 2 included these measures along with post-treatment WBIS scores. This model was also shown to be significant, though again WBIS did not emerge as a significant independent predictor.

Table 9

Summary of Multiple Regression Analyses Predicting Psychological Functioning

Dependent Variable	Block	Independent Variables	Model R^2	F	R^2 Change	F Change	Standardized Beta
BSQ Change from Baseline to Follow-up	1	Baseline BMI	0.29	8.51**	0.28	8.51**	-0.14
		Baseline BSQ					-0.46
	2	Baseline WBIS			0.00	0.06	-0.04
BSQ Change from Post-treatment to Follow-up		Post-treatment					
	1	BMI	0.24	4.04*	0.21	4.04*	-0.02
		Post-treatment					
		BSQ					-0.33
	2	Baseline WBIS			0.03	1.15	-0.21

Note. Data presented are from the Intent-to-Treat analysis. BMI = Body Mass Index; WBIS = Weight Bias Internalization Scale; BSQ = Body Shape Questionnaire

* $p < 0.05$. ** $p < 0.01$

Discussion

Summary of Results

Consistent with previous research (Carels et al., 2010), the present study demonstrated that levels of internalized weight bias decrease over time among participants enrolled in behavioral weight loss treatment. Significant decreases in internalized weight bias occurred from pre-treatment to post-treatment as well as from post-treatment to six month follow-up. These findings suggest that changes in internalized weight bias can be maintained after the active treatment phase.

Participants also experienced other positive psychological changes during treatment. Between pre-treatment and post-treatment assessments, participants in this

study showed a decrease in anti-fat attitudes, lower levels of depressive symptoms, anxiety, and stress, and an increase in self-esteem, indicating a general pattern of improved functioning associated with active treatment. However, following the treatment phase, there were no further changes in self-esteem and depressive symptoms and anxiety and stress levels significantly worsened between post-treatment and follow-up. There were no significant changes in body image concern from baseline to post-treatment and post-treatment to follow-up. These changes indicate either no additional improvement in psychological functioning or worsening of functioning during the follow-up period. These findings contrast with results indicating that internalized weight bias and anti-fat attitudes continue to decrease following treatment.

That these patterns of change diverge suggests a differential impact of treatment on obesity-specific attitudes compared to more general measures of self-esteem and mental health. Significant decreases in internalized weight bias might be the result of non-specific factors of treatment, where participants show positive changes simply by participating in treatment for an issue which is of concern to them (i.e. their weight). Future research in this area could compare active behavioral weight loss treatment to no-treatment or non-dieting control groups to assess whether changes in internalized weight bias occur due to the presence of a behavioral weight loss treatment intervention.

There might also be specific components of obesity treatment which cause changes in internalized weight bias, with or without causing changes in other psychological variables. For example, the intervention used in the present study utilizes a group-based methodology, where participants shared connections to local community

groups. Engaging in a group-based treatment for obesity may help to normalize participants' experiences and concerns about being overweight, which in turn may reduce the negative attributions individuals make about themselves. It may also be the case that strategies included in behavioral weight loss treatment, such as self-monitoring of eating and activity, development of specific goals related to eating, weight and exercise and fine-tuned analysis of behavior, such as identification of triggers for overeating or lack of activity, serve to increase participants' degree of self-awareness. This increased level of self-awareness may lead participants to experience a greater internal locus of control with regard to their behavior, thereby increasing their sense of self-efficacy. An increase in the belief that an individual can exert control over their thoughts and actions may serve to directly challenge negative self-statements associated with internalized weight bias. For example, the belief that one is less competent as an overweight person might be countered by successes an individual experiences in behavioral weight loss treatment, such as completion of self-monitoring forms, increased physical activity and/or actual weight loss. To resolve this dissonance, an individual may lessen his/her degree of belief in the negative self-statement. Future research can be designed to address these hypotheses and explore the mechanisms of change behind differences observed in the current study.

Exploring both intra- and interparticipant change in internalized weight bias revealed a linear pattern of change, with no differences across treatment conditions. However, in the absence of a no-treatment control condition, which would provide information about natural changes in internalized bias over time, a firm conclusion about

the pattern of change cannot be drawn. In this sample, a different rate of change was observed between those participants reporting a low level of internalized bias or a high level of internalized weight bias at baseline. Among the participants reporting high baseline levels, internalized weight bias decreased twice as fast as those reporting low baseline levels. This difference may indicate a greater positive effect of treatment for those who hold more negative attitudes about themselves.

