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RESEARCH ARTICLE

Pretreatment and During-Treatment Weight Trajectories in Black and White Women

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Introduction: Black participants often lose less weight than White participants in response to behavioral weight-loss interventions. Many participants experience significant pretreatment weight fluctuations (between baseline measurement and treatment initiation), which have been associated with treatment outcomes. Pretreatment weight gain has been shown to be more prevalent among Black participants and may contribute to racial differences in treatment responses. The purpose of this study was to (1) examine the associations between pretreatment weight change and treatment outcomes and (2) examine racial differences in pretreatment weight change and weight loss among Black and White participants.

Methods: Participants were Black and White women (n=153, 60% Black) enrolled in a 4-month weight loss program. Weight changes occurring during the pretreatment period (41 ± 14 days) were categorized as weight stable (±1.15% of baseline weight), weight gain (≥+1.15%), or weight loss (≤−1.15%). Recruitment and data collection occurred from 2011 to 2015; statistical analyses were performed in 2021.

Results: During the pretreatment period, most participants (56%) remained weight stable. Pretreatment weight trajectories did not differ by race (p=0.481). At 4-months, those who lost weight before treatment experienced 2.63% greater weight loss than those who were weight stable (p<0.005), whereas those who gained weight before treatment experienced 1.91% less weight loss (p<0.01).

Conclusions: Pretreatment weight changes can impact weight outcomes after initial treatment, although no differences between Black and White participants were observed. Future studies should consider the influence of pretreatment weight change on long-term outcomes (e.g., weight loss maintenance) along with potential racial differences in these associations.

This study is registered (retrospectively registered) at ClinicalTrials.gov (NCT02487121) on June 26, 2015.

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INTRODUCTION

Behavioral treatment programs for obesity can achieve clinically meaningful weight loss (≥5%–10% of initial weight).[1] Growing evidence suggests that weight fluctuations occurring before treatment may impact weight outcomes at follow-up.[2-4] The duration of the waiting period between pretreatment assessment visits (e.g., screening and baseline assessments)[5-7] and treatment

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initiation often vary.[2,8] For example, 1 study reported a range of 8–159 days between the baseline visit and first treatment session during which weight fluctuations ranged from −4.6% to +6.6%.[3] Other studies have shown that ~40% of participants enrolled in behavioral treatment experience significant weight changes during the pretreatment waiting period.[2,8] Significant pretreatment weight fluctuations may not only confound the interpretation of weight and cardiometabolic outcomes of behavioral interventions, but it may also predict which individuals are more or less likely to achieve a meaningful weight loss in treatment.

For example, Black participants tend to lose less weight than White participants in behavioral treatment programs,[9-13] and weight gain before treatment could potentially be a contributing factor. Studies exploring the impact of race on pretreatment weight fluctuations are scarce. However, a recent study showed that minority participants were more likely than White participants to experience pretreatment weight gain,[8] highlighting a potential for pretreatment weight fluctuations to influence treatment outcomes among minority groups. This is particularly relevant because (1) achieving clinically meaningful weight loss (e.g., ≥5%) during the initial phase of treatment is often a prerequisite for extended treatment[7,14,15] and (2) Black participants are disproportionately affected by obesity[16] and may be less likely to qualify for extended treatment.[9-12] Thus, there is a clear need to better understand the potential impact of pretreatment weight changes on treatment responses among minority groups.

Although pretreatment weight changes may influence treatment efficacy, findings are mixed, which is likely because of variations in how treatment outcomes are defined relative to the pretreatment period.[2-4,8,17] Some studies use weight measured during screening or baseline visits as the starting weight when quantifying weight-related treatment outcomes,[2,8] which is problematic because pretreatment weight change (the potential predictor) is included within the calculation of weight loss in response to treatment (the outcome).[2] Others have used weight measured at the first treatment session as the starting weight,[3,4] which may be more appropriate to clarify the impact of pretreatment weight fluctuations on treatment responses because it separates pretreatment and during-treatment weight changes. In addition, many studies have relied on data from trials where participants were randomized to different treatment arms.[2,4,8] Although randomization is typically a methodologic strength, in the context of understanding the influence of pretreatment weight change on treatment outcomes, differences between treatment conditions (e.g., treatment modalities, contact frequency) may confound results and contribute to inconsistent findings. Finally, most existing studies have not included sufficient representation from minority participants, and few studies have examined the impact of race on pretreatment weight fluctuations and treatment outcomes.[3,8]

This study addresses previous limitations by (1) isolating pretreatment weight fluctuations from weight loss observed during treatment in a (2) racially-balanced cohort of Black and White women who (3) are enrolled in the same 4-month weight loss treatment program. The purpose of this study is to (1) examine the impact of pretreatment weight fluctuations on weight loss in a behavioral weight management program and (2) explore racial differences in pretreatment weight change and weight loss among Black and White participants.

