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## Satisfaction with Weight Loss: Examining the Longitudinal Covariation Between People's Weight-loss-related Outcomes and Experiences and Their Satisfaction

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### Abstract

**Background**—Recent research has shown that satisfaction with weight loss is predictive of weight loss maintenance, yet empirical evidence for how people derive satisfaction with weight loss is quite limited.

**Purpose**—To determine whether satisfaction with weight change systematically covaries with various weight-loss-related outcomes and experiences (e.g., improvement in physical appearance, amount of frustration experienced), which outcomes and experiences are the strongest longitudinal correlates of satisfaction, and whether the longitudinal covariations are due to between-person differences and/or within-person changes.

**Methods**—We analyzed longitudinal data obtained from overweight or obese individuals enrolled in a weight-loss program who were followed for 18 months using random coefficient models.

**Results**—In univariate analyses controlling for the amount of weight people lost, nine of ten outcomes and experiences independently covaried with people's satisfaction, and the models accounted for 21–38% of the within-person variance in satisfaction. In a multivariate analysis, four outcomes and experiences remained as significant longitudinal covariates of satisfaction. In both sets of analyses, there were more significant relations due to within-person changes than to between-person differences.

**Conclusions**—The results suggest that people's weight loss satisfaction systematically covaries with ongoing changes in weight-loss-related outcomes and experiences. The findings help elucidate how people derive satisfaction with weight loss.

### Keywords

Satisfaction; Weight loss; Weight-loss outcomes and experiences; Behavior change maintenance

## Introduction

The health benefits that result from weight loss are contingent on people maintaining the weight loss over time (i.e., years), yet most people who are initially successful losing weight are unable to maintain their lower weight [1, 2]. This problem illustrates the importance of understanding what might influence people's decision to maintain the behaviors that contributed to their initial weight loss success [3, 4; see also 5, 6]. In considering people's decisions regarding the maintenance of behaviors they have recently changed, it seems intuitive that people will continue to engage in behaviors they find satisfying. For example, people's decision to maintain recently initiated exercise and eating plans is likely contingent on whether they find exercising regularly and changing their eating habits to be worth the effort required. Despite the fact that inducing people's satisfaction with their weight loss efforts has proven difficult [7, 8], there is evidence that greater satisfaction with weight loss is predictive of maintained weight loss over time [7, 9]. Moreover, there is evidence in the domain of smoking cessation demonstrating that satisfaction predicts maintenance over time, but self-efficacy does not predict maintenance when it is considered jointly with satisfaction [10]. These findings are consistent with a theoretical framework that posits that people's decisions to initiate and maintain behavioral changes are psychologically distinct, and that the decision to maintain a change is guided primarily by satisfaction [3, 4]. Given that people's satisfaction is a uniquely critical factor in behavior change maintenance, a better understanding of how people determine their satisfaction with weight loss is central to elucidating their decisions regarding weight loss maintenance. In addition, given that satisfaction has proven difficult to induce, a better understanding of what influences people's satisfaction can shed light on how inducing it might be done more effectively.

### How do People Determine their Satisfaction with Weight Loss?

It is thought that people's satisfaction with behavior changes, such as weight loss, is determined by an ongoing assessment of whether the outcomes afforded by the new pattern of behavior are worth the effort required [3, 4; see also 11, 12]. To the extent that people perceive the consequences of the new behaviors to exceed the costs of engaging in them, they will be satisfied. This type of cost-benefit analysis suggests that people may monitor ongoing changes in different outcomes and experiences related to engaging in weight loss to determine their satisfaction. For example, people may continually assess their satisfaction by monitoring changes in the focal outcome (i.e., weight loss achieved), changes in other outcomes associated with weight loss (e.g., improved physical appearance, improvement in clothes fitting, compliments from other people), and changes in their experiences associated with engaging in the weight loss behaviors (e.g., amount of effort it takes, amount of frustration experienced). Thus, people's satisfaction is thought to vary as a function of the day-to-day or week-to-week changes they experience during the weight-loss process. However, there is no empirical evidence to date demonstrating that satisfaction systematically varies with the ongoing changes people experience during the weight loss process. The purpose of this research is to begin to fill this gap.

