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Internalized Weight Stigma Moderates Eating Behavior Outcomes in Women with High BMI Participating in a Healthy Living Program

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Abstract

Weight stigma is a significant socio-structural barrier to reducing health disparities and improving quality of life for higher weight individuals. The aim of this study was to examine the impact of internalized weight stigma on eating behaviors after participating in a randomized controlled trial comparing the health benefits of a weight-neutral program to a conventional weight-management program for 80 community women with high body mass index (BMI > 30, age range: 30-45). Programs involved 6 months of facilitator-guided weekly group meetings using structured manuals. Assessments occurred at baseline, post-intervention (6 months), and 24-months post-randomization. Eating behavior outcome measurements included the Eating Disorder Examination-Questionnaire and the Intuitive Eating Scale. Intention-to-treat linear mixed models were used to test for higher-order interactions between internalized weight stigma, group, and time. Findings revealed significant 3-way and 2-way interactions between internalized weight stigma, group, and time for disordered and adaptive eating behaviors, respectively. Only weight-neutral program participants with low internalized weight stigma improved global disordered eating scores. Participants from both programs with low internalized weight stigma improved adaptive eating at 6 months, but only weight-neutral program participants maintained changes at follow-up. Participants with high internalized weight stigma demonstrated no changes in disordered and adaptive eating, regardless of program. In order to enhance the overall benefit from weight-neutral approaches, these findings underscore the need to incorporate more innovative and direct methods to reduce internalized weight stigma for women with high BMI.

Key Words: internalized weight stigma, disordered eating, intuitive eating, obesity, health at every size, conventional weight-management

Introduction

Widespread concerns over the "obesity epidemic" have dominated the scientific literature on weight for the greater part of the 21st Century. A consequence of this increased attention on obesity is a pervasive stigmatization of people with a higher weight status—a stigmatization that is on the rise among adults and children (Andreyeva, Puhl, & Brownell, 2008; Harriger, Calogero, Witherington, & Smith, 2010; Latner & Stunkard, 2003). Indeed, weight discrimination has been well-documented in educational, workplace, and healthcare settings (e.g., Giel, Thiel, Teufel, Mayer, & Zipfel, 2010; Neumark-Sztainer, Story, & Harris, 1999; Puhl & Latner, 2007; Puhl, Latner, King, & Luedicke, 2014; Puhl, Luedicke, & Heuer, 2011; Puhl & Peterson, 2014; Ruggs, Hebl, & Williams, 2015; Sabin, Marini, & Nosek, 2012). Even healthcare professionals who have chosen a career path specializing in the medical management of obese patients demonstrate anti-fat attitudes, as assessed implicitly in laboratory research (Schwartz, Chambliss, Brownell, Blair, & Billington, 2003). Given these data, it is no surprise that higher weight individuals report avoiding preventive healthcare and suffer from receiving suboptimal medical treatment (Phelan et al., 2015; Wee, McCarthy, Davis, & Phillips, 2000).

Weight-neutral approaches to promote health, actively attempt to reduce the perpetuation of weight stigma and promote size acceptance by shifting the focus of interventions away from weight loss (i.e., typical of conventional weight-management programs) to well-being and self-care, regardless of weight status (Tylka et al., 2014). Notably, Health at Every Size® (HAES) models characterize the weight-neutral approach (Bacon, 2010; Bombak, 2014; O'Hara & Gregg, 2014; Robison, Putnam, & McKibbin, 2007), and studies that have tested weight-neutral programs demonstrated improvements (compared to baseline values) in many physical health, eating, and well-being indices such as: lower total cholesterol, low-density lipoprotein cholesterol, triglycerides, systolic blood pressure, disinhibited eating, bulimic symptomatology,

drive for thinness, body dissatisfaction, poor interoceptive awareness, and depression (e.g., Bacon et al., 2002; Bacon, Stern, Van Loan, & Keim, 2005; Mensinger, Calogero, Stranges, & Tylka, 2016; for reviews, see Cadena-Schlam & Lopez-Guimera, 2014; Clifford et al., 2015; and Schaefer & Magnuson, 2014). Although this body of research demonstrated effectiveness for weight-neutral programs, what is less clear is whether there are moderators that strengthen or weaken their effectiveness. Moderators answer the question of *when* or *for whom* a given relationship exists or an effect occurs (Karazsia, van Dulmen, Wong, & Crowther, 2013).

One such mechanism that has received substantial attention and could act as a moderator of weight-neutral programs' effectiveness is internalized weight stigma. *Internalized weight stigma* refers to the adoption and personal endorsement of negative weight-based societal stereotypes (Carels et al., 2013; Durso & Latner, 2008; Tylka et al., 2014). Individuals with high internalized weight stigma judge themselves based on these very stereotypes (Pearl, Puhl, & Dovidio, 2014)—thus, they assume personal responsibility for their weight and view their bodies as unattractive and in need of modification due to their size. This self-judgment may prompt additional body shame and body hatred, which may then result in decreased psychological well-being and physical health (Durso et al., 2012; Muennig, 2008; Wirth, Blake, Hebert, Sue, & Blair, 2014). Preliminary evidence suggests that individuals with greater internalized weight stigma report lower engagement in physical activity (Carels et al., 2009; Pearl et al., 2014; Vartanian & Novak, 2011), higher caloric intake during weight loss programs (Carels et al., 2009; Schvey, Puhl, & Brownell, 2011), and greater eating disorder symptomatology (Carels, Wott, Young, et al., 2010; Durso et al., 2012; Puhl, Moss-Racusin, & Schwartz, 2012; Schvey, Roberto, & White, 2013; Schvey & White, 2015)—all of which may interfere with the effectiveness of health promotion programs. It is plausible, then, that internalized weight stigma poses a barrier to receiving the full benefit from participating in such programs.

To evaluate this proposition, the present study examined internalized weight stigma as a moderator of the effectiveness of a weight-neutral program and a conventional weight-management program for women of high BMI, with a particular focus on their eating behavior outcomes. More specifically, we predicted that women with high internalized weight stigma would be less likely to benefit from a weight-neutral program than those with low internalized weight stigma. Indeed, women with high internalized weight stigma may find it harder to engage in adaptive eating behaviors as well as harder to disengage from disordered eating if they have internalized societal weight-based stereotypes and therefore blame themselves for their high weight. Furthermore, without a special focus on interventions for reducing internalized weight stigma, implementing size acceptance principles characteristic of weight-neutral programs may be particularly challenging to this subset of people with high BMI. In contrast, conventional weight-management programs promise a method of escaping the stigmatized group through dietary prescriptions and lifestyle modifications that assure weight loss. Therefore, we predicted those with high internalized weight stigma in a conventional weight-management program may not differ as much in their changes in eating behaviors compared to their low internalized weight stigma counterparts.

In summary, to test these assertions, three specific hypotheses were examined: (a) internalized weight stigma would have a more negative impact on eating behaviors over time in the weight-neutral program compared to the conventional weight-management program; (b) participants with high levels of internalized weight stigma would see smaller declines in disordered eating and less improvement in adaptive eating over time compared to those low in internalized weight stigma, regardless of intervention; and (c) participants in the weight-neutral program would experience greater declines in disordered eating and larger improvements in adaptive eating behaviors than those in the conventional weight-management program. In

addition, change in internalized weight stigma between and within both programs from baseline to post-treatment and follow-up was explored. If either program is able to reduce participants' internalized weight stigma directly, then additional support would be accrued for the program's clinical relevance.