Though sample size did not allow for the separate analysis of participants who gained weight following treatment, the results of this study indicate a relationship between weight regain and changes in internalized weight bias. Changes in internalized weight bias were significantly related to a concurrent change in percent of initial body weight lost between post-treatment assessment and follow-up assessment. During this phase of the study, increases in internalized weight bias saw accompanying increases in weight. It may be the case that participants who gained weight during the follow-up period perceived themselves as having failed treatment, reinforcing the perception of being an overweight person and thereby strengthening the internalization of negative stereotypes about being overweight. There was no corresponding statistical relationship between these variables during the active treatment phase, suggesting that losing weight alone is not sufficient to cause changes in internalized weight bias.

Additional analyses demonstrated that baseline levels of internalized weight bias were significantly and positively related to change in body weight from baseline to follow-up, a result not found in a previous study using the WBIS (Carels et al., 2010). This finding indicates that higher initial levels of internalized weight bias are associated

with smaller amounts of weight loss or even weight gain from baseline to follow-up. This converges with the finding that participants reporting low levels of internalized weight bias at baseline lost 5.98% of IBW at follow-up and participants with high baseline levels lost 2.95% of IBW. Though a smaller sample, this difference was even more dramatic among those participants completing treatment, where participants with low levels of internalized weight bias at baseline lost just over 10% of IBW, compared to just under 5% of IBW among those participants reporting high baseline levels of internalized weight bias.

The relationship between degree of internalized weight bias and amount of weight lost during behavioral weight loss treatment may be attributable to a number of factors. Participants who hold stronger negative beliefs about themselves as overweight people may also be more likely to hold a belief that as a result of their overweight status, they are less likely to succeed in weight loss treatment. Having higher levels of internalized weight bias may also make it harder for these participants to recover from perceived failures in treatment and make desired behavioral changes which would result in additional weight loss. Alternatively, high baseline levels of internalized weight bias may simply correlate with other markers of poor overall functioning (e.g. poor self-esteem, high body image concern) and this general factor of negative wellbeing may result in poorer weight loss outcomes. Correlation analyses from the present study support this hypothesis, demonstrating that high internalized weight bias is related to higher levels of body image concern, anti-fat attitudes, depressive symptoms and lower self-esteem. Future research in this area may continue to explore differences between

individuals with low and high levels of internalized weight bias, by comparing associations with other markers of psychological functioning and by measuring participants' sense of self-efficacy for weight loss and their readiness and motivation for change.

The significant difference between amount of weight lost by participants with low baseline levels of internalized weight bias and participants with high levels of internalized weight bias suggests that participants evidencing greater internalized weight bias have less success in behavioral weight loss treatment in terms of weight-based outcomes. This is an interesting finding in light of the significant decrease in internalized weight bias over the course of treatment for these same participants. While internalized weight bias may negatively impact degree of weight loss for participants in behavioral weight loss programs, these programs appear to have a positive impact on participants' psychological functioning by reducing internalized weight bias. It may be important for future research to ascertain which treatment components have the effect of reducing internalized bias, even without resulting weight loss. For example, treatment components included in behavioral weight loss programs which do not address weight loss per se, such as the use of cognitive restructuring to address negative thinking patterns, might cause the observed changes in attributions that participants make about themselves without directly causing weight loss.

Among the psychological variables assessed in this study, internalized weight bias, body image concern and self-esteem were the only constructs found to relate to changes in body weight. Anti-fat attitudes, depressive symptoms, anxiety and stress

levels were unrelated to percent change in initial body weight among participants in this sample. In addition, though showing a relationship with changes in weight, internalized weight bias was not found to be related to BMI at any assessment point. This reinforces previous findings that internalizing weight bias is unrelated to degree of overweight (Durso & Latner, 2008; Durso et al., 2011) and may be more related to the self-perception of being overweight (Durso & Latner, 2011).

From a measurement perspective, it is important to note that internalized weight bias was related to weight change but that anti-fat attitudes were not. Crerand et al. (2007) did not report data relating change in anti-fat attitudes to change in weight and thus this study expands the literature base by including measurements of both of these types of attributions. This result suggests the importance of assessing attributions made about the self (i.e. internalized weight bias) rather than assessing attributions made about others (i.e. anti-fat attitudes) in research exploring the impact of weight bias on weight-related treatment outcomes.

The significant correlations found between baseline levels of internalized bias and subsequent weight change suggest a predictive relationship between internalized weight bias and weight change. However, the regression models presented in this study, which included both internalized weight bias and other baseline levels of psychological functioning, were unable to predict change in body weight over time. Previous research has established that psychological and behavioral variables are weak predictors of weight change among participants enrolled in behavioral weight loss treatments (Teixeira et al., 2005). That these models failed to predict change in body weight prevented exploration

of this study's research questions relating to the possible mediating role of internalized weight bias between changes in psychological variables and weight change. Therefore overall, the present study presents a mixed picture of whether internalized weight bias can be used to predict treatment outcome, and additional research is needed to clarify these relationships.