There is certainly extant evidence that people's satisfaction is affected by weight-loss-related outcomes. For example, the amount of weight people successfully lose positively affects their satisfaction [9, 13, 14] and weight loss produces improvements in other outcomes that people find desirable, such as health and well-being [9, 13–16], quality of relationships [9, 13–15], physical appearance [13, 14, 16–18], and self-confidence and control [9, 13–15, 18]. Moreover, there is evidence that engaging in weight loss can affect a variety of psychological and behavioral experiences, such as stress, anxiety, frustration, and effort [13, 18] that might also influence people's satisfaction. Yet regarding the question of whether people's satisfaction systematically covaries with ongoing changes in these kinds of

weight-loss outcomes and experiences, the existing evidence is limited in three important ways.

First, some of the existing evidence on the relation between people's satisfaction and weight-loss-related outcomes is retrospective [14, 15, 19]. By definition, retrospective data do not offer insight to the question of whether different weight-loss-related outcomes and experiences are ongoing, dynamic correlates of satisfaction.

Second, most studies that have assessed the prospective relation between people's satisfaction and changes in weight-loss-related outcomes and experiences have assessed changes at just one or two points in time [9, 13, 16, 17]. This type of data allows for conclusions about whether people who report certain changes (e.g., greater physical attractiveness, less frustration) also report greater satisfaction (i.e., a between-person effect). But this type of data does not allow for conclusions about whether the ongoing changes in weight-loss-related outcomes and experiences systematically covary with ongoing changes in satisfaction (i.e., a within-person effect), independent of any between-person differences that may exist. Estimates of within-person associations are necessary to rule out the possibility that significant associations between people's satisfaction and their weight-loss outcomes and experiences are simply due to people who are disposed to report both positive changes and greater satisfaction.

Third, the one study that did assess more frequent, ongoing changes in weight-loss-related outcomes and experiences prospectively did not assess the covariation between people's satisfaction and the changes they experienced during the weight loss process [18]. Thus, there is no clear empirical evidence to date that can address whether people's satisfaction with weight loss systematically covaries with ongoing, dynamic changes in relevant weight-loss outcomes and experiences. In addition, there is no empirical evidence to date regarding which weight-loss outcomes and experiences might be the strongest correlates of satisfaction. A clearer understanding of these associations would provide valuable insight to factors that determine people's satisfaction, and in turn, influence their decisions regarding weight loss maintenance.

### Current Analyses

The purpose of the current analyses was to determine whether people's satisfaction covaries with ongoing changes that occur during their weight loss efforts by examining the longitudinal covariation between people's satisfaction with weight loss and (1) the amount of weight successfully lost, (2) other weight-loss-related outcomes (e.g., improved physical appearance, improvement in clothes fitting), and (3) experiences related to engaging in weight loss behaviors (e.g., amount of effort it takes, amount of frustration experienced). We distinguish between outcomes and experiences as a useful way to categorize different types of factors that may be associated with people's satisfaction. To tease apart associations with satisfaction that are due to average differences between people (i.e., between-person effects) and associations that are due to changes in the outcomes and experiences within people over time (i.e., within-person effects), we examined both the between- and within-person associations between satisfaction and the various weight-loss-related outcomes and experiences. In addition, we sought to determine which outcomes and experiences are the strongest longitudinal correlates of satisfaction. Specifically, this set of analyses addresses (a) whether satisfaction is associated with average levels of weight-loss-related outcomes and experiences; (b) whether satisfaction covaries with changes over time in levels of weight-loss-related outcomes and experiences; and (c) which weight-loss-related outcomes and experiences are most strongly associated with satisfaction.