Materials and Methods

Design and Procedure

Participants for this longitudinal, randomized controlled trial were recruited from a suburban community setting in Southeastern Pennsylvania in late Fall 2008 through a local coupon magazine advertisement, flyers placed in physicians' offices, and the sponsoring hospital's website. Research staff conducted phone screens with interested study applicants to determine preliminary eligibility. If they met the initial criteria, applicants were instructed to consult their primary care physician to obtain a signature on a requisite clearance form that described the study and its eligibility criteria. They then attended an intake session with a trained research assistant who garnered participants' informed consent and ascertained participants' BMI by measuring body weight and height without shoes using a Detecto balance beam scale and a wall-mounted stadiometer to the nearest 0.1 kilogram and 0.1 centimeter, respectively.

At the end of the baseline assessment, study participants were handed a sequentially numbered envelope containing a randomly assigned intervention group (1:1 ratio), a welcome letter, and instructions regarding the study. Follow-up assessments occurred immediately post-intervention (6 months) and at 24-months post-randomization. Incentives of $20 were provided for attending follow-up assessments. Research technicians with health science training (nurses and public health backgrounds) collected study measurements for all time points in the laboratory of the Clinical Research Center at the sponsoring hospital. Although self-report measures were used, study personnel read the questions to participants, and participants' answers

were provided orally in a structured interview-like format, in order to ensure clarity of all questions and completeness of the data. The study protocol and procedures were approved and monitored by the Institutional Review Board of the Reading Health System.

Eligibility Criteria

To be eligible for the study, participants had to be female, between 30 and 45 years old, have a BMI between 30 and 45 kg/m^2, practice birth control if heterosexual and pre-menopausal, and be physically inactive (i.e., scoring in either the 'inactive' or 'light intensity activity' categories on the Stanford Brief Activity Survey; Taylor-Piliae et al., 2006). Women were excluded if they were current smokers, were not fluent in English, were taking medications known to affect weight, were presently participating in a weight loss program, were pregnant or intending to become pregnant, had type 1 or insulin-dependent type 2 diabetes, had or were planning to have bariatric surgery, had an active neoplasm, or had a history of myocardial infarction, congestive heart failure, cerebrovascular disease, renal disease, or cirrhosis. Specific psychological contraindications that also warranted exclusion were a diagnosis of bulimia nervosa, anorexia nervosa, or substance abuse, and psychiatric disturbances that significantly disrupted daily functioning (e.g., suicidal ideation, current manic episode, schizophrenia).

A total of 80 women were enrolled in the study after screening 252 women for eligibility. Based on the screening, 110 women did not meet the eligibility criteria listed above. A further 60 women were excluded because they were unable to commit to attend the weekly evening group on Wednesdays due to a conflict with pre-existing commitments on that day of the week. Two additional women were excluded because they missed the deadline for submitting their clearance form from their physicians. A total of 72 participants were available for assessment at the 6-month assessment and 40 participants were available at the 24-month assessment. Figure 1 displays the flow of participant involvement for the duration of the study.

Interventions

Forty women were randomly assigned to the weight-neutral program, and 40 women were randomly assigned to the conventional weight-management program. Participants within each program were divided into two cohorts of 20. Both cohorts for each program met weekly for 90-minute sessions, held simultaneously on a weekday evening for the duration of 6 months. The cohort sizes were based on recommendations by the developers of the program protocols and consultations with the group facilitators prior to the commencement of the study. Both facilitators had previous experience working with psychoeducational groups of up to 20 individuals. The length of the interventions, intensity of the interventions, resources provided to participants, and the expertise of the facilitators (i.e., in the focus of the respective interventions) were equivalent between the programs.

Participants in the weight-neutral program received the *HUGS Program for Better Health* (Omichinski, 2007), which stands for **H**ealth-focused, **U**nderstanding lifestyle, **G**roup supported, and **S**elf-esteem building. HUGS is a holistic health promotion program that follows an evidence-based (Omichinski, 1995) manualized curriculum (Omichinski, 2007) incorporating the main components of popular weight-neutral programs such as Health at Every Size® (Bacon, 2010). Although the weight-neutral program underscored the HAES® tenets (ASDAH, 2015; Tylka et al., 2014) and emphasized the appreciation of body size diversity and size acceptance, the curriculum did not *directly* address internalized weight stigma. HUGS also taught the principles of eating for well-being *and* pleasure, and engaging in physical activity for personal enjoyment and fulfillment. A key aim of this program was to help participants break away from a dieting mindset that often leads to a vicious cycle of bingeing and guilt due to an overly restrictive lifestyle (Polivy & Herman, 1985; van Strien, Herman, & Verheijden, 2014). Participants received the books *Staying Off of the Diet Roller Coaster* (Omichinski, 2000) and

Tailoring Your Tastes (Omichinski & Hildebrand, 1995), in addition to a booklet of handouts including psycho-educational worksheets (e.g., exploring hunger with a hunger rating scale, discerning emotional from physical hunger), and a set of affirmation CDs produced by HUGS Inc. Each week participants were encouraged to further explore topics they discussed within their group sessions on their own at home. For example, participants completed assigned readings from the books, wrote positive affirmations about themselves and their changing daily routines to bring back and share with the group the following week, kept a food and feelings journal in order to reconnect with hunger and satiety cues, and engaged in new and enjoyable physical activities. At the end of the 6 months, participants were encouraged to maintain their non-dieting lifestyles and self-affirming attitudes about their bodies by utilizing the social support network developed during the program. Email and phone number lists were created and distributed in both cohorts to help facilitate this network. This program was delivered by a psychotherapist and fitness professional with over 15 years of experience in providing health-centered, HAES®-oriented approaches for clients with high BMI within individual and group settings.

Participants in the conventional weight-management program received the *LEARN Program for Weight Management*, which stands for **L**ifestyle, **E**xercise, **A**ttitudes, **R**elationships, and **N**utrition (Brownell, 2000). This evidence-based behavior modification curriculum emphasizes weight loss as an ultimate goal of the program, while focusing on gaining skills to overcome weight loss barriers, and, learning how to change diet and lifestyle. The LEARN program has been referred to as the gold standard for weight-management programs (Gardner et al., 2007; Womble et al., 2004). Participants in the LEARN program received the 10th edition of the *LEARN Program for Weight Management* manual (Brownell, 2000) and the *LEARN Weight Stabilization and Maintenance Guide* (Brownell, 2008) along with the LEARN Program CD set. In addition to maintaining food diaries and physical activity logs between the scheduled program

meetings each week, participants were expected to complete exercises from the manual. Examples of the exercises included: (a) a self-assessment of eating risk factors, (b) a worksheet to prepare one with coping skills for "high risk situations" that might lead to overeating, (c) an eating habits checklist, (d) a nutrition quiz, and (e) an exercise quiz. As with the weight-neutral program, at the end of the 6-month program, participants in the conventional weight-management program were encouraged to maintain their lifestyle changes by utilizing the social support network developed during the program. Email and phone number lists were created and distributed in both cohorts to help facilitate this network. This program was delivered by a registered dietician with over 15 years of experience working with bariatric populations and patients with type 2 diabetes within individual and group settings.