METHODS

Study Sample

This secondary analysis utilizes data collected in the "Improving Weight Loss" (ImWeL) trial (NCT02487121); the design and primary outcomes have been described elsewhere.[7,14] Briefly, adults (aged ≥21 years) with a BMI of 28–45 were recruited into a 16-month behavioral weight management program consisting of a 4-month prerandomization weight loss program run-in period[18] requiring participants to achieve ≥5% weight loss to be eligible for randomization into a 12-month maintenance program. Because the 4-month run-in period was focused on participants achieving ≥5% weight loss for the subsequent randomized trial, participant retention was not emphasized, and attrition was >40% for the 4-month run-in period. The ImWeL trial initially enrolled 305 participants (95.4% female, 54.6% minority). The study was conducted at an urban academic medical center located in the southeastern U.S. Recruitment, treatment delivery, and data collection for the parent study were ongoing from December 2011 to March 2015. Participants for this study included White and Black women who completed the 4-month prerandomization weight loss program run in (n=153). This study was limited to women because there were so few men (n=7; Figure 1).

Measures

Prospective participants were screened by phone and, if eligible, invited to an orientation visit. Participants providing consent returned for a baseline visit before starting the 4-month weight loss program. The intervention was modeled after the Diabetes Prevention Program[19] and consisted of 16 weekly, group-based sessions and training in behavioral strategies for weight management (e.g., self-monitoring, goal setting) and recommendations for caloric restriction (1,200 or 1,500 kcals per day depending on weight) and physical activity (≥180 minutes per week).[7] The IRB at the participating academic health center approved the ImWeL trial, and informed consent was obtained from participants before participation.

Participants self-reported age, race, educational attainment, income, and marital status at baseline. Trained staff measured height at baseline and weight at baseline, the beginning of each treatment session, and Month 4 using the same equipment and protocol. Total weight loss was calculated as the percentage weight

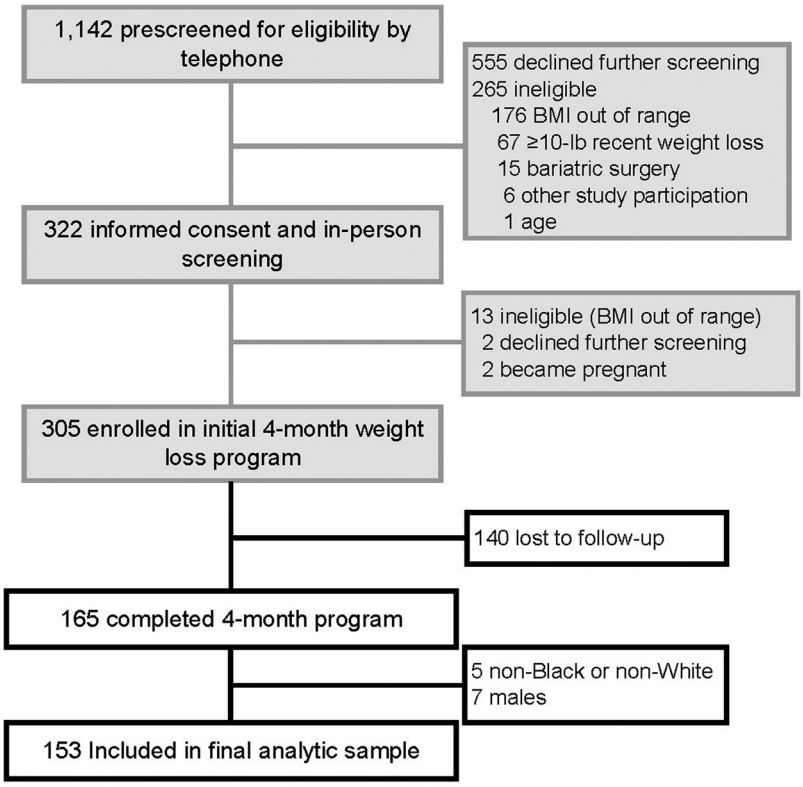

Figure 1. CONSORT flow diagram.
Note: The upper portion (gray boxes) of the diagram was adapted from the published primary ImWeL results.[7] The lower portion (black outlined boxes) reflects the sample for this study.
ImWeL, Improving Weight Loss.

