Prospective Evaluation of Internalized Weight Bias and Weight Change Among Successful Weight-Loss Maintainers

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Objective: Internalized weight bias (IWB) has been associated with weight regain after intentional weight loss, but reliance on cross-sectional data limits the 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 y) were asked to complete an online questionnaire including current weight and Weight Bias Internalization Scale-Modified (WBIS-M) at baseline and 12 months.

Results: At baseline, 1,250 of 1,643 eligible individuals completed the baseline assessment (71% female; 94% white; mean age ± SD: 52 y ± 13.1; BMI: 27 ± 5.5). The 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 = 0.02) but not women (n = 608; t = 1.22; P = 0.22). 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.

Introduction

Weight-related stigma, which is exposure to bias, discrimination, or ridicule because of one’s body weight, is common in the United States (1-4) and can be debilitating (5,6). Internalized weight bias (IWB) occurs when individuals with overweight or obesity believe that 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 IWB is associated with reduced quality of life, 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 IWB to risk for metabolic syndrome (15) and greater bodily pain (16), indicating additive health risk of IWB for weight-related medical comorbidity.

Elevated IWB has also 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 IWB compared with those who reported that they had maintained weight loss (17). In turn, the authors suggested that greater IWB may be a risk factor for poor weight control after successful weight loss.

However, the findings presented by Puhl et al. rely on cross-sectional data and retrospective recall. The current study was designed to prospectively evaluate the relationship between IWB 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 IWB and demographic and weight-history variables, (2) evaluate IWB as a prospective predictor of weight change, and (3) evaluate the relationship between change in IWB and change in weight over time. It was hypothesized that higher IWB at baseline would be associated with weight gain at follow-up and that change in weight and change in IWB would be positively correlated.

Methods

Participants

Eligible individuals were recruited from the NWCR (18). The NWCR is a national database tracking more than 10,000 men and women in the United States who are 18 years of age and older who lost at least 13.6 kg (30 lb) and maintained the weight loss for ≥ 1 year. Participants enrolled in the NWCR complete questionnaires upon entry and annually thereafter to allow prospective evaluation of weight trajectory and behavioral strategies associated with weight maintenance as well as...
Factors linked to weight regain. Participants also indicate whether 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) was 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 BMI (kilograms divided by meters squared). 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 that negative weight-related attributes are accurate and applicable to him- or 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 those with BMI less than 25. The modified version was chosen to allow for assessment of IWB across a range of body weights because 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 α = 0.82 for the 10-item version of the questionnaire). Possible scores on the WBIS-M range from 1 to 7.

Data analysis
SAS version 9.4 (SAS Institute, Cary, North Carolina) was used for all analyses. Correlation and analysis of variance (ANOVA) were utilized to evaluate the association of demographic and weight-history variables with IWB at baseline. Only the demographic variables determined to be associated with IWB at baseline in the current study were used as covariates in the following analyses. Repeated-measures ANOVA was conducted to evaluate change in IWB and change in body weight from baseline to follow-up. A linear regression model was used to evaluate IWB 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 gender. To evaluate the relationship between change in IWB and change in BMI, a hierarchical regression model using percent weight change as the outcome variable was conducted. A change score was calculated by subtracting follow-up WBIS-M from baseline WBIS-M so that a positive score reflects improvements in IWB (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: gender and baseline age) 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, 1,260 registry participants completed the survey and were then eligible for the follow-up survey. A total of 1,250 individuals were included in baseline analyses (10 were excluded because of current pregnancy at baseline; Figure 1 provides a diagram of participant flow through the study). The sample was primarily female (71%) and white (94%), with an average BMI of 27.2 kg/m² (SD: 5.5; range: 17.16-52.7) and an average age of 52 years (SD: 13.1; range: 20-86). At enrollment, participants reported maintaining an average weight loss of approximately 33.1 kg (SD: 19.2). On average, participants reported maintaining a weight loss of 13.6 kg (30 lb) for 7.8 years (SD: 6.4). Participants reported an ideal weight that was approximately 8 kg (SD: 11.0) lower than their current weight. The average WBIS-M score was 3.0 (SD: 1.3; range: 1889
1.0-7.0). BMI was positively correlated with IWB ($r = 0.43; P < 0.001$), and WBIS-M scores increased incrementally across BMI categories (normal weight [n = 513]: 2.4 [SD: 1.1]; overweight [n = 453]: 3.0 [SD: 1.3]; obesity I [n = 170]: 3.7 [SD: 1.2]; BMI ≥ 35 [n = 110]: 4.3 [SD: 1.2]; $P < 0.001$). Women reported higher scores than men (women: 3.1 [SD: 1.4]; men: 2.8 [SD: 1.2]; $P < 0.001$), and age was negatively associated with IWB ($r = -0.14; P < 0.001$). IWB was not associated with years of education ($P = 0.41$) or race ($P = 0.10$). Greater distance from ideal weight (weight discrepancy) was associated with greater IWB ($r = 0.48; P < 0.001$), while maintenance of greater weight loss (weight suppression) was associated with lower IWB ($r = -0.07; P = 0.01$).

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 and 3 (incomplete cases and women who reported current pregnancy were excluded from the final data set for analysis). Compared with individuals included in final analyses (n = 862), individuals who were excluded (n = 398) were younger and reported higher IWB. There were no differences between the two groups on gender, race, baseline BMI, weight suppression, or weight discrepancy (Table 1).