The two programs shared many common principles in that both emphasized the importance of healthy lifestyle choices and gradual sustainable change. However, the conventional weight-management program made weight loss an explicit goal and focused on food intake levels based on external prescriptions and caloric restriction. In contrast, the weight-neutral program taught size acceptance, self-care, and strategies to recognize and respond to physiological signs of hunger and satiety to determine food intake. We ensured fidelity of the programs by using checklists derived from the leaders' manuals and randomly selecting approximately 20% of the sessions for audit by a trained staff member from the Reading Health System Clinical Research Center.

Measures

Adaptive eating. We defined adaptive eating as *intuitive eating*, or eating mainly in response to physiological hunger and satiety cues—those who eat intuitively are attuned to and trust their hunger and satiety signals to guide their eating (Tylka, 2006). Intuitive eating has been described as a flexible and adaptive eating behavior (Tribole & Resch, 2012). We assessed this

eating style using Tylka's (2006) original Intuitive Eating Scale (IES), as the updated IES-2 (Tylka & Kroon Van Diest, 2013) was not yet published. The IES contains 21 items that are rated along a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Items assess one's ability to: (a) recognize and trust hunger and satiety cues, (b) eat in accordance to physical rather than emotional cues, and (c) give oneself unconditional permission to eat. While subscale scores can be generated, we averaged the 21 items to create an overall composite score, as recommended by Tylka (2006). The IES has been found to show evidence of reliable and valid scores among college students, indicating a higher-order factor structure (Tylka, 2006), as well as among community-based samples of women (Tylka, Lumeng, & Eneli, 2015). Cronbach's alpha for the the IES in the present sample was .76.

Disordered eating. Disordered eating attitudes and behaviors were measured using the Eating Disorder Examination Questionnaire (EDE-Q) version 6.0 (Fairburn & Cooper, 2008; Fairburn, Cooper, & O'Connor, 2008). The EDE-Q is a 28-item measure based on the Eating Disorder Examination interview (Cooper & Fairburn, 1987). EDE-Q scores were conceptualized along a continuum of degree, whereby progressively higher scores correspond to progressively higher levels of eating psychopathology; support for this dimensional approach can be found in Tylka (2004) and Tylka and Subich (1999). Because participants were excluded on the basis of a diagnosis of bulimia nervosa or anorexia nervosa, a clinical cut-off score was determined to not be useful and therefore not calculated in the present study. The EDE-Q consists of four subscales (Restraint, Eating Concern, Weight Concern, and Shape Concern) that are summed and averaged to obtain a total composite index of global eating disturbance, as was done in the present study. Participants are asked to rate the frequency with which they experience a series of behaviors and cognitions that are characteristic of disordered eating over the past 28 days on a 7-point scale (0 = *no days*, 1 = *1-5 days*, 2 = *6-12 days*, 3 = *13-15 days*, 4 = *16-22 days*, 5 = *23-27 days*, 6 =

every day). The EDE-Q has been validated in large population-based samples of community women and demonstrates sound psychometric properties within these samples (Hilbert, de Zwaan, & Braehler, 2012; Mond, Hay, Rodgers, & Owen, 2006; Mond, Hay, Rodgers, Owen, & Beumont, 2004). Cronbach's alpha for the global EDE-Q in the present sample was .80.

Internalized weight stigma. We used the Weight Bias Internalization Scale (WBIS; Durso & Latner, 2008) to measure participants' levels of internalized weight stigma. The WBIS contains 11 items that are rated on a 7-point Likert scale ranging from *strongly disagree* (scored as 1) to *strongly agree* (scored as 7). Items are averaged, with higher scores indicating higher internalized weight stigma. In a sample of community women and men who were classified as overweight or obese, scores on the WBIS demonstrated internal consistency reliability and construct (i.e., convergent, incremental) validity (Durso & Latner, 2008). Cronbach's alpha for the WBIS was .84 in the present sample.

Data Analysis

Statistical tests were performed in SPSS (Version 22.0, Armonk, NY: IBM Corp.). Using independent samples *t*-tests for continuous variables and chi-square tests for categorical variables (e.g., race/ethnicity, marital status), study non-completers were compared to study completers on all baseline levels of the outcome variables as well as the participant demographic characteristics reported in Table 1 in order to determine how attrition may have influenced the findings. We applied linear mixed models with the intention-to-treat principle to test the primary hypotheses: (a) a third order interaction effect (group × time × internalized weight stigma); (b) a second-order interaction effect (internalized weight stigma × time); and (c) a second-order interaction effect of the group differences in mean changes in the outcomes over time (group × time). In addition to testing these hypotheses, the models provided estimates for the between-group differences in change from baseline to 6-month and 24-month assessments, the within-group effects of time

(including *post hoc* comparisons using the Least Significance Difference test), and the main effect of internalized weight stigma on disordered and adaptive eating behaviors. Internalized weight stigma was also explored over time with an intention-to-treat linear mixed model examining the within and between-group effects as well as the group by time interaction effect. The compound symmetry assumption was used to fit the covariance matrices for the models. Sample size determination was based on data from a previous trial comparing a weight-neutral to a conventional weight-management intervention with 78 obese women and a 50% attrition rate at the 24-month follow-up (Bacon et al., 2005). We determined that with 20 participants per intervention by long-term follow-up, we would have adequate power (.80) to detect differences of a moderate effect size.

Higher-order interaction effects were descriptively probed using the standard "pick-a-point" approach that was developed for fixed effects regression models (Rogosa, 1980; Aiken & West, 1991) and further extended to multi-level, or growth-curve models with subject-specific random effects (Bryk & Raudenbush, 1987; Willet, Singer, & Martin, 1998). Trajectories of change depicting individuals who scored 1 standard deviation (*SD*) above the mean on internalized weight stigma and those who scored 1 *SD* below the mean were used as anchors on the graphs.

Results

Table 1 displays the baseline sample characteristics grouped by program. No significant differences were demonstrated between the programs on any of the measures (all *p*s > .05), indicating that the randomization was successful in creating adequately comparable groups. At 6 months (immediately after the program ended), 90% of the participants were available for assessments. At 24 months, 50% of the participants were available for follow-up assessments. Attrition analyses indicated no differences between the completers and non-completers on any of

the baseline scores for the outcome variables or demographic characteristics, with the exception of race/ethnicity. Of the five participants who identified as a racial minority, none completed the 24-month assessment (Fisher's Exact Test; $p = .055$). To further ensure that attrition had no impact on the present findings, we entered a dropout variable into the linear mixed models; results were unchanged after doing so.

Table 2 reports the estimated marginal means at baseline, 6 months, and 24 months from the intention-to-treat linear mixed analyses for each outcome variable[1]. These values are based on models that include the main effects for internalized weight stigma (WBIS scores), group (weight-neutral program versus conventional weight-management program), time (baseline, 6 months, 24 months), as well as all 2-way interactions (group × time; group × internalized weight stigma; time × internalized weight stigma), and the 3-way (group × time × internalized weight stigma) interaction effect on these variables. When internalized weight stigma was the outcome, the model included the group and time main effects as well as the group by time interaction. All models also examined between-group differences in change from baseline to 6 months and 24 months, as well as the within-group effects of time. Table 2 reports the *F*-statistics, *p*-values, parameter estimates, and 95% confidence intervals for all of the effects reported below.