loss from baseline to Month 4 relative to baseline weight. During-treatment weight loss was calculated as the percentage weight loss from the first treatment session to Month 4. When weight at the first treatment session was not available, weight at the second or third treatment session was used as the starting weight. Treatment session attendance was assessed through participant weigh-ins at the 16 weekly group sessions.

Pretreatment weight changes were defined as the percentage change in weight between baseline and first treatment session and, consistent with previous studies,[2-4,8] were categorized as follows: weight gain (≥+1.15% above baseline weight), weight loss (≤−1.15% below baseline weight), weight stable (within 1.15% of baseline weight). A cut off of 1.15% was used to allow for comparison of current results with those of previous studies.[2-4,8] However, secondary analyses were conducted using pretreatment weight change as a continuous variable (Appendix Tables 1 and 2, available online). The duration of the pretreatment waiting period was determined on the basis of the number of days between baseline and first treatment visits.

Statistical Analysis

Statistical analyses were performed from April–December 2021 using SAS 9.4 for Windows. Differences in participant characteristics by pretreatment weight change group were analyzed by chi-square goodness-of-fit test or Fisher's exact test for categorical variables and *t* test or ANOVA for continuous variables. Separate linear regression models were used to analyze the adjusted effect of pretreatment weight change on either percent weight change from baseline to Month 4 or percent weight change during treatment. Exploratory analyses of the bivariate relationships of the following potential covariates with either weight loss outcome of interest (percent weight loss from baseline to Month 4 or percent weight loss during treatment) were performed using linear regression for continuous variables and *t* test or ANOVA for categorical variables: race, education, income, marital status, age, BMI at baseline, duration of pretreatment period, and the number of treatment sessions attended. Any covariate that was a predictor of either weight loss outcome at $p<0.05$ was subsequently included in all multivariate models. *F*-test was used to examine the signification of the interaction between race and pretreatment weight change on weight loss outcomes. Values are presented as means ± SD for continuous variables and frequencies for categorical variables. Because the proportion of missing data at Month 4 was >40%, multiple imputation was not a valid option, and instead, analyses were limited to observed data.[20]

RESULTS

Participants were aged 50.5 ± 12.5 years with a BMI of 35.4 ± 4.4 kg/m^2. Most participants were Black (59.5%). On average, participants attended 12 ± 3 (75%) treatment sessions. Those excluded from analyses were

Table 1. Differences in Participant Characteristics by Pretreatment Weight Change

Variable	Lost weight before treatment 24 (15.69%)	Weight stable before treatment 85 (55.56%)	Gained weight before treatment 44 (28.76%)	*p*-Value
Race, *n* (%)				
Black	15 (62.50)	47 (55.29)	29 (65.91)	0.4811[a]
White	9 (37.50)	38 (44.71)	15 (34.09)	
Education[b], *n* (%)				
No college degree	12 (50.00)	37 (43.53)	13 (29.55)	0.1815[a]
College degree or higher	12 (50.00)	48 (56.47)	31 (70.45)	
Income, *n* (%)				
≤$40,000	4 (16.67)	31 (36.47)	13 (29.55)	0.1986[c]
$40,001–$80,000	9 (37.50)	35 (41.18)	19 (43.18)	
>$80,000	11 (45.83)	19 (22.35)	12 (27.27)	
Marital status, *n* (%)				
Not married	9 (37.50)	45 (52.94)	23 (52.27)	0.3909[a]
Married	15 (62.50)	40 (47.06)	21 (47.73)	
Age, years, mean ± SD	49.1 ± 12.1	53.4 ± 12.0	45.6 ± 12.4	**0.0029**[d]
BMI at baseline, kg/m^2, mean ± SD	35.5 ± 4.2	35.6 ± 4.5	34.8 ± 4.1	0.6102[d]
Duration of pretreatment period, days[e], mean ± SD	39.5 ± 12.8	40.2 ± 14.1	44.5 ± 13.8	0.1946[d]

Note: Boldface indicates statistical significance ($p<0.05$).
[a]Chi-square test was used.
[b]*College degree* refers to a 4-year bachelor's degree or higher.
[c]Fisher's exact test was used.
[d]ANOVA test was used for continuous variables.
[e]Days between the baseline assessment visit and first treatment session.

significantly younger and had a higher BMI, as reported in Appendix Table 1 (available online).