## Methods

### Participants

Participants ( $N=235$ ) included in these analyses were drawn from a larger sample of overweight or obese individuals ( $N=349$ ) who were recruited to participate in a weight-loss program. To be included in these analyses, participants needed to be involved in the program at the end of active treatment (i.e., 2 months after baseline). Participants included in these analyses were between 20 and 66 years of age ( $M=47.9$ ,  $SD=8.45$ ), primarily Caucasian (91.5%), female (87.2%), and college-educated (65.1%). On average, the sample was obese at baseline with a mean body mass index of 33.7 (range: 25.7–47.6).

### Procedure

After enrollment, participants completed baseline measures and were then randomly assigned to one of two treatments designed to manipulate expectations about weight loss (optimistic vs. balanced expectations). The intervention consisted of eight weekly 1-h sessions, and after the final session, participants provided 14 monthly assessments (the time between assessments ranged from 1 to 2 months) via mailed questionnaire and two in-person visits (at 6 and 18 months after baseline). All participants were given informed consent and the institutional review board at the University of Minnesota approved this study. As reported elsewhere, the treatment groups did not differ in satisfaction [7]. But in order to adjust for any effect treatment group assignment may have on the relations we examined, we included the treatment group variable as a covariate in all the models reported here. Because the treatment groups are not the focus of the current analyses, they will not be discussed further (but see [7] for additional details about the intervention and the treatment groups).

### Measures

Participants' weight-loss outcomes and experiences were assessed at 2, 4, 5, 6, 8, 11, 13, 15, and 18 months after enrolling in the program. The assessment of these variables began 2 months after program enrollment to allow time for participants to experience the different outcomes and experiences. Although participants' weight and satisfaction were assessed monthly, only their values assessed at the same time points as the outcome and experience variables were considered in these analyses.

**Satisfaction**—At the final session of active treatment (i.e., 2 months after baseline), participants' satisfaction was measured with a single item that asked, "Given the effort you put into following your weight control plan, how satisfied are you with your progress over the past week?" At the remaining eight time points, satisfaction was measured with a similar item that was worded slightly differently to reflect the change in the length of the assessment period (i.e., from 1 week to 1 month) and that, over time, there were likely to be changes in people's weight in both directions (i.e., losses and gains). It asked, "Given the effort you put into following your weight control plan, how satisfied are you with the amount of weight you have either lost or gained during the past month?" Responses to both items were measured on a  $-4$  (very dissatisfied) to  $+4$  (very satisfied) scale that included a midpoint label (neither satisfied nor dissatisfied).

**Weight-loss-related Outcomes and Experiences**—Participants completed five items that asked about different outcomes associated with weight loss and five items that asked about different experiences related to engaging in the weight loss process. The items were selected for these analyses because they represented a range of outcomes and experiences (i.e., affective, cognitive, behavioral, and social) that are common in weight loss. The weight-loss outcome items assessed (1) improvement in clothes fitting, (2) positive feedback from others, (3) negative feedback from others, (4) perceived attractiveness, and (5)

perceived self-control. The items assessing experiences related to engaging in the weight loss process were (1) amount of frustration experienced, (2) amount of effort following the plan, (3) approach to thinking about efforts, (4) missing foods high in calories and/or fat, and (5) self-weighing. Responses to each item were measured on nine point scales with anchors labeled to indicate low and high levels of the outcome or experience. For example, one item asked, “During the past month, how would you describe the way you have approached thinking about your efforts to manage your weight? I have been thinking about...” with responses measured on a -4 (the difficult aspects of my weight loss efforts) to +4 (the successful aspects of my weight loss efforts) scale with a midpoint label (both the difficult and the successful aspects of my weight loss efforts).