Adaptive Eating

For the first hypothesis, the 3-way interaction effect between group, time, and internalized weight stigma trended towards significance, suggesting that the influence of internalized weight stigma on adaptive eating was marginally different for the two programs. The second hypothesis was supported by the significant 2-way interaction between internalized weight stigma and time, suggesting that internalized weight stigma influenced the degree to which participants changed their adaptive eating behaviors over the course of the study, regardless of program type.

To interrogate the meaning of the interactions involving internalized weight stigma, we plotted a graph utilizing the model's parameter estimates to demonstrate the changes in adaptive eating between women with high (1 *SD* above the mean) internalized weight stigma and low (-1 *SD* below the mean) internalized weight stigma for each program over the time points. Figure 2 demonstrates that women with high internalized weight stigma in both programs did not demonstrate improvements in adaptive eating at the 6-month or 24-month assessments. In contrast, women with low internalized weight stigma reported improved adaptive eating at the 6-month assessment (internalized weight stigma × time effect). The significant 3-way interaction effect (group × time × internalized weight stigma) provides evidence that of the individuals with low internalized weight stigma, the greatest improvement occurred among women in the weight-neutral program.

The third hypothesis was also supported by the significant 2-way interaction between group and time, suggesting that changes in adaptive eating behaviors over time were different according to the assigned program. Significant between-group differences in mean change from baseline were found at post-intervention for adaptive eating behaviors. Specifically, the improvement in adaptive eating behaviors was greater in the weight-neutral program compared to the conventional weight-management program between the baseline and 6-month assessment (t = -2.60, p = .011). At the 24-month assessment, the mean difference in change from baseline was no longer significantly different between the two programs for adaptive eating (t = -1.38, p = .169).

Within-group effects of time for adaptive eating were evident in both programs. Overall improvements between baseline and the 6-month assessment were demonstrated for the weight-neutral program (p < .001) and conventional weight-management program (p = .008). However, only the weight-neutral program participants sustained improvements above baseline levels at

the 24-month assessment (weight-neutral $p = .001$ vs. conventional weight-management $p = .462$).

Disordered Eating

Global EDE-Q scores. For the first hypothesis, the 3-way interaction between group, time, and internalized weight stigma was statistically significant, indicating that the influence of internalized weight stigma on global disordered eating over time was not equivalent for the two programs. The second hypothesis was supported by the significant 2-way interaction between internalized weight stigma and time, suggesting that internalized weight stigma influenced the degree to which participants decreased disordered eating behaviors over the course of the study regardless of assigned program.

To interrogate the meaning of the interaction effects involving internalized weight stigma, we plotted a graph utilizing the model's parameter estimates to depict how women with high (1 *SD* above the mean) internalized weight stigma compared to women with low (-1 *SD* below the mean) internalized weight stigma on disordered eating behaviors within each program. Figure 3 reveals that women with high internalized weight stigma did not show reductions in disordered eating at the 6-month or 24-month assessment, regardless of the assigned program. In comparison, women with low internalized weight stigma did show reductions in disordered eating at the 6-month assessment (internalized weight stigma × time effect), with the largest decrements observed for women with low internalized weight stigma within the weight-neutral program, providing support for the first hypothesis (group × time × internalized weight stigma effect). The difference in mean change for the weight-neutral program from baseline to the 6-month assessment for high versus low internalized weight stigma was 1.32, while the difference in mean change for the conventional weight-management program from baseline to the 6-month assessment was 0.40. Notably, the 6-month assessment mean for women with lower than average

internalized weight stigma within the weight-neutral program was 0.50 *SD* units *below* the global EDE-Q mean derived from age and sex equivalent population norms (women between 33-37 years-old; Mond et al., 2006) and 1.56 *SD* units below the global EDE-Q mean derived from a population-based community sample of women between the ages of 16 and 50 with a BMI >30 (Rø, Reas, & Rosenvinge, 2012).

The third hypothesis was also supported by the significant 2-way interaction between group and time, suggesting that changes in disordered eating behaviors over time were different according to the assigned program. Specifically, women in the weight-neutral program demonstrated significantly greater reductions in disordered eating than women in the conventional weight-management program between baseline and the 6-month assessment (t = 3.36, p = .001); however, these differences between the programs were no longer significant at the 24-month assessment (t = 1.31, p = .194).

Within-group effects of time for global disordered eating scores were evident only in the weight-neutral program. Participants reported reductions in global disordered eating at the 6-month assessment (p < .001), and these reductions were sustained at the 24-month assessment (p = .001).

EDE-Q subscales. In order to further understand the patterns of change and provide context for the overall findings in global disordered eating, we conducted a supplementary analysis for each EDE-Q-subscale as an outcome in lieu of the total global disordered eating score. As reported in Table 2, the 3-way interaction effect for group, time, and internalized weight stigma as well as the 2-way interactions between time and internalized weight stigma on the Weight Concern and Shape Concern subscales closely align with the results for global disordered eating. Although the group by time interaction effects for Weight Concern and Shape Concern were not significant, there was a strong group by time interaction for the Restraint

subscale. Whereas Restraint scores in the conventional weight-management program significantly increased (hence become more disordered), those in the weight-neutral program did not change over the course of the study. The 3-way interaction effect was not significant for the Eating Concerns subscale, suggesting that the effect of internalized weight stigma did not differ between the weight-neutral program and the conventional weight-management program. However, both hypothesized 2-way interactions (internalized weight stigma × time, group × time) trended towards significance for Eating Concerns.

Internalized Weight Stigma

In addition to the tests of the main hypotheses, we also explored whether there was a group by time interaction effect for internalized weight stigma, and examined the associated between-group and within-group effects of time (see Figure 4 and bottom section of Table 2). The group by time interaction effect did not reach statistical significance, and there were no between-group differences in mean changes from baseline to the 6-month or 24-month assessment. Within-group effects of time were evident in both the weight-neutral program and the conventional weight-management program. Overall improvements in internalized weight stigma between baseline and the 6-month assessment were reported by those in the weight-neutral program ($p < .001$) and those in the conventional weight-management program ($p < .001$). These positive changes in internalized weight stigma were further sustained at the 24-month assessment for the weight-neutral program ($p < .001$) and the conventional weight-management program ($p = .010$). The difference between the means in internalized weight stigma was negligible at baseline (Cohen's $d = 0.21$), but large effect sizes were noted between the programs at the 6-month assessment (Cohen's $d = -1.73$) and the 24-month assessment (Cohen's $d = -2.00$). The means of the weight-neutral program were lower than the means of the conventional weight-management program in the two latter assessments.

Discussion

This study examined the moderating effect of internalized weight stigma on eating behavior outcomes over time when comparing a weight-neutral program to a conventional weight-management program for women with high BMI. Women with high levels of internalized weight stigma showed less improvement in their eating behaviors (i.e., adaptive eating and disordered eating) regardless of intervention type, whereas women with low internalized stigma showed meaningful improvements in both adaptive and disordered eating behavior—this was especially the case for the weight-neutral program. Specifically, at the end of the intervention, women with low internalized stigma had global EDE-Q scores below (.50 *SD* units) age and gender-matched population averages reported in the literature (Mond et al., 2006) and well below (1.56 *SD* units) population averages reported for women with high BMI (>30) (Rø et al., 2012). Furthermore, women in the weight-neutral program showed significantly greater improvement in adaptive and disordered eating behaviors between baseline and post-intervention compared to women in the conventional weight-management program, independent of internalized weight stigma. In fact, women in the conventional weight-management program did not sustain positive changes in adaptive eating at the 24-month assessment, nor did they demonstrate significant within-group changes over time in global disordered eating.