The pretreatment waiting period was 41.3 ± 13.9 days (19–83 days). In the overall sample, participants gained 0.33 ± 1.65% of baseline weight during this period. Most participants remained weight stable (55.6%; gained weight: 28.8%; lost weight: 15.7%). Differences in participant characteristics by pretreatment weight change group are shown in Table 1. There was a significant association between age and pretreatment weight change (p=0.0029), whereby participants who gained weight were 7.74 (95% CI 2.29–13.19) years younger than those who remained weight stable; age was not significantly different between the weight loss and weight stable groups. Total weight loss but not during-treatment weight loss differed by pretreatment weight change (Appendix Figure 1, available online). No other variables differed by pretreatment weight change group (Table 1).

In models examining the impact of race on pretreatment weight change and treatment outcomes, pretreatment weight change did not differ by race (chi-square[2] =1.46, p=0.48; Table 1) in unadjusted analyses. Therefore, no subsequent adjusted models were run. In unadjusted analyses, total percent weight loss (i.e., baseline to Month 4) was not significantly different by race (White: −6.49 ± 4.49%; Black: −5.18 ± 3.78%; t= −1.96, p=0.052; Figure 2). However, during-treatment percent weight loss (i.e., treatment initiation to Month 4) was significantly different by race (White: 6.80 ± 3.96%; Black: 5.49 ± 3.41%; t= −2.19, p<0.05; Figure 2).

When examining the interaction between race and pretreatment weight change on weight outcomes, neither the association of pretreatment weight change with total weight loss (F=0.74, p=0.480; not shown) nor with during-treatment weight loss (F=1.07, p=0.347; not shown) differed by race. Therefore, the interaction between pretreatment weight change category and race was excluded from final models predicting weight loss outcomes.

Regression model results for total weight loss are shown in Table 2. In the final model of main effects, total weight loss was significantly different by pretreatment weight change (F=13.76, p<0.0001), such that participants demonstrating pretreatment weight loss lost 2.63% more weight (p<0.005), whereas participants gaining weight before treatment lost 1.91% less total weight (p<0.005) than the pretreatment weight stable group. Race was not a significant predictor of total weight loss (p=0.074). Treatment session attendance was

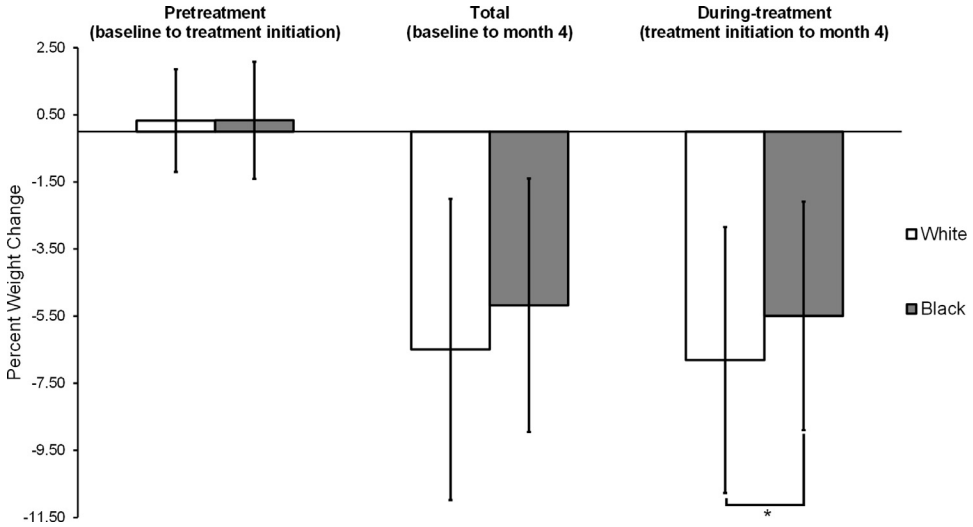

Figure 2. Comparison of mean ± SD percent pretreatment, total, and during-treatment weight loss by race. *p<0.05.

significant; for each additional treatment session attended, there was an additional 0.53% weight loss from baseline to Month 4 (p<0.0001). When the final adjusted model was rerun using pretreatment percent weight change as a continuous variable, results were similar except that race became significant (p<0.05; Appendix Table 2, available online) such that Black participants lost 1.10% less total weight than White participants.