In addition to demonstrating a relationship between internalized weight bias and weight change, the present study also found a relationship between internalized weight bias and measures of psychological functioning. Specifically, greater internalized weight bias at baseline was associated with greater body image concern, lower self-esteem, greater fear of fat beliefs and higher depressive symptoms at baseline. At post-treatment, greater internalized weight bias was again shown to relate to greater body image concern, lower self-esteem, greater anti-fat attitudes (both of dislike of obese people and fear of fat) and higher depressive symptoms. Follow-up assessments included too few participants to assess for significant relationships at six months post-treatment. Regression models which included baseline internalized weight bias scores and baseline body image scores significantly predicted changes in body image concern over the course of treatment and follow-up. However, baseline internalized weight bias scores were not able to predict changes in any other psychological variable. These findings are similar to results found by Carels et al. (2010), who showed that internalized weight bias was significantly related to changes in body image concern but unrelated to levels of depressive symptoms in their sample.

Implications for Obesity Treatment

The present study is among the first to explore changes in internalized weight bias over the course of weight loss treatment, and its findings have implications for the treatment of obesity. The findings suggest that behavioral weight loss treatment may effect positive change in the degree to which individuals have internalized weight bias. These changes occurred without any intervention designed to specifically target these attitudes. In addition to identifying existing treatment components which have an impact on levels of internalized weight bias, future research may look to augment behavioral weight loss treatment protocols with modules designed to address and improve internalized beliefs, as has been done with interventions to improve body image (Katzer et al., 2008; Ramirez & Rosen, 2001) and fat phobia (Robinson & Bacon, 1996). Direct intervention may result in even larger changes in internalized weight bias and further improve participants' psychological health.

Interventions to target internalized weight bias may also take place in the context of "non-dieting" approaches to developing healthy eating and exercise behaviors, such as the Health At Every Size (HAES) paradigm. Weight loss is not considered a main outcome variable within these approaches and the interventions often promote size acceptance along with healthy lifestyle habits. A recent randomized controlled trial comparing a HAES protocol to a social support-only condition and a no-treatment control condition showed that positive changes in eating habits could be developed and body weight reduced among women enrolled in the HAES intervention, and that these changes could be maintained at one-year follow-up (Provencher et al., 2009). Further research

using the HAES approach may consider including measures of internalized weight bias, to assess whether acceptance-based approaches might positively impact these types of beliefs.

A second and related treatment implication which follows from the present study findings is that higher baseline levels of internalized weight bias were associated with smaller weight losses between baseline and six month follow-up. This suggests that treatment interventions may look to address internalized weight bias specifically among those participants who endorse high levels at baseline, rather than all participants taking part in a weight loss treatment protocol. For example, treatment intervention studies could test whether attempting to reduce internalized weight bias prior to initiation of behavioral weight loss treatment can improve degree of weight loss among those individuals reporting high baseline levels of internalized bias. This approach of addressing weight-related beliefs prior to discussion of lifestyle habits has been taken in studies using non-dieting approaches to healthy eating and activity (Bacon et al., 2002).

Strengths and Limitations

The strengths of the present study include its sample size and comprehensive assessment of psychological functioning, including body image and weight-related measures as well as measures of depressive symptoms, anxiety and perceived stress. It also provided an important methodological test of a relatively new measure, the Weight Bias Internalization Scale, by simultaneously assessing internalized weight bias and anti-fat attitudes and exploring the relationship of these constructs to weight change and psychological functioning. The present study also built upon existing literature by

presenting data across three assessment time points – baseline, post-treatment and at six month follow-up.

An important additional strength of this study was the heterogeneity of the sample. Participants included both men and women of varied ages and ethnic backgrounds, increasing the generalizability of study findings. However, a methodological limitation is that Cronbach's alpha for baseline WBIS scores was low in this sample. Previous research into the psychometric properties of this scale among community and clinical samples demonstrated excellent reliability, however, the participants in these samples were predominantly White (e.g. Durso & Latner, 2008; Durso et al., 2011). This result may indicate that the questionnaire performs differently among White and non-White samples and future refinement of the scale may be required.