When dimensions of disordered eating were investigated separately (i.e., EDE-Q subscales), weight and shape concerns largely mirrored the global EDE-Q findings. Significant between-group differences were evident in restraint behaviors at the 6-month and 24-month assessments. Restraint increased from baseline to post-intervention in the conventional weight-management program while no significant changes were evident for the weight-neutral program. A trend in the group by time effect also indicated more pronounced improvements in eating concerns in the weight-neutral program compared to the conventional weight-management

program; this effect was driven by significant between-group differences in changes from baseline to 6 months.

These findings are consistent with previous research that has demonstrated the effectiveness of weight-neutral programs for reducing disordered eating and improving adaptive eating among women with high BMI (e.g., Bacon et al., 2005; Carrier, Steinhardt, & Bowman, 1994; Mensinger et al., 2016; Provencher et al., 2009; Watkins, Ebbeck, & Levy, 2014). Moreover, this study extends prior research by highlighting internalized weight stigma as a potential factor that may mitigate the effectiveness of weight-neutral *and* conventional weight-management programs. Indeed, research shows that those with high levels of internalized weight stigma view themselves through the fat-phobic lens that is omnipresent within Western culture (Brownell, Puhl, Schwartz, & Rudd, 2005; Crandall, 1994; Puhl & Latner, 2008; Sikorski et al., 2011), and internalized weight stigma can contribute to harsher self-judgments, more body shame, and less self-care (for a review, see Tylka et al., 2014).

Likewise, researchers are investigating new theoretical models for how weight stigma in Western culture has become embodied in high BMI individuals (Brewis, 2014; Puhl & Heuer, 2010; Tomiyama, 2014; Tylka et al., 2014). These models posit multiple mechanisms that result in higher weight (e.g., physiological stress, psychosocial stress, social relationships, intergenerational effects), even amidst individuals' efforts to reduce their size through changes in eating patterns. It is important to note here that the widespread conflation of weight and health, as well as fusing eating with weight variables, is itself a structural form of weight stigma perpetuated in the scientific and medical literatures, which fuels the internalization of weight stigmatizing messages (Calogero, Tylka, & Mensinger, 2016). Indeed, being mindful of the tendency to conflate these variables in the scientific literature, and to avoid making weight a central variable in a study focused on changes in disordered and adaptive eating, we did not

report results for BMI and weight changes in this paper. As indicated earlier, these results are available upon request from the first author and will be reported in a relevant paper where we tested specific hypotheses related to BMI and weight changes (Mensinger et al., 2016).

The importance of internalized weight stigma for health-related outcomes is further underscored by recent research demonstrating that internalized weight stigma and physical activity were the *only* significant predictors of physical health-related quality of life in a sample of adults who were classified as overweight or obese, even after controlling for age, BMI, medical conditions, and medication use (Latner, Durso, & Mond, 2013). Research on weight dissatisfaction (i.e., a subjective and affective self-evaluation based on one's ideal versus actual weight) similarly demonstrates how psychological perceptions and beliefs about one's body can have a stronger impact on indicators of health and well-being (e.g., blood pressure, onset of type 2 diabetes) than actual BMI status (Blake et al., 2013; Muennig, Jia, Lee, & Lubetkin, 2008; Wirth et al., 2014; Wirth, Blake, Hebert, Sui, & Blair, 2015).

Clinical Implications and Limitations

Regardless of program type, it was clear from the findings that the eating behaviors of those with high internalized weight stigma were not improved. Although weight-neutral programs (e.g., Bacon et al., 2002; Provencher et al., 2009; Robison et al., 2007), such as Health at Every Size® and the curriculum employed in the present study (Omichinski, 2007), emphasize body and self-acceptance by challenging weight bias and discrimination, specific intervention components designed for the explicit purpose of reducing internalized weight stigma are largely missing. In light of the growing body of evidence on the ubiquitous scope of institutionalized weight stigma (Brochu & Esses, 2009; Malterud & Ulriksen, 2011; Phelan et al., 2014; Phelan et al., 2015; Pomeranz & Puhl, 2013), it is imperative that the psychological impact of the structural inequities faced by people living in larger-sized bodies is directly addressed. Thus,

lowering internalized weight stigma should be a critical target for all healthy living programs. As demonstrated in the present study, both programs lowered internalized weight stigma over time; however, a non-significant group by time effect (p = .173) may have been due to a small sample size. When comparing the means between programs at the 6-month and 24-month assessments, large effect sizes were noted, suggesting that women in the weight-neutral program reported lower means in internalized weight stigma at these assessments.

Working to directly lower internalized weight stigma within conventional weight-management programs may prove to be more challenging because a goal of weight loss (and having to "reduce" to be viewed as "better" and "healthier" human beings) may be inherently stigmatizing. For example, Murakami and Latner (2015) recently demonstrated that weight dissatisfaction on the part of obese targets led to significantly greater stigmatizing and biased responses from participants compared to obese targets who expressed size acceptance. In contrast to conventional weight-management programs, a weight-neutral program explicitly promotes size acceptance, which would address internalized weight stigma more directly and potentially facilitate rejection of this stigma over time.

There are a number of practical strategies for directly targeting internalized weight stigma in weight-neutral programs, such as assigning portions of Bacon and Aphramor's (2014) *Body Respect* for participants to read. We also propose borrowing elements from body image programs developed during the anti-dieting movement of the late 1980s and early 1990s (Garner & Wooly, 1991; Polivy & Herman, 1992). Additionally, interventions targeting thin-ideal internalization would be suitable to adapt within weight-neutral programs to address internalized weight stigma, given that greater internalized weight stigma has been found to be associated with a stronger pro-thin bias (Carels & Musher-Eizenman, 2010). For example, mounting evidence supports a cognitive dissonance strategy as successful in helping female participants reject the thin ideal

and pro-weight loss attitudes, and thereby reduce their disordered eating behaviors (e.g., Stice & Presnell, 2007; Stice, Rohde, Gau, & Shaw, 2009). Cognitive dissonance strategies could also be designed to have participants advocate for higher weight individuals and verbally criticize anti-fat bias in order to reinforce new positive attitudes and behaviors around weight and shape.

Ultimately, a predominant underlying theme of a successful weight-neutral program should be that optimal self-care evolves out of self-compassion and self-acceptance (Breines & Chen, 2012; Daye, Webb, & Jafari, 2014; Magnus, Kowalski, & Mchugh, 2010; Schoenefeld & Webb, 2013). Interventions to increase self-compassion can reduce body shame (Albertson, Neff, & Dill-Shackleford, 2014), which is a potential barrier to more fully actualizing adaptive treatment effects, and is likely to coincide with high internalized weight stigma. Reducing body shame and dissatisfaction in Western culture will involve teaching body image flexibility and body appreciation, which involve relinquishing social norms for beauty, appreciating the body's unique qualities, and approaching body image threats (e.g., external pressures to be thin) with mindful awareness and self-compassion while pursuing meaningful and valued activities (Moore, Masuda, Hill, & Goodnight, 2014; Sandoz, Wilson, Merwin, Kellum, 2013; Tylka & Wood-Barcalow 2015; Webb, 2015; Webb, Wood-Barcalow, & Tylka, 2015).