**Weight**—Participants were weighed by intervention staff at baseline, at the final session of active treatment, and at 6 and 18 months after baseline. At all other times, participants provided self-reported weights. If participants did not attend an on-site visit at 6 and 18 months, self-reported weights were requested. Given that people have a tendency to underestimate self-reported weights [20], we added 4.4 lb (2 kgs) to all self-reported weights. Because we were interested in the association between the amount of weight participants had lost and their satisfaction, we computed the percentage of baseline weight lost at each time point ( $(\{\text{baseline weight} - \text{current weight}\} / \text{baseline weight}) * 100$ ) to adjust for differences in baseline weight. Thus, a positive value indicated the percentage of baseline weight a participant had lost, whereas a negative value indicated the percentage of baseline weight a participant had gained. The weights used in these analyses were measured in pounds.

## Data Analysis

We conducted a series of random coefficient models with SAS PROC MIXED using restricted maximum likelihood estimation to maximize the amount of analyzable data and yield unbiased parameter estimates with missing data [21, 22].<sup>1</sup> We conducted four series of models. First, we ran the following unconditional means model that served as a baseline model from which to compare the amount of within-person variance explained by subsequent models:

$$Y_{ij} = \gamma_{00} + [\zeta_{0i} + \varepsilon_{ij}] \quad (1)$$

where,  $Y_{ij}$  = satisfaction for the  $i$ th person at the  $j$ th time point,  $\gamma_{00}$  = the grand mean of satisfaction across all participants and all time points,  $\zeta_{0i}$  = between-person variance in satisfaction for the  $i$ th person, and  $\varepsilon_{ij}$  = within-person variance in satisfaction for the  $i$ th person at the  $j$ th time point.

<sup>1</sup>To be sure, the robustness of the estimates produced by these models assumes that the missing data meet the assumption of missing at random (MAR [23]). The most likely violation of the MAR assumption in these data is if people who were less successful losing weight stopped completing questionnaires. If weight loss success was a major source of missing data (i.e., only those who were successful continued to complete questionnaires), we would expect (1) the mean level of weight loss percentage to *increase* over time, (2) the variability in weight loss percentage to *decrease* over time, and (3) the number of people completing questionnaires to *decrease* over time. It is also possible that these expected changes eventually asymptote. An inspection of the percent change from baseline weight reported in Table 1 reveals that (1) the mean level of weight loss percentage shows an increasing trend over time, (2) the variability in weight loss percentage actually *increases* over time, and (3) the number of people providing weight data shows a decreasing trend, but actually *increases* over the final two time points. Taken together, these data suggest that there was variability in weight loss success among the people who completed questionnaires over time and there were people who returned to completing questionnaires after prior non-response. We think this evidence supports the credibility of the MAR assumption.

Second, we ran a model to determine the longitudinal covariation between the percent change in weight people experienced and their satisfaction. Specifically, we ran the following model:

$$Y_{ij} = \gamma_{00} + \gamma_{10} \text{percentchange}_{ij} + [\zeta_{0i} + \zeta_{1i} \text{percentchange}_{ij} + \varepsilon_{ij}] \quad (2)$$

where,  $\text{percent change}_{ij}$  = the percent change in weight from baseline for the  $i$ th person at the  $j$ th time point and  $\gamma_{10}$  = the average strength of the association between percent change in weight and satisfaction over  $j$  time points. In addition, the model allowed satisfaction ( $\zeta_{0i}$ ) and the relation between percent change in weight and satisfaction ( $\zeta_{1i}$ ) to vary randomly among individual participants. Although not shown in Eq. 2, the model also included age, gender, treatment group, and time as covariates. Finally, following the equation provided by Singer and Willett [22], we computed an estimate of within-person variance in satisfaction explained by comparing the estimate of within-person variation generated from the second model to the estimate generated from the baseline model (1).<sup>2</sup> We also computed estimates for each subsequent model described next.