As with other treatment outcome studies, the present study is limited by participant attrition, though the rate presented is comparable to other behavioral weight-loss treatment studies (Dansinger, Tatsioni Wong, Chung, & Balk, 2007), and using imputation methods to account for missing data may obscure true differences in the sample. However, to address this issue, data analyses using weight-related variables were compared between treatment completers-only and the intent-to-treat sample and no significant differences were observed. Further, imputed data among the psychological variables were used only for a single set of analyses (Repeated Measures ANOVA) and all other analyses were conducted using available raw data.

The use of self-report questionnaires is a limitation of the present study, as this method introduces potential error variance resulting from scale construction and

presentation of items and participant characteristics, such as consistency of responding, the influence of social desirability and mood state (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). Further, the face validity of the WBIS may differ between pre- and post-treatment assessments for participants who no longer considered themselves overweight at the conclusion of the study. As presently worded, the items in the WBIS require the respondent to first consider himself/herself overweight and then rate his/her agreement with each statement (e.g. "As an overweight person, I feel that I am just as competent as anyone."). In longitudinal analyses such as the present study, participants who lose weight and no longer consider themselves overweight may disagree with the scale items not because of the content of the item, but because they no longer identify with the category of overweight. Future work with the WBIS may require revision of the scale items to reflect the changes in weight that participants enrolled in behavioral weight loss treatment are likely to experience. For example, the wording of items may be revised to assess for a respondent's degree of belief in negative self-statements "when" they are overweight rather than "because" they are overweight. Further, in the context of behavioral weight loss treatment, items such as, "I am OK being the weight that I am" are likely to be more strongly endorsed by all respondents, given their enrollment in a treatment whose express goal is to change their weight.

Finally, though results indicate a statistical difference for changes in internalized weight bias, this statistically significant result may not represent a clinically meaningful change. Additional research studies are needed to ensure that quantitative changes on

self-report measures translate into real-world outcomes, particularly studies designed to directly address and manipulate internalized bias.

Future Research Directions

Future research in this area could further explore the nature of observed changes in internalized weight bias across behavioral weight loss treatment. The present analyses suggested a linear change across time, however, there was a small subset of participants whose growth plots suggested curvilinear change. The addition of further follow-up assessment points can be used to ascertain the best fitting model of change for this construct. It will also be important to address whether the observed decreases in internalized weight bias over treatment represents true changes in participants' beliefs about themselves. For example, research into self-reported body image among formerly obese persons suggests the existence of a "phantom fat" phenomenon (Cash, Counts, & Huffine, 1990), whereby negative body image associated with being overweight persists even when individuals are no longer overweight. Future research may use paradigms such as pre-conscious processing of cues to assess whether participants report explicit changes in internalized weight bias while maintaining implicit beliefs. Carels et al., (2010) provided an initial test of this hypothesis, by comparing changes in explicit weight bias, implicit weight bias and internalized weight bias across behavioral weight loss treatment. Implicit weight bias was not significantly related to explicit or internalized weight bias and did not change significantly between baseline and post-treatment assessments (Carels et al., 2010). This result suggests that while participants may

explicitly report positive changes to their beliefs following behavioral weight loss treatment, negative associations linked to obesity may remain.

Just as it has been a challenge to reduce weight bias among the general population (Daníelsdóttir, O'Brien, & Ciao, 2010) it may also prove difficult to make lasting and meaningful change to internalized weight bias. Despite these challenges, the field may continue to move forward with the development of interventions to change these types of beliefs. These interventions may utilize techniques found in traditional cognitive and behavioral treatments, such as cognitive restructuring to identify and challenge negative thinking patterns or working to reduce avoidance of feared situations, or try more recently-developed or novel approaches. For example, non-dieting interventions have included treatment components which seek to educate participants about biological bases of weight with the aim of reducing the belief that being overweight is the "fault" of the individual (Bacon et al., 2002). Future research designs might include treatment components from more recently developed protocols, such as cognitive defusion techniques from Acceptance and Commitment Therapy (Hayes, Strosahl, & Wilson, 1999). Rather than instructing participants to challenge negative thoughts, these exercises aim to help individuals disassociate negative thoughts from behaviors and/or a person's sense of self. This type of approach may be particularly useful at reducing the internalization of weight bias, relative to other types of negative thoughts, as part of internalizing weight bias includes an individual making negative statements about the self. As research continues to identify and understand the correlates and effects of

weight-based stigmatization and the internalization of stereotypes, future studies should prioritize further exploration and development of interventions to reduce weight bias.

