HHS Public Access

Author manuscript

*Obesity (Silver Spring)*. Author manuscript; available in PMC 2019 May 13.

Published in final edited form as:

*Obesity (Silver Spring)*. 2018 December ; 26(12): 1888–1892. doi:10.1002/oby.22283.

# A prospective evaluation of internalized weight bias and weight change among successful weight loss maintainers

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## Abstract

**Objective—**Internalized Weight Bias (IWB) is associated with weight regain after intentional weight loss, but reliance on cross-sectional data limits our understanding of this relationship. This study prospectively evaluated IWB as a predictor of weight change in a longitudinal observational study of successful weight loss maintainers.

**Methods—**National Weight Control Registry participants (maintained 13.6 kg weight loss for ≥ 1 year) were asked to complete an online questionnaire at baseline and 12 months including current weight and Weight Bias Internalization Scale-Modified (WBIS-M).

**Results—**At baseline, 1250 of 1643 eligible individuals completed the baseline assessment (71% female, 94% white, mean± SD age: 52yrs.±13.1, BMI: 27±5.5). Average WBIS-M score was 3.0 (±1.3). Study completers (n=862) reported 2.2% (±7.8) weight gain. Higher baseline IWB predicted weight gain among men (n=254, t=−2.28, p=.02) but not women (n=608, t=1.22, p=.22). A one point reduction in WBIS-M score at follow-up was associated with a 3.0% weight loss.

**Conclusions—**Among weight loss maintainers, IWB may be a risk factor for weight gain among men. Weight loss at follow-up was associated with reduced IWB in both men and women. Reliance on female-only samples may limit our understanding of IWB and its implications for weight control.

### Keywords

Internalized weight bias; Overweight; Obesity; Weight loss maintenance; Weight Regain



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**Disclosure:** Dr. Thomas reports personal fees from Slimming World, Inc., outside the submitted work. Dr. Olson, Dr. Lillis, and Dr. Wing have nothing to disclose.

## Introduction

Weight-related stigma, which is exposure to bias, discrimination, or ridicule due to one's body weight, is common in the United States (1–4) and can be debilitating (5–6). Internalized weight bias occurs when individuals with overweight or obesity believe negative societal attitudes about weight status are relevant to themselves, resulting in a devalued sense of self-worth. This form of stigma has been shown to uniquely impact mental and physical well-being (7–8).

Elevated internalized weight bias is associated with reduced quality of life and poorer psychological functioning (9–10), unhealthy eating (e.g., emotional eating, 11), avoidance of exercise (12), and reduced weight loss success in behavioral obesity treatment (13–14). These findings are compounded by recent work linking internalized weight bias to risk for metabolic syndrome (15) and greater bodily pain (16), indicating additive health risk of internalized weight bias for weight-related medical comorbidity.

Elevated internalized weight bias also has been linked to weight regain after weight loss. In a cross-sectional study, individuals who reported regaining weight after successful weight loss (defined as ≥10% initial body weight) reported higher internalized weight bias compared to those who reported that they had maintained weight loss (17). In turn, the authors suggest that greater internalized weight bias may be a risk factor for poor weight control after successful weight loss. However, the findings presented by Puhl and colleagues rely on cross-sectional data and retrospective recall. The current study was designed to prospectively evaluate the relationship between internalized weight bias and weight change over time among participants enrolled in the National Weight Control Registry (NWCR; 18), a large cohort of men and women who maintained a significant weight loss. The aims of the study were to 1) evaluate the relationship between internalized weigh bias and demographic and weight-history variables, 2) evaluate internalized weight bias as a prospective predictor of weight change, and 3) evaluate the relationship between change in internalized weight bias and change in weight over time. It was hypothesized that higher internalized weight bias at baseline would be associated with weight gain at follow-up and that change in weight and change in internalized weight bias would be positively correlated.