Although the present study offered important findings regarding the benefits of a weight-neutral program for improving eating behavior, it is not without limitations. Having knowledge about the degree to which our participants utilized their newly formed support systems during the post-intervention phase would have been useful data for understanding the behavioral changes demonstrated. In addition, our small sample was primarily White, middle class, all female, and within a relatively narrow age range, thus limiting the generalizability of the results. Future research with larger, more diverse populations in gender, age, and race/ethnicity are needed to

understand how internalized weight stigma impacts eating-related outcomes in the context of weight-neutral and conventional weight-management programs for these groups.

One of the biggest limitations involved the high attrition rate at long-term follow-up. Although this is not atypical for studies involving weight reduction (e.g., Dalle et al, 2005; Douketis, Macie, Thabane, & Williamson, 2005; Fabricatore et al., 2009), attrition in weight-neutral programs has been shown to be better in comparison to conventional weight-management programs (Bacon et al., 2002, 2005). Given that the attrition analyses revealed little evidence to suggest characteristics that were predictive of study completion (aside from the significant association with race/ethnicity), we can only speculate about what could have been done differently to encourage better adherence at the 24-month follow-up. Perhaps incentives to return at 24 months should have been incrementally larger as opposed to equal to the 6-month incentives of $20. Smaller groups at the start of the program, in addition to more active strategies to maintain group cohesion during post-intervention and follow-up (such as sponsoring a celebratory gathering every 3 to 6 months), may have helped with loyalty and commitment to the program and overall study. Past research has examined the dropout phenomenon among weight-loss interventions as a threat to validity through overestimates of treatment effect for weight (Kaplan & Atkins, 1987); it is possible similar threats to validity could occur with outcomes other than weight. As such, cautious interpretations of the present study's results are warranted.

As a result of attrition, we only had adequate power to detect a moderate effect or larger in this study. In the 6-month and 24-month assessments, power was reduced to a point that small effect sizes were not statistically significant. Larger sample sizes and reduced attrition may have revealed these small effect sizes to be significant; for example, perhaps the 3-way interaction (group × time × internalized weight stigma) for adaptive eating behaviors would move from

marginally significant to significant, and perhaps a group × time effect would be noted for internalized weight stigma as the outcome.

Conclusion

There has been a recent call for more empirical research on weight-neutral programs for health promotion among those with high BMI (Penney & Kirk, 2015). The current study has responded to this call, and addresses a gap in the literature by focusing on the mechanisms that may enhance or undermine the success of weight-neutral programs. Our findings underscore the importance of developing program interventions that include a specific focus on internalized weight stigma. Such programs would directly address negative social stereotypes about higher weights, as well as the body shame that often accompanies inhabiting a larger body in a culture where these bodies are stigmatized. In summary, with weight stigma gaining increased attention in the public health discourse (Puhl & Latner, 2008; Puhl & Peterson, 2014; Ramos, 2015), the literature has made it clear that the next generation of research on weight-neutral programs would benefit from considering both experienced and internalized weight stigma as primary variables of interest in the development of interventions for improving health and well-being.

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929

930 Footnote

931 [1]Program differences in changes in BMI for individuals as a function of internalized

932 weight stigma are available upon request by contacting the first author at

933 Janell.L.Mensinger@drexel.edu.

934

935 Figure Captions

936 *Figure 1.* Flowchart of participant involvement. * No significant differences were observed
937 between programs on completion rates (p = .37).

938

939 *Figure 2.* Internalized weight stigma as a moderator of adaptive eating in a weight-neutral versus
940 conventional weight-management program. IWS = Internalized Weight Stigma. WN = Weight-
941 Neutral Program. CWM = Conventional Weight-Management Program.

942

943 *Figure 3.* Internalized weight stigma as a moderator of disordered eating in a weight-neutral
944 program versus a conventional weight-management program. EDE-Q = Eating Disorder
945 Examination Questionnaire. IWS = Internalized Weight Stigma. WN = Weight-Neutral Program.
946 CWM = Conventional Weight-Management Program.

947

948 *Figure 4.* Changes in internalized weight stigma after participating in a weight-neutral program
949 versus a conventional weight-management program. WBIS = Weight Bias Internalization Scale.
950 WN = Weight-Neutral Program. CWM = Conventional Weight-Management Program.

Table 1. *Baseline Characteristics of the Study Sample*

Characteristic	Weight-Neutral Program	Conventional Weight-Management Program	
	***n* (%)**[§]	***n* (%)**[§]	***p* -value**[ǂ]
Education			.066
High School Diploma, or Some High School	8 (20)	14 (35)	
Some College (or Technical School)	17 (43)	21 (53)	
College Graduate (Bachelor's Degree)	10 (25)	4 (10)	
Graduate or Professional Degree	5 (13)	1 (3)	
Employment Status, *n* *(%)*			.378
Employed for Wages Full-Time	22 (55)	31 (78)	
Employed for Wages Part-Time	11 (28)	6 (15)	
Not Working	7 (18)	3 (8)	
Race/Ethnicity			.644
African American/Black Non-Hispanic	0 (0)	1 (3)	
Hispanic	3 (8)	1 (3)	
White Non-Hispanic	37 (93)	38 (95)	
Relationship Status			.962
Married	28 (70)	28 (70)	
Member of an Unmarried Couple	4 (10)	4 (10)	
Divorced	2 (5)	3 (7)	
Never Been Married	6 (15)	5 (12)	
Mean Age (*SD*), *y*	39.83 (4.34)	39.35 (3.91)	.609
Mean Body Mass Index (*SD*), kg/m^2	37.42 (0.57)	38.56 (0.65)	.191
Median Household Income (min-max), *US$* [†]	68,750 (18,000-180,000)	60,000 (12,000-130,000)	.504
Median Individual Income (min-max), *US$* [*]	29,500 (0-120,000)	30,000 (5,000-75,000)	.916

[§] Percentages are rounded to the higher integer when value => .5 causing totals to exceed 100%

[ǂ] *p* -values based on *t* -tests, chi-squares, and Mann-Whitney U-tests as appropriate for variable types

[†] Household income data missing for 2 Weight-Neutral Program participants

[*] Individual income data missing for 1 Conventional Weight-Management program participant

Table 2. *Estimated Marginal Means for Eating Behaviors and Internalized Weight Stigma (IWS) by Group over Time*