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Appendix A

The Weight Bias Internalization Scale (Durso & Latner, 2008)

Please rate your level of agreement with the following statements using this scale:

1 = Strongly disagree
2 = Disagree
3 = Slightly disagree
4 = Neutral
5 = Slightly agree
6 = Agree
7 = Strongly agree

____ 1. As an overweight person, I feel that I am just as competent as anyone.
____ 2. I am less attractive than most other people because of my weight.
____ 3. I feel anxious about being overweight because of what people might think of me.
____ 4. I wish I could drastically change my weight.
____ 5. Whenever I think a lot about being overweight, I feel depressed.
____ 6. I hate myself for being overweight.
____ 7. My weight is a major way that I judge my value as a person.
____ 8. I don't feel that I deserve to have a really fulfilling social life, as long as I'm overweight.
____ 9. I am OK being the weight that I am.
____ 10. Because I'm overweight, I don't feel like my true self.
____ 11. Because of my weight, I don't understand how anyone attractive would want to date me.

Appendix B

Anti-fat Attitudes Questionnaire (Crandall, 1994)

Please rate your agreement with these statements from 0 (strongly disagree) to 9 (strongly agree).

____ 1. I really don't like fat people much.
____ 2. I don't have many friends that are fat.
____ 3. I tend to think that people who are overweight are a little untrustworthy.
____ 4. Although some fat people are surely smart, in general, I think they tend not to be quite as bright as normal weight people.
____ 5. I have a hard time taking fat people too seriously.
____ 6. Fat people make me feel somewhat uncomfortable.
____ 7. If I were an employer looking to hire, I might avoid hiring a fat person.
____ 8. I feel disgusted with myself when I gain weight.
____ 9. One of the worst things that could happen to me would be if I gained 25 pounds.
____ 10. I worry about becoming fat.
____11. People who weigh too much could lose at least some part of their weight through a little exercise.
____ 12. Some people are fat because they have no willpower.
____ 13. Fat people tend to be fat pretty much through their own fault.

Appendix C

Rosenberg Self-Esteem Scale (Rosenberg, 1979)

	Strongly Agree	**Agree**	**Disagree**	**Strongly Disagree**
1. On the whole, I am satisfied with myself.	_____	_____	_____	_____
2. At times, I think I am no good at all.	_____	_____	_____	_____
3. I feel that I have a number of good qualities.	_____	_____	_____	_____
4. I feel I do not have much to be proud of.	_____	_____	_____	_____
5. I am able to do things as well as most people.	_____	_____	_____	_____
6. I certainly feel useless at times.	_____	_____	_____	_____
7. I feel that I am a person of worth, at least on an equal plane with others.	_____	_____	_____	_____
8. I wish I could have more respect for myself	_____	_____	_____	_____
9. I take a positive attitude towards myself	_____	_____	_____	_____
10. All in all I am inclined to feel that I am a failure	_____	_____	_____	_____

Appendix D

Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995)

Please read each statement and circle a number 0, 1, 2, or 3 which indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:
0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

		--			+
1	I found it hard to wind down	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I found it difficult to work up the initiative to do things	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I experienced trembling (e.g., in the hands)	0	1	2	3
8	I felt that I was using a lot of nervous energy	0	1	2	3
9	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting agitated	0	1	2	3
12	I found it difficult to relax	0	1	2	3
13	I felt down-hearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3

18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3

Appendix E

Short Version of the Body Shape Questionnaire (Dowson & Henderson, 2002)

We would like to know how you have been feeling about your appearance over the past two weeks. Please read each question and circle the appropriate number. Please answer all the questions.

	Never	Rarely	Some-times	Often	Very Often	Always
1 Have you been so worried about your shape that you have been feeling that you ought to diet?	1	2	3	4	5	6
2 Has being with thin people made you feel self-conscious about your shape?	1	2	3	4	5	6
3 Have you ever noticed the shape of other people and felt that your own shape compared unfavorably?	1	2	3	4	5	6
4 Has being undressed, such as when taking a bath, made you feel fat?	1	2	3	4	5	6
5 Has eating sweets, cakes or other high calorie food made you feel fat?	1	2	3	4	5	6
6 Have you felt excessively large and rounded?	1	2	3	4	5	6
7 Have you felt ashamed of your body?	1	2	3	4	5	6
8 Has worry about your shape made you diet?	1	2	3	4	5	6
9 Have you thought that you are the shape you are because you lack self-control?	1	2	3	4	5	6
10 Have you worried about other people seeing rolls of fat around	1	2	3	4	5	6

your waist and stomach?						
11 Have you felt that it is not fair that other people are thinner than you?	1	2	3	4	5	6
12 Has seeing your reflection e.g. in a mirror or shop window. made you feel bad about your shape?	1	2	3	4	5	6
13 Have you been particularly self-conscious about your shape when in the company of other people?	1	2	3	4	5	6
14 Has worry about your shape made you feel you ought to exercise?	1	2	3	4	5	6