Third, we ran separate univariate models to examine the between-person and within-person associations between satisfaction and each of the weight-loss outcomes and experiences. Specifically, the models were based on the following equation:

$$Y_{ij} = \gamma_{00} + \gamma_{10} \bar{X}_i + \gamma_{20} (\bar{X}_{ij} - \bar{X}_i) + [\zeta_{0i} + \zeta_{2i} (X_{ij} - \bar{X}_i) + \varepsilon_{ij}] \quad (3)$$

where  $\bar{X}_i$  = the average value of the respective weight-loss outcome or experience variable for the  $i$ th person (between-person term),  $(X_{ij} - \bar{X}_i)$  = the deviation from  $i$ th person's average value at  $j$ th time point (within-person term),  $\gamma_{10}$  = strength of the association between average levels of the respective weight-loss outcome or experience variable and satisfaction, and  $\gamma_{20}$  = strength of the association between changes in the respective weight-loss outcome or experience variable and satisfaction over time. In addition, the models allowed the within-person term ( $\zeta_{2i}$ ) to vary randomly. These models included the same covariates as the percent change model (2), plus we added percent change in baseline weight as a covariate to these models in order to assess the strength of the associations above and beyond the amount of weight change.

Fourth, given that there is likely overlap in the variance in satisfaction explained by the separate predictor variables, we sought to determine which weight-loss-related outcomes and experiences were the strongest longitudinal correlates of satisfaction by running a multivariate model in which the between-person terms and within-person terms of all ten variables were entered simultaneously (based on Eq. 3). However, allowing all of the within-person terms to randomly vary led to an over-parameterization of the model in which the estimations of the model did not converge. Because we did not have an a priori theoretical or empirical reason to allow some of the outcomes or experiences to randomly vary but not others, we chose not to include any of the outcomes or experience variables as random terms. This model included the same covariates as the previous models (age, gender, treatment group, time, and percent change in weight). Finally, in order to control the type I

<sup>2</sup>We have not reported estimates of between-person variance because the meaning of the between-person variance components (i.e., intercepts and rates of change) changes between different models that includes time-varying predictors (as the models reported here do). Thus, there is no meaningful way to interpret changes in the between-person variance components from model to model (see [22]).



error rate over tests of the ten variables, a significance level of 0.005 (0.05/10) was used for each test.

## Results

### Descriptive Statistics

To assist in the interpretation of the analyses that follow, descriptive statistics across the nine time points for satisfaction, percent change in baseline weight, and the weight-loss outcomes and experience variables are reported in Table 1. As can be seen in Table 1, there was some change in the mean levels of all the relevant variables over time, and there was variability in all of the outcomes and experiences. For example, mean levels of satisfaction steadily decreased from the end of the active treatment program until the 18-month follow-up visit. The analyses reported below test whether these changes in satisfaction are systematically associated with the average between-person levels and/or within-person changes in the various weight-loss-related outcomes and experiences.

### Weight Loss and Satisfaction

We first tested whether the amount of weight people had lost since baseline covaried with their satisfaction. The results of the percentage change in weight model are reported in Table 2. As we expected, there was a significant, positive association between the percentage of baseline weight participants had lost and their satisfaction, indicating that for each percentage of baseline weight participants lost, there was a 0.16 unit increase in their satisfaction.<sup>3</sup> Moreover, this model accounted for approximately 18% of the within-person variation in satisfaction.

### Do Weight-loss-related Outcomes and Experiences Covary with Satisfaction?

The results of the univariate models where we tested the between- and within-person associations for each of the weight-loss-related outcomes and experiences are also reported in Table 2. When tested separately, four of the five weight-loss outcomes had significant between-person associations with satisfaction. Average levels of self-control, perceived attractiveness, positive feedback, and improvement in clothes fitting were positively associated with satisfaction. For example, between-person differences of one scale unit of self-control were associated with a 0.33 scale unit difference in satisfaction. Furthermore, all five of the weight-loss outcomes had significant within-person associations with satisfaction. Within-person increases in self-control, perceived attractiveness, positive feedback, improvement in clothes fitting, and decreases in negative feedback were all associated with increases in satisfaction. For example, a one scale unit within-person increase in the amount of self-control was associated with a 0.48 unit increase in satisfaction. Finally, the amount of within-person variation in satisfaction explained by the models ranged from 38% (amount of self-control) to 21% (amount of negative feedback).