In the final model of main effects for during-treatment weight loss (Table 2), there was no significant difference in during-treatment weight loss by pretreatment weight change category (F=1.27, p=0.283). Race was significant (p<0.05), such that Black participants lost 1.13% less weight during treatment than White participants. Treatment session attendance was significantly associated with during-treatment weight loss; for each additional treatment session attended, there was an additional 0.51% weight loss from treatment initiation to Month 4 (p<0.0001). Results were unchanged when models were run using pretreatment percent weight change as a continuous variable (Appendix Table 2, available online).

Table 2. Regression Models Predicting Total Percent Weight Loss and Percent Weight Loss During Treatment

Variable	Estimate	SE	(95% CI)
DV: Total weight loss[a]			
Intercept	0.16	1.25	(−2.32, 2.64)
Lost weight pre-treatment[c]	**−2.63**	**0.79**	**(−4.20, −1.06)****
Gained weight pre-treatment[c]	**1.91**	**0.63**	**(0.66, 3.17)****
Race (Black)[d]	1.01	0.56	(−0.10, 2.13)
Treatment session attendance	**−0.53**	**0.09**	**(−0.72, −0.35)*****
DV: During-treatment weight loss[b]			
Intercept	−0.24	1.22	(−2.65, 2.17)
Lost weight pre-treatment[c]	−0.50	0.77	(−2.03, 1.03)
Gained weight pre-treatment[c]	−0.06	0.62	(−1.28, 1.16)
Race (Black)[d]	**1.13**	**0.55**	**(0.05, 2.22)***
Treatment session attendance	**−0.51**	**0.09**	**(−0.69, −0.33)*****

Notes: Boldface indicates statistical significance (*p<0.05; **p<0.005; ***p<0.0001).
[a]Percent weight loss from baseline to month 4.
[b]Percent weight loss from treatment initiation to month 4.
[c]Pre-treatment weight change category was coded such that the weight stable group was the reference category.
[d]Race was coded such that White was the reference category.
DV, dependent variable.

DISCUSSION

Among this sample of Black and White women enrolled in a behavioral weight loss program, the majority remained weight stable during the pretreatment period. Because previous studies have mixed results, which may be owing to differences in how treatment outcomes have been defined relative to the pretreatment period,[2-4,8,17] analyses were conducted with treatment outcomes calculated in 2 ways. First, total weight loss from baseline to follow-up (which includes the pretreatment period) was calculated. Using this method, participants who lost weight before treatment lost more total weight, whereas those who gained weight before treatment lost less total weight at 4-months than those who remained weight

stable before treatment. However, this method is flawed because pretreatment weight change (the predictor) is included within the calculation of the weight loss outcome. Thus, models were also run using during-treatment weight loss, calculated as weight loss from treatment initiation to follow-up, which separates pretreatment and during-treatment weight changes. Using this method, no difference in during-treatment weight loss was observed by pretreatment weight change. These findings suggest that individuals who gain weight before treatment are not predisposed to respond poorly to a behavioral weight loss intervention. However, those who gained weight before treatment did not recover the ground they lost before treatment and ultimately lost significantly less total weight from baseline to follow-up.

The finding that pretreatment weight change was unrelated to during-treatment weight loss is consistent with those of previous studies.[3,4,8] Although it is encouraging that pretreatment weight change was not an indicator of response to a behavioral weight loss intervention, pretreatment weight changes do appear to contribute to differences in total weight loss from baseline to follow-up, whereby participants who gain weight before treatment ultimately lose less weight at follow-up than those who remain weight stable or lose weight before treatment.[3,4] This has several implications. First, most studies assess treatment efficacy using an outcome measure that encompasses the pretreatment period (e.g., percent weight loss from baseline to follow-up), which could confound results such that pretreatment weight variations that are not a true effect of treatment are mistakenly attributed to the treatment. Second, participants who gained weight before treatment never recovered from that initial setback and ultimately lost less weight from baseline to follow-up than those who remained weight stable or lost weight before treatment. As such, it is important to consider approaches for minimizing the influence of pretreatment weight changes on treatment outcomes while maximizing overall weight loss success.