## Methods

### Participants

Eligible individuals were recruited from The National Weight Control Registry (18). The NWCR is a national database tracking over 10,000 men and women in the U.S. who are 18 years of age and older and who lost at least 13.6 kg (30 pounds) and maintained the weight loss for ≥1 year. Participants enrolled in the NWCR complete questionnaires upon entry and annually thereafter to prospectively evaluate weight trajectory and behavioral strategies associated with weight maintenance as well as factors linked to weight regain. Participants also indicate if they would like to be contacted about opportunities to complete one-time surveys. For the current study, a cohort of participants who requested to be contacted for one-time studies and completed an annual survey within the past year (i.e., considered 'active' within the registry) were invited to participate. These participants were provided

with a link to complete online questionnaires. Individuals who completed the first survey were eligible to complete a follow-up survey 12 months later. Data were collected between September 2016 and December 2017. This study was approved by the Lifespan Miriam Hospital Institutional Review Board and all participants provided written consent prior to enrolling in the registry.

## Measures

The following measures were administered electronically at baseline and approximately 12 months later:

**Demographics—**Participants provided demographic information including age, gender, race, and years of education.

**Weight history—**Participants were asked to provide information about their weight history including their current weight, highest weight (excluding pregnancy) and their ideal weight. Participants also reported their height in order to calculate body mass index (BMI, $kg/m^2$). Distance between current and ideal weight at baseline was calculated (referred to as 'weight discrepancy') and distance between current weight and highest weight was calculated (referred to as 'weight suppression').

**Weight bias internalization Scale-Modified—**(WBIS-M; 19) The original WBIS measure is an 11-item questionnaire designed to assess the degree to which an individual believes negative weight-related attributes are accurate and applicable to him/herself (7). Although the questionnaire was developed for use among individuals with overweight or obesity, it has been modified for use among individuals of varying weight status including a BMI less than 25. The modified version was chosen to allow for assessment of internalized weight bias across a range of body weights as a variety of BMI classes are represented in the NWCR. Consistent with previous work documenting poor internal reliability of the first item on the WBIS ("As an overweight person, I feel that I am just as competent as anyone"; 20), this item was removed from all analyses (resulting Cronbach's alpha=0.82 for the 10-item version of questionnaire).

## Data analysis

SAS v9.4 was used for all analyses. Correlation and analysis of variance (ANOVA) were utilized to evaluate the association of demographic and weight history variables with internalized weight bias at baseline. Only the demographic variables determined to be associated with internalized weight bias at baseline in the current study were used as covariates in the following analyses. Repeated measures ANOVA was conducted to evaluate change in internalized weight bias and change in body weight from baseline to follow-up. A linear regression model was used to evaluate internalized weight bias at baseline as a predictor of weight change. Baseline WBIS-M score was entered in the model predicting percent weight change, adjusted for baseline age and sex. To evaluate the relationship between change in internalized weight bias and change in BMI, a hierarchical regression model was conducted using percent weight change as the outcome variable. A change score was calculated by subtracting follow-up WBIS-M from baseline WBIS-M so that a positive

score reflects improvements in internalized weight bias (i.e., decreased bias at follow-up). The first step of the model included age and gender. The second step of the model included the WBIS-M change score as the predicting variable, controlling for the variables entered in the first step. The unique variance predicted by the WBIS-M change score (above and beyond the baseline covariates; baseline age, and gender) was tested.

## Results

Of the currently enrolled NWCR participants, 1,643 individuals were eligible for participation at baseline and were sent an email with a link to complete the one-time survey. Of the eligible individuals, 1260 registry participants completed the survey and were then eligible for the follow-up survey. A total of 1250 individuals were included in baseline analyses (n=10 were excluded due to current pregnancy at baseline; See Figure 1 for diagram of participant flow through the study). The sample was primarily female (71%) and white (94%) with an average BMI of 27.2 $kg/m^2$ (SD: 5.5; range 17.16–52.7) and average age of 52 years (SD: 13.1; range 20–86). At enrollment, participants reported maintaining an average weight loss of approximately 33.1 kilograms (SD: 19.2). On average, participants reported maintaining a weight loss of 13.6 kg (30 pounds) for 7.8 years (SD: 6.4). Participants reported an ideal weight that was approximately 8 kilograms (SD: 11.0) lower than their current weight. Average WBIS-M score was 3.0 (SD: 1.3; range 1.0–7.0). BMI was positively correlated with internalized weight bias ($r=.43$, $p<.001$) and WBIS-M scores increased incrementally across BMI categories (Normal (n=513): 2.4 (SD: 1.1); Overweight (n=453): 3.0 (SD: 1.3); Obese I (n=170): 3.7 (SD: 1.2); ≥Obese II (n=110): 4.3, (SD: 1.2), $p<.001$). Women reported higher scores than men (W: 3.1 (SD: 1.4), M: 2.8 (SD: 1.2), $p<.001$) and age was negatively associated with internalized weight bias ($r=-.14$, $p<.001$). Internalized weight bias was not associated with years of education ($p=.41$) or race ($p=.10$). Greater distance from ideal weight (weight discrepancy) was associated with greater internalized weight bias ($r=.48$, $p<.001$) while maintenance of greater weight loss (weight suppression) was associated with lower internalized weight bias ($r=-.07$, $p=.01$).