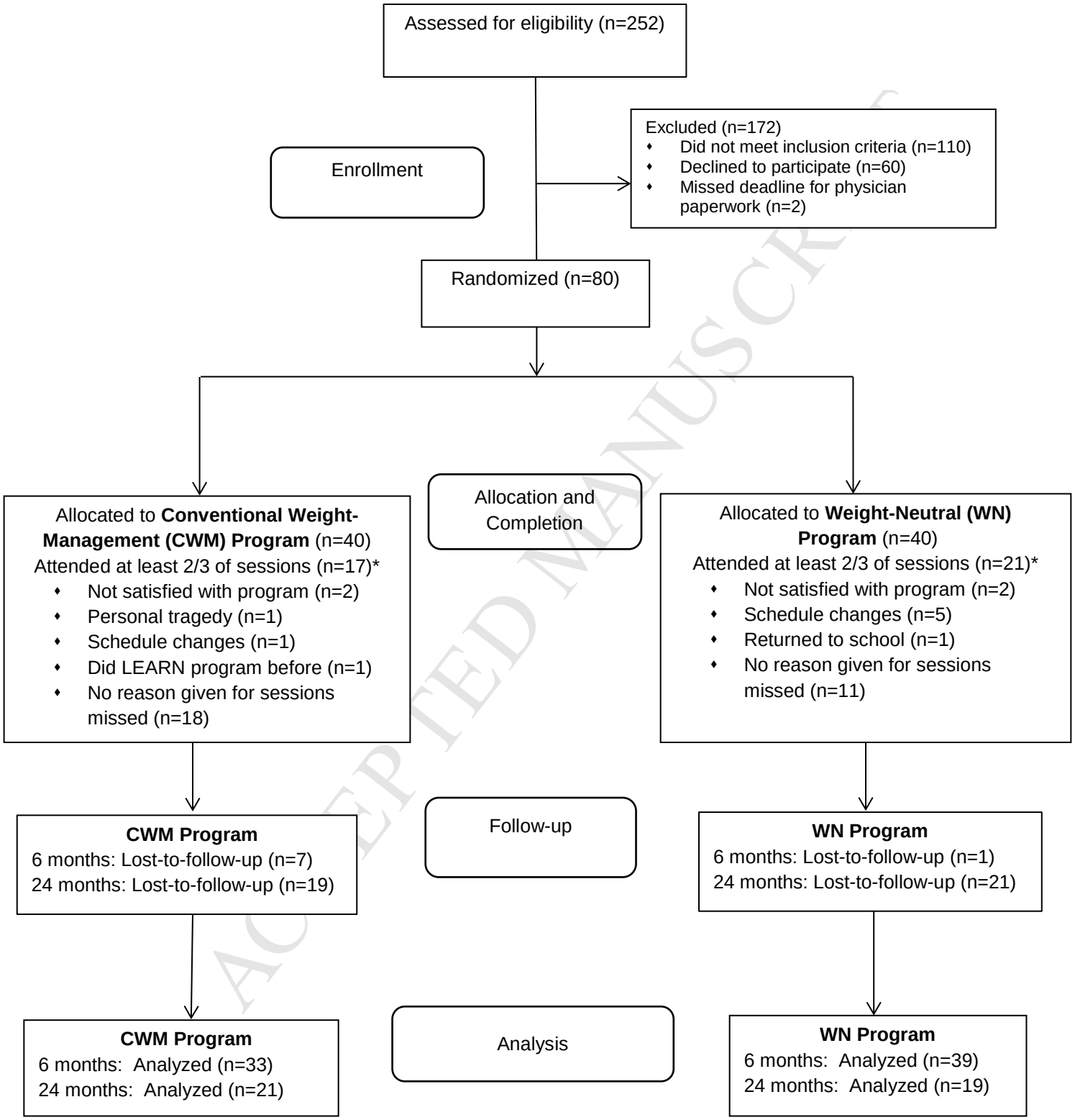
	Weight-Neutral Program	Conventional Weight-Management Program	Between-Group Differences[†] (95% CI)	IWS x Group x Time	IWS x Time	Group x Time	IWS Main Effect
Adaptive Eating (IES)	**N**	**N**		*F* (df)	*F* (df)	*F* (df)	*F* (df)
Baseline	40 2.87 (0.07)	40 2.93 (0.06)					
6 months	37 3.29 (0.06)*	33 3.11 (0.06)*	-0.23 (-0.41 to -0.06)	2.26 (2, 115)	4.74 (2, 115)	3.43 (2, 106)	29.27 (1, 162)
24 months	19 3.15 (0.08)*	21 3.05 (0.07)	-0.15 (-0.37 to 0.07)	p = .109	p = .011	p = .036	p < .001
Within-group effects, *F* (df)	22.69 (2, 107) p < .001	3.71 (2, 106) p = .028					
Global Disordered Eating (EDE-Q)							
Baseline	40 2.58 (0.11)	40 2.35 (0.11)					
6 months	37 1.75 (0.11)*	33 2.19 (0.11)	0.66 (0.27 to 1.05)	4.20 (2, 130)	8.93 (2, 130)	5.67 (2, 115)	70.36 (1, 139)
24 months	19 2.00 (0.15)*	21 2.10 (0.14)	0.32 (-0.16 to 0.77)	p = .017	p < .001	p = .004	p < .001
Within-group effects, *F* (df)	19.29 (2, 116) p < .001	1.22 (2, 114) p = .229					
EDE-Q Weight Concern							
Baseline	40 3.35 (0.13)	40 3.24 (0.13)					
6 months	37 2.35 (0.12)*	33 2.52 (0.13)*	0.24 (-0.21 to 0.70)	6.14 (2, 134)	9.45 (2, 134)	0.73 (2, 117)	90.99 (1, 130)
24 months	19 2.18 (0.17)*	21 2.38 (0.16)*	0.27 (-0.28 to 0.81)	p = .003	p < .001	p = .490	p < .001
Within-group effects, *F* (df)	26.22 (2, 118) p < .001	13.70 (2, 116) p < .001					
EDE-Q Shape Concern							
Baseline	40 4.29 (0.16)	40 4.13 (0.16)					
6 months	37 2.88 (0.15)*	33 3.15 (0.16)*	0.42 (-0.13 to 0.96)	2.91 (2, 125)	13.13 (2, 124)	1.50 (2, 110)	90.89 (1, 140)
24 months	19 2.97 (0.21)*	21 3.29 (0.20)*	0.46 (-0.19 to 1.11)	p = .058	p < .001	p = .229	p < .001
Within-group effects, *F* (df)	31.88 (2, 110) p < .001	13.65 (2, 109) p < .001					
EDE-Q Eating Concern							
Baseline	40 1.53 (0.15)	40 1.13 (0.15)					
6 months	37 0.83 (0.14)*	33 0.88 (0.19)	0.46 (0.01 to 0.91)	0.76 (2, 115)	2.84 (2, 115)	2.20 (2, 105)	15.43 (1, 160)
24 months	19 0.60 (0.19)*	21 0.57 (0.19)*	0.37 (-0.17 to 0.92)	p = .469	p = .063	p = .119	p < .001
Within-group effects, *F* (df)	15.10 (2, 106) p < .001	4.19 (2, 105) p < .018					
EDE-Q Restraint							
Baseline	40 1.15 (0.18)	40 0.89 (0.18)					
6 months	37 0.91 (0.17)	33 2.22 (0.18)*	1.54 (0.89 to 2.20)	1.40 (2, 136)	1.13 (1, 130)	11.11 (2, 120)	0.39 (1, 130)
24 months	19 1.40 (0.25)	21 2.16 (0.23)*	1.02 (0.23 to 1.81)	p = .250	p = .325	p < .001	p = .531
Within-group effects, *F* (df)	1.58 (2, 121) p = .211	18.38 (2, 118) p < .001					
Internalized Weight Stigma (WBIS)							
Baseline	40 4.32 (0.19)	40 4.28 (0.19)					
6 months	37 3.25 (0.18)*	33 3.57 (0.19)*	0.36 (-0.11 to 0.82)			1.79 (2, 104)	

24 months	19	3.31 (0.22)*	21	3.75 (0.22)*	0.48 (-0.09 to 1.05)	NA	NA	p = .173	NA
Within-group effects, F (df)		24.73 (2, 103) p < .001		8.86 (2, 105) p < .001					

† Mean differences in change from baseline at 6 months and 24 months after controlling for IWS (except where IWS is the outcome), group, time, and all 2-way and 3-way interactions in the linear mixed model

* Significant within-group difference from baseline (p < .05)

Figure 1.