Consistent with previous studies,[9-13] Black participants lost significantly less weight than White participants in response to treatment. However, there were no significant racial differences observed in pretreatment weight change, which is consistent with the finding of another study in a racially diverse sample[3] but in contrast to the finding of a study in a U.S. military population, which reported that individuals who identified as Black or Other race/ethnicity were more likely to gain weight before treatment than those identified as White.[8] Although pretreatment weight change did not appear to contribute to racial differences in treatment outcomes in this study, the conflicting results between studies[3,8] and potential methodologic limitations suggest that future, longer-term studies are needed to clarify the impact of race on pretreatment weight change and whether these early fluctuations could contribute to racial differences in initial treatment responses and long-term maintenance.

Because pretreatment weight fluctuations can confound the interpretation of weight outcomes and impact the total amount of weight loss achieved, a logical approach for minimizing these undesirable effects might be to minimize the duration of the pretreatment period. However, shortening the pretreatment period is not always feasible, and the duration of the pretreatment period was not associated with the likelihood of losing, gaining, or remaining weight stable before treatment in this study and others.[4] Thus, another approach could be to include pretreatment guidance or counseling to promote weight stability before treatment. Providing counseling promoting skills for weight stability before treatment could have potential long-term benefits.[21]

The overall understanding of factors influencing pretreatment weight fluctuations remains limited. A standard practice of obtaining an additional weight measurement at treatment initiation, which has been advocated for by others,[3,4,8,17] would provide important information on pretreatment weight change and exciting opportunities to expand research to provide insight into the factors influencing pretreatment weight fluctuations. Such information could help to improve intervention tailoring to better address the unique needs of participants and enhance the understanding of the impact of pretreatment weight fluctuations on treatment outcomes.

Limitations

Because this study utilized data from the initial pretreatment weight loss phase for a larger weight loss maintenance trial, efforts during this initial run-in phase were focused on participant achievement of ≥5% weight loss rather than on participant retention. As such, attrition was high during this phase. Owing to the high attrition at the 4-month visit (>40%), multiple imputation could not be used to deal with missing data.[20] Instead, analyses were limited to participants who initiated treatment and completed the Month 4 assessment,[20] which could influence conclusions regarding the association between pretreatment weight changes and treatment outcomes. Inclusion status and pretreatment weight change did not differ by race; however, there were significant age differences. Excluded participants were significantly younger than those included in the analyses. Because younger participants were more likely to gain weight before treatment, those excluded may have been more likely to gain weight before treatment. Unfortunately, excluded

participants failed to initiate treatment and complete the 4-month follow-up, so data necessary to compare differences in pretreatment or during-treatment weight trajectories were unavailable. Because this was only a 4-month intervention, conclusions cannot be drawn about the potential impact of pretreatment weight change on long-term weight outcomes. It is possible that those who were able to independently lose a significant amount of weight before treatment are also more likely to succeed at maintaining weight losses after treatment cessation. Finally, only female participants were included in these analyses, limiting the generalizability of findings to males.

CONCLUSIONS

Previous studies examining the influence of pretreatment weight change on treatment outcomes have largely been conducted in predominantly White cohorts and yielded mixed findings.[2-4,8,17] In this study, pretreatment weight change did not differ by race, nor did it appear to contribute to observed racial differences in treatment response. Nonetheless, future studies in larger, racially diverse cohorts are needed to corroborate these findings. This study adds to the growing body of literature showing that although pretreatment weight fluctuations do not appear to impact during-treatment weight loss, those who gain even modest amounts of weight before treatment onset lose less total weight from baseline to follow-up.[3,4] To account for the impact pretreatment weight fluctuations can have on the interpretation of intervention outcomes and the magnitude of total weight loss, researchers should consider incorporating strategies to encourage weight stability before treatment, including offering counseling focused on weight maintenance or encouraging behavioral self-monitoring, such as daily self-weighing.[21,22] However, more research is ultimately needed to understand the factors contributing to and the best approaches for preventing significant pretreatment weight fluctuations. Finally, future studies are needed to examine the influence of pretreatment weight change on long-term weight outcomes, including whether clinically meaningful pretreatment weight fluctuations are predictive of successful weight maintenance after treatment has ceased.

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SUPPLEMENTAL MATERIAL

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SUPPLEMENT NOTE

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