A total of 862 individuals (68.4% of the initial sample) provided complete responses at both time points and were included in the analysis for study aims 2–3 (incomplete cases and women who reported current pregnancy were excluded from the final dataset for analysis). Compared to individuals included in final analyses (n=862), individuals who were excluded (n=398) were younger and reported higher internalized weight bias. There were no differences between the two groups on gender, race, baseline BMI, weight suppression, or weight discrepancy (see Table 1).

On average, participants reported 2.2% (SD: 7.8; 1.7kg SD: 6.6) weight gain from baseline to follow-up (Baseline: 78.1kg±17.7; Follow-up 79.7kg±19.0, $F(1,861)=55.20$, $p<.001$). Internalized weight bias at baseline did not predict percent weight change from baseline to follow-up. Because Puhl and colleagues (17) found that individuals who regained weight were disproportionately female, a post hoc exploratory analyses was conducted evaluating the interaction effect of gender*internalized weight bias on weight change. A regression analysis was conducted predicting percent weight change at follow-up. Sex, WBIS-M, and the interaction term were entered into the model. The interaction effect was significant

(β=1.22, t=2.59, p=0.01) and in probing the effect it was revealed that higher baseline internalized weight bias predicted subsequent weight gain among men (β=−0.94, t=−2.28, p=0.02) but no relationship was observed among women (β=0.28, t=1.22, p=0.22). Post hoc analysis indicated there was no difference between men and women in percent weight change reported (F (1, 861)=0.05, p=0.82).

Participants reported a small but statistically significant increase in internalized weight bias from baseline to follow-up (Baseline: 2.9±1.32; Follow-up: 3.02±1.34, F(1,861)=9.61, p<.01). In fact, WBIS-M scores at baseline and follow-up were strongly correlated (r=.76, p<.001), suggesting a high degree of stability in the measure across time points. The hierarchical regression model evaluating the relationship between change in internalized weight bias and percent weight change was significant and the WBIS-M change score accounted for unique variance in the model adjusted for baseline age and sex ($R^2$=0.01, $R^2\Delta$=12.3, F(1,856)=121.7, p<.001). Parameter estimates indicate that changes in weight and internalized weight bias were positively associated such that a one point decrease in WBIS-M score was associated a 3.0% weight loss at follow-up (β=3.0, t=11.03, p<.001).

## Discussion

This is the first study to conduct an observational prospective evaluation of internalized weight bias in the context of weight loss maintenance. Internalized weight bias was higher among women than men and associated with higher BMI and younger age. Individuals who reported maintenance of greater weight loss (weight suppression) also reported lower internalized weight bias while those who reported an ideal weight that was farther (lower) from their current weight reported higher WBIS-M scores. Higher internalized weight bias at baseline predicted weight gain among men but not women; while weight loss was associated with decreased internalized weight bias at follow-up among both men and women.