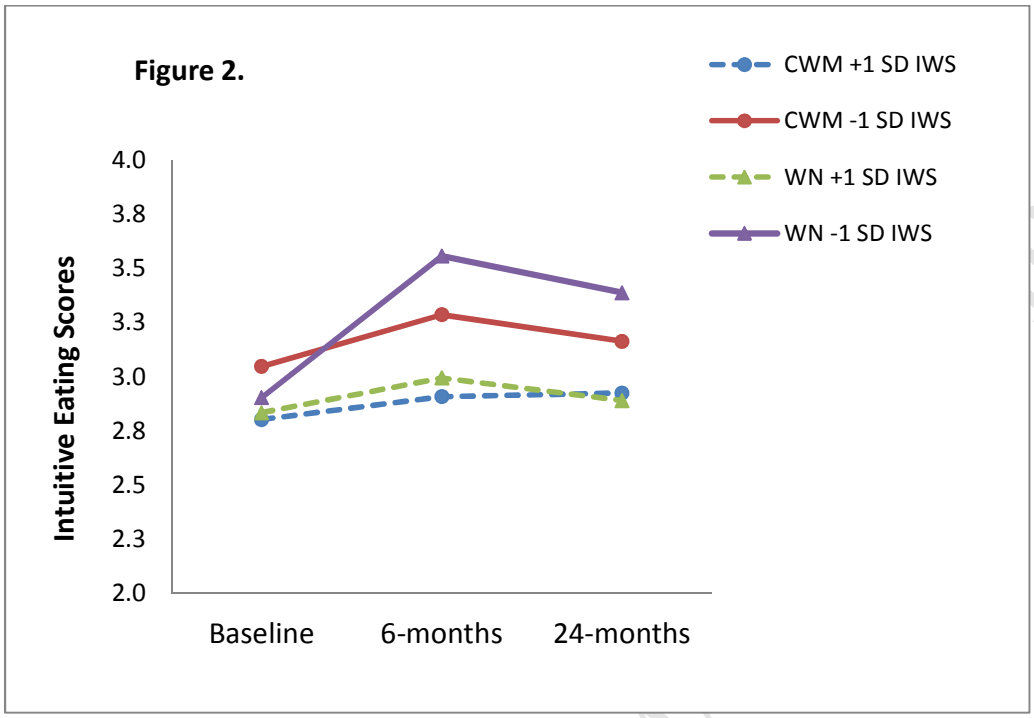
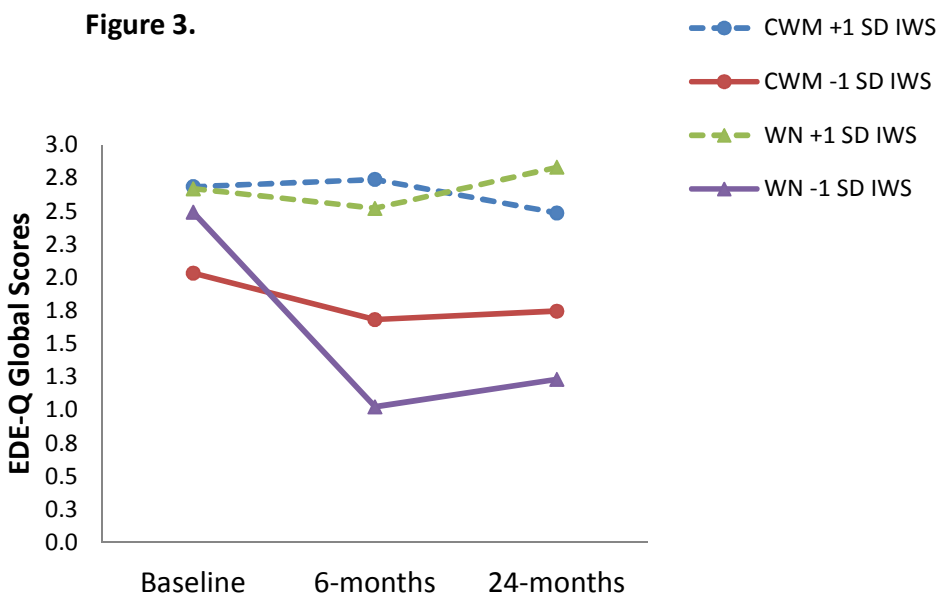
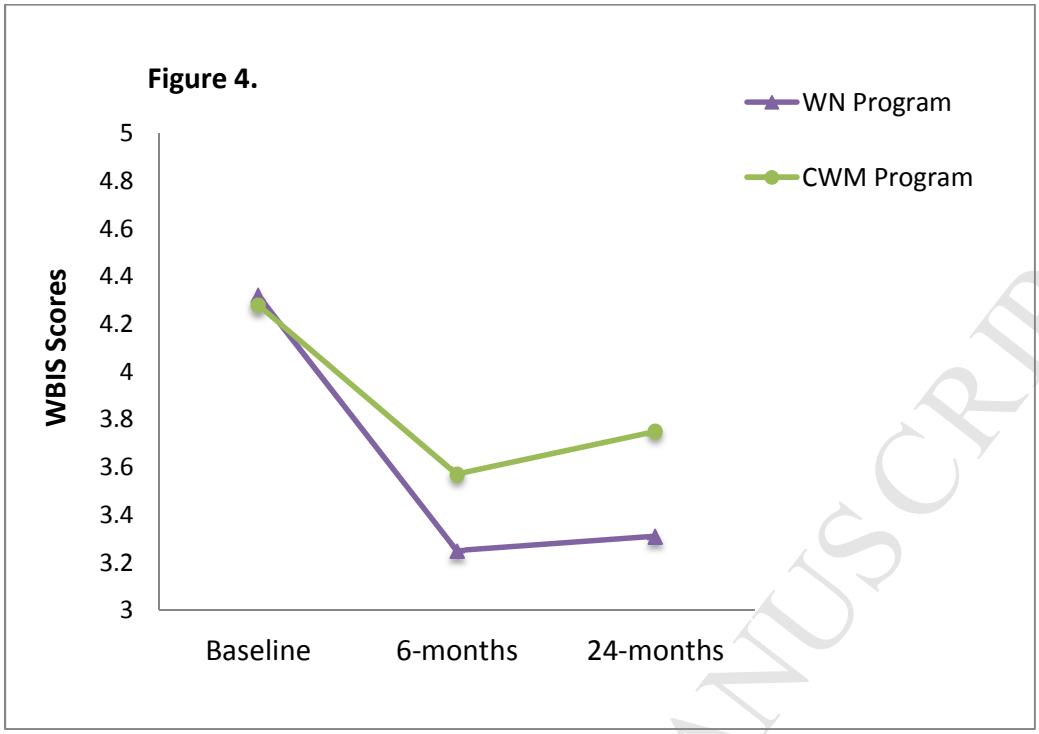


Figure 3.





Highlights

- Women with high BMI participated in a weight-neutral or conventional weight-management program.
- Impact of internalized weight stigma (IWS) on women's eating behaviors was explored.
- Women in the weight-neutral program with low IWS improved disordered and adaptive eating.
- Women with high IWS did not improve disordered or adaptive eating in either program.