On average, participants reported 2.2% (SD: 7.8%) (1.7 kg; SD: 6.6) weight gain from baseline to follow-up (baseline: 78.1 kg ± 17.7; follow-up: 79.7 kg ± 19.0; $F[1,861] = 55.20; P < 0.001$). IWB at baseline did not predict percent weight change from baseline to follow-up. Because Puhl et al. (17) found that individuals who regained weight were disproportionately female, a post hoc exploratory analysis evaluating the interaction effect of gender and IWB on weight change was conducted. A regression analysis predicting percent weight change at follow-up was conducted. Gender, WBIS-M, and the interaction term were entered into the model. The interaction effect was significant ($\beta = 1.22; r = 2.59; P = 0.01$), and in probing the effect, it was revealed that higher baseline IWB predicted subsequent weight gain among men ($\beta = -0.94; t = -2.28; P = 0.02$), but no relationship was observed among women ($\beta = 0.28; r = 1.22; P = 0.22$). 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 IWB from baseline to follow-up (baseline: 2.9 ± 1.32; follow-up: 3.02 ± 1.34; $F[1,861] = 9.61; P < 0.01$). In fact, WBIS-M scores at baseline and follow-up were strongly correlated ($r = 0.76; P < 0.001$), suggesting a high degree of stability in the measure across time points. The hierarchical regression model evaluating the relationship between change in IWB 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 ($R^2 = 0.01; R^2^\Delta = 12.3; F[1,856] = 121.7; P < 0.001$). Parameter estimates indicated that changes in weight and IWB were positively associated such that a one-point decrease in the WBIS-M score was associated with a 3.0% weight loss at follow-up ($\beta = 3.0; t = 11.03; P < 0.001$).

### Table 1: Comparison of individuals included (completed) to those who were excluded from final analyses (noncompleters) on baseline characteristics

|                      | Completers (n = 862) | Noncompleters (n = 398) |
|----------------------|----------------------|-------------------------|
| Age (y)              | 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)*               |

Values are mean (SD) or %. See Figure 1 for description of completers and noncompleters. ANOVA for continuous variables and $\chi^2$ analysis for categorical variables were utilized to compare demographic, weight, and WBIS-M variables. $P < 0.05$.

This large sample of successful weight-loss maintainers from the NWCR reported an average WBIS-M score (mean ±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, 3.1-3.6) (21). In comparison, samples of treatment-seeking individuals with overweight or obesity have consistently reported 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 IWB. This suggests that weight loss, even if the resulting weight is still in the overweight or obese range, may have positive effects on IWB. Conversely, it may be that individuals who have success with weight loss and maintenance have lower IWB prior to starting weight-loss efforts. Lastly, the lower scores may simply reflect the wide range of BMIs represented in the NWCR; IWB incrementally increased across BMI categories, consistent with previous research.

The cross-sectional finding that weight suppression is associated with lower IWB is consistent with Puhl et al.’s results documenting that individuals who reported weight maintenance also reported lower IWB compared with 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 IWB. However, the role of IWB 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 IWB on average, IWB prospectively predicted weight gain among men but not women. Weight stigma (both experienced and internalized bias) research has disproportionately focused on females (25,26) and has understudied men compared with women. The current findings highlight the importance of considering gender differences in the study of IWB because it may be a risk factor for poor weight.

### Discussion

This is the first study to conduct an observational prospective evaluation of IWB in the context of weight-loss maintenance. IWB was higher among women than men and was associated with higher BMI and younger age. Individuals who reported maintenance of greater weight loss (weight suppression) also reported lower IWB, while those who reported an ideal weight that was further (lower) from their current weight reported higher WBIS-M scores. Higher IWB at baseline predicted weight gain among men but not women, while weight loss was associated with decreased IWB at follow-up among both men and women.
control, specifically among men. If replicated, the findings suggest that IWB 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 reveal that changes in IWB were associated with changes in weight from baseline to follow-up. In fact, each one-point change in the 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 the 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 IWB, 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 IWB to weight-related behaviors in a way that suggests it may interfere with weight-control efforts. Furthermore, Lillis et al. (29) found that individuals who had recently completed at least 6 months of a weight-loss program and then received a 1-day workshop to reduce stigma reported lower internalized weight stigma and greater weight loss at the 3-month follow-up compared with a no-treatment control group.

Because of the preliminary nature of the current study, it is also important to consider that IWB and weight status may be bidirectionally 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 IWB with multiple assessments to track change across time in both IWB 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 IWB may influence engagement and retention, especially in the context of weight-management treatment. If IWB is consistently associated with attrition as well as poor weight outcomes, it will only bolster the clinical utility of screening for IWB and potentially targeting it upon entry into behavioral obesity treatment.

Fortunately, efforts to develop effective interventions to address IWB are underway. The fact that change in IWB 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 IWB, there has been accumulating evidence that subjective factors, such as perceived weight status (17,19), body dissatisfaction (7), or distance from ideal weight in the current study, are associated with IWB. 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 (30) and Cognitive Behavioral Group Therapy (31) as well as targeting body image (32) to address IWB.

There are a number of limitations of the current study. The NWCR 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 kg at the time of the baseline assessment. Because the NWCR is a select and nonrandom group of individuals, the current findings cannot be considered representative of other samples of individuals engaged in weight maintenance. Furthermore, the sample is not diverse, which has been a limitation of many studies of IWB to date. Some studies have documented differences in IWB by race (21), but there were no differences in the current study. Lack of power because of 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 interrelated 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, whether weight changes were intentional, and what methods were being used if so. It is also unknown whether participants 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 IWB among individuals who have successfully lost weight and are trying to maintain it. IWB 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 IWB were observed over time, and these changes were 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 underaddressed psychosocial factor for individuals with overweight or obesity.

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