This large sample of successful weight loss maintainers from the National Weight Control Registry reported an average WBIS-M score ((M±SD): 3.0±1.3) that appears lower than previously documented in weight loss maintainers (3.5±1.5, (17)) and other large community samples (average scores ranging from 3.1–3.6; (21)). In comparison, treatment-seeking samples of individuals with overweight or obesity consistently report higher values (typically ≥ 3.6; 15, 22–24). The relatively lower scores observed among weight loss maintainers in the NWCR registry is consistent with the current finding that greater weight suppression (maintaining a weight that is below highest weight excluding pregnancy) is associated with lower internalized weight bias. This suggests that weight loss, even if resulting weight is still in the overweight or obese range, may have positive effects on internalized weight bias. Conversely, it may be that individuals who have success with weight loss and maintenance have lower internalized weight bias prior to starting weight loss efforts. Lastly, the lower scores may simply reflect the wide range of BMIs represented in the NWCR; internalized weight bias incrementally increased across BMI categories, consistent with previous research.

The cross-sectional finding that weight suppression is associated with lower internalized weight bias is consistent with Puhl and colleagues' results documenting that individuals who reported weight maintenance also reported lower internalized weight bias compared to those who regained (17). Although these samples are quite different in terms of demographic characteristics and weight history, there is a consistent pattern of results demonstrating that a history of weight maintenance after weight loss is associated with lower internalized weight bias. However, the role of internalized weight bias in predicting weight control prospectively over time is less clear. In the current study, WBIS-M scores at baseline did not predict weight change in the total sample. While men reported lower internalized weight bias on average, internalized weight bias prospectively predicted weight gain among men but not women. Weight stigma (both experienced and internalized bias) research has been disproportionately focused on females (25–26) and understudied among men compared with women. The current findings highlight the importance of considering gender differences in the study of internalized weight bias, as it may be a risk factor for poor weight control specifically among men. If replicated, the findings suggest that internalized weight bias may influence weight-related behaviors differently for men than women and highlight the important of screening and early intervention specifically for men.

The current findings also revealed that changes in internalized weight bias were associated with changes in weight from baseline to follow-up. In fact, each one-point change in WBIS-M score from baseline to follow-up was associated with a 3% change in body weight. It is of note, that the average amount of change in WBIS-M score from baseline to follow-up was approximately 0.1. Previous research in the context of standard behavioral weight loss treatment has documented changes in WBIS-M scores around 0.7 (27, 28). Because of the correlational nature of this analysis, the direction of this relationship cannot be determined from the current data. Given the lack of psychosocial intervention to target internalized weight bias, it follows logically that participants in the current study may report internalizing weight bias to a lesser degree as a result of or in reaction to positive changes in body weight. This is consistent with the extant literature documenting both physical and psychological benefits of modest weight reductions. Conversely, it is reasonable to hypothesize that weight stigma causally influences weight through difficulties regulating eating and physical activity behaviors. This is consistent with evidence linking internalized weight bias to weight-related behaviors in a way that suggests it may interfere with weight control efforts. Further, Lillis and colleagues (29) found that among individuals who recently completed at least 6 months of a weight loss program and then received a one-day workshop to reduce stigma reported lower internalized weight stigma and greater weight loss at three month follow-up compared to a no treatment control group.

Because of the preliminary nature of the current study, it is also important to consider that internalized weight bias and weight status may be bi-directionally related, or that the relationship varies across individuals. This highlights the importance of using research methodology that can clarify the direction of the relationship, especially rigorously controlled randomized trials targeting internalized weight bias with multiple assessments to track change across time in both internalized weight bias and body weight. It is important to note that individuals excluded from the follow-up analyses reported higher baseline WBIS-M scores than those who completed the study. Further research is needed to determine how

internalized weight bias may influence engagement and retention, especially in the context of weight management treatment. If internalized weight bias is consistently associated with attrition as well as poor weight outcomes, it will only bolster the clinical utility of screening for internalized weight bias and potentially targeting it upon entry into behavioral obesity treatment.

Fortunately, efforts to develop effective interventions to address internalized weight bias are underway. The fact that *change* in internalized weight bias was observed and that this was associated with changes in weight highlights the potential clinical utility of intervention. While more objective factors such as BMI are consistently associated with internalized weight bias, there is accumulating evidence that subjective factors such as perceived weight status (17, 19), body dissatisfaction (7), or in the current study distance from ideal weight, are associated with internalized weight bias. This may reflect a discrepancy between how researchers and medical professionals conceptualize weight status and risk, and how the typical lay person thinks about their body weight. Incorporating the individual's experience into intervention development will be essential to developing the most effective approaches to treatment. Preliminary findings demonstrate promise for Acceptance and Commitment Therapy (ACT; 30), Cognitive Behavioral Group Therapy (31), as well as targeting body image (32) to address internalized weight bias.

There are a number of limitations of the current study. The National Weight Control Registry participants represent a unique group of individuals who have demonstrated a high level of success in achieving and maintaining weight loss. In the current subset of registry participants, the average maintained weight loss was 33 kilograms at the time of the baseline assessment. Because the NWCR is a select and non-random group of individuals, the current findings cannot be considered representative for other samples of individuals engaged in weight maintenance. Further, the sample is not diverse which has been a limitation of many studies of internalized weight bias to date. Some studies have documented differences in internalized weight bias by race (21), although there were no differences in the current study. Lack of power due to a smaller proportion of individuals enrolled in the registry who identify as a racial minority may explain the discrepancy. It is worth noting that many individuals, within the NWCR but also in the general population, have a long history of attempting weight loss and may experience periods of weight loss, weight maintenance, and weight regain over time. Future research would benefit from longer windows of observation to provide a more nuanced understanding of how these variables are inter-related over time. The current study is also limited by the lack of information about current weight control efforts. It is unknown whether participants were attempting to lose or maintain their weight, if weight changes were intentional, and if so what methods were being used. It is also unknown if participant were engaging in any psychosocial interventions that may have influenced weight stigma over time.

The current study provides an important contribution to the literature regarding the role of internalized weight bias among individuals who have successfully lost weight and are trying to maintain it. Internalized weight bias prospectively predicted weight gain among men but not women highlighting the potential role of this construct to provide meaningful information about variability in weight maintenance outcomes after significant weight loss.

As predictors of weight maintenance success remain elusive, this is a promising advancement that warrants further investigation. Additionally, changes in internalized weight bias were observed over time, and these changes are associated with significant variability in weight. While more research is needed to elucidate the direction of this relationship, the extant literature provides a reliable portrait of internalized weight stigma as a detrimental but under-addressed psychosocial factor for individuals with overweight or obesity.

## Acknowledgments

**Funding Support:** T32 HL076134

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**What is already known about this subject? (or for Review Proposals/Reviews, what major reviews have already been published on this subject?)**

- Internalized weight bias is common among men and women with overweight or obesity.
- Internalized weight bias is associated with negative mental and physical health correlates including depressive symptoms, reduced quality of life, metabolic syndrome, and bodily pain.
- Recent cross-sectional data suggest that internalized weight bias is associated with weight regain among individuals who have successfully lost at least 10% of their initial body weight.

**What does your study add?**

- Among individuals who have lost weight and maintained it, higher internalized weight bias at baseline predicted subsequent weight gain among men but not women. Change in weight was associated with changes in internalized weight bias with a one point reduction in WBIS-M score associated with 3.0% weight loss at follow-up.
- The current study addresses limitations of the existing data by implementing a prospective design to evaluate the relationship between internalized weight bias and weight change over time among individuals who have lost weight and maintained it.
- The results highlight the potential clinical significance of internalized weight bias especially for men, a group that is understudied in the weight bias literature.

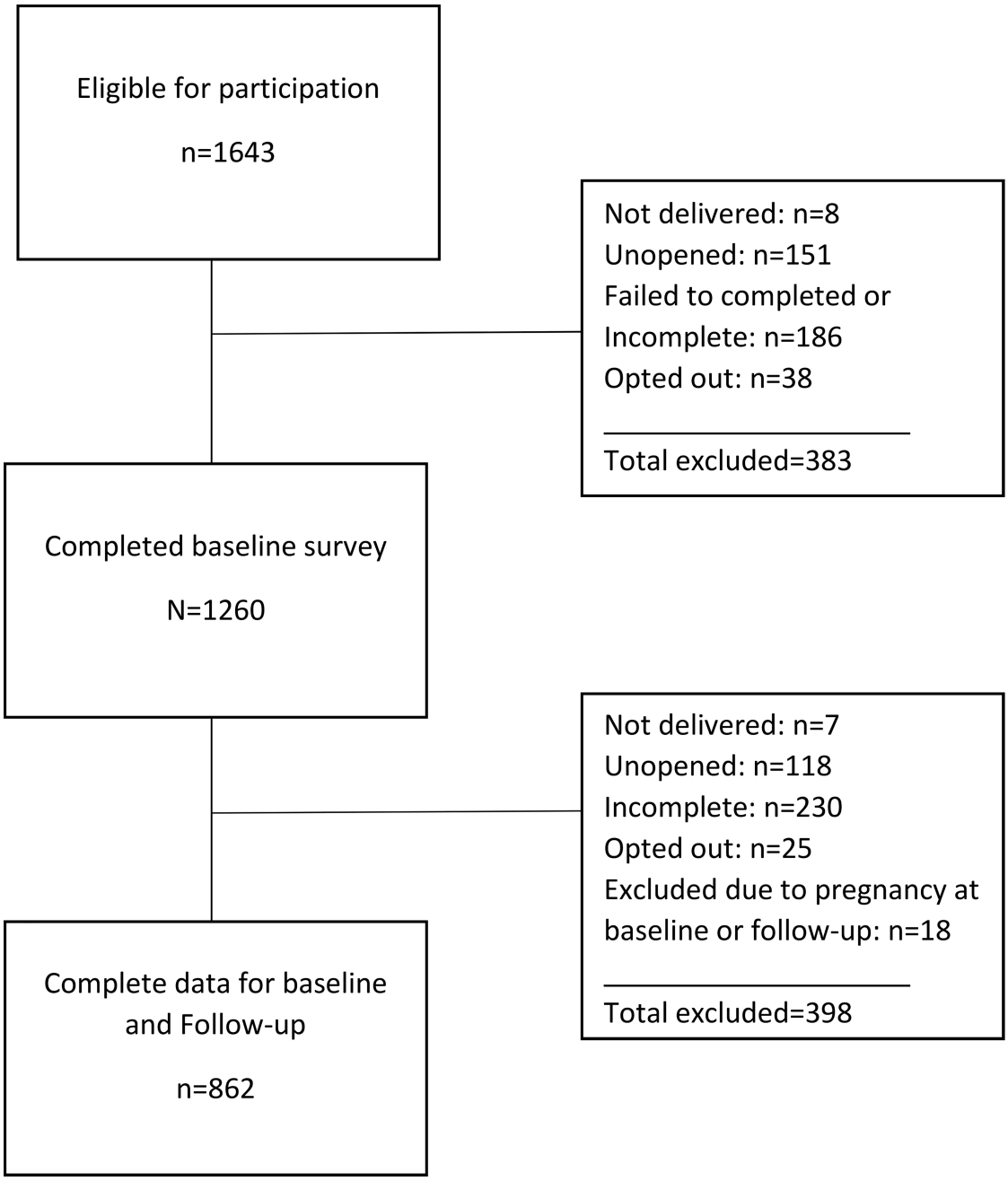


**Figure 1.**
Flow chart of data collection from baseline to follow-up with documentation of exclusion at each time point.

## Table 1

Comparison of individuals included (completers) to those who were excluded (non-completers) from final analyses on baseline characteristics.

| | Completers (n=862) | Non-completers (n=398) |
|---|---|---|
| Age (years) | 52.2 (12.9) | 50.0 (13.7) * |
| Sex (% female) | 71% | 71% |
| Race (% minority) | 6% | 7% |
| BMI | 27.1 (5.5) | 27.4 (5.4) |
| Current weight (kg) | 78.1 (17.7) | 79.0 (18.5) |
| Suppression | 33.1 (19.2) | 33.0 (19.3) |
| Weight Discrepancy | 8.2 (10.9) | 9.0 (11.2) |
| WBIS-M | 2.9 (1.3) | 3.1 (1.4) * |

Note: See Figure 1 for description of completers and non-completers; Analysis of Variance for continuous variables and chi-square analysis for categorical variables were utilized to compare demographic, weight, and WBIS-M variables;

* represents significant effect at $p<.05$.