Regarding the experiences related to engaging in the weight loss process, three of the five experiences had significant between-person associations with satisfaction. Average levels of effort and approach to thinking about weight loss were positively associated with satisfaction, whereas average levels of frustration were negatively associated with satisfaction. For example, between-person differences of one scale unit of frustration were associated with a  $-0.31$  scale unit difference in satisfaction. Furthermore, four of the five experiences had significant within-person associations with satisfaction. Increased changes in effort exerted, number of days of self-weighing, thinking more positively about weight

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<sup>3</sup>All the coefficients reported in the paper should be interpreted as the association between the respective variable and satisfaction at the average levels of all the covariates.

loss, and decreased changes in frustration were associated with increases in satisfaction. For example, a one scale unit within-person increase in frustration was associated with a 0.38 unit decrease in satisfaction. Finally, the amount of within-person variation in satisfaction explained by the models ranged from 38% (amount of effort exerted) to 21% (missing foods high in fat and/or calories).

### **Which Outcomes and Experiences are the Strongest Longitudinal Correlates of Satisfaction?**

The results of the multivariate model where we simultaneously tested the between-person and within-person terms for all ten outcome and experience variables are reported in Table 3. At the between-person level, one weight-loss outcome (improvement in clothes fitting) and one weight loss experience (amount of frustration) were significant. This finding indicates that while controlling for the other outcomes and experiences, between-person differences in the improvement people experienced in the way their clothes fit and the amount of frustration they experienced were the strongest between-person correlates of satisfaction. At the within-person level, two outcomes (amount of self-control, improvement in clothes fitting) and two experiences (amount of effort, amount of frustration) were significant. This finding indicates that while controlling for the other outcomes and experiences, within-person changes in the amount of self-control people perceived, improvement in the way their clothes fit, the amount of effort they exerted, and the amount of frustration they experienced were the strongest within-person correlates of satisfaction. The multivariate model explained 42% of the within-person variation in satisfaction.

### **Discussion**

We examined the longitudinal covariation between people's satisfaction with weight loss and a variety of weight-loss-related outcomes and experiences to determine whether people's satisfaction is associated with the outcomes and experiences that occur during their weight loss efforts. The findings indicated that, above and beyond the amount of weight change people have experienced, many weight-loss-related outcomes and experiences are independently associated with their satisfaction. These findings represent the first known evidence to date that examines the longitudinal covariation between ongoing changes people experience during their weight loss efforts and their satisfaction.

We also estimated both within-person and between-person associations to better understand the nature of the associations between people's satisfaction and their weight-loss-related outcomes and experiences. The significant within-person associations indicated that changes in many of the weight-loss-related outcomes and experiences systematically covary with changes in people's satisfaction, ruling out the possibility that the associations are simply due to people who are disposed to report both positive changes and greater satisfaction. However, the significant between-person associations indicated that, for some of the outcomes and experiences, people who reported more positive outcomes and experiences reported greater satisfaction. Overall, the findings suggest that people's satisfaction with weight loss is associated with the ongoing, within-person changes that occur during their weight loss efforts (e.g., increasing one's effort) and, for some outcomes and experiences, with the average, between-person differences in the outcomes and experiences as well (e.g., people who expend more effort on average report greater satisfaction). In addition, the value of distinguishing these effects is illustrated by the fact that some of the outcomes and experiences only had a significant within-person association—a finding that would not be evident with only a between-person analysis.

The findings from the multivariate analysis suggest that people may be more responsive to some outcomes and experiences than others when determining their satisfaction. For



example, improvement in how people's clothes fit (both the between- and within-person associations) remained significant in the multivariate analysis, but between- and within-person associations for perceived attractiveness and positive feedback from others became non-significant. This particular finding suggests that aspects of people's satisfaction that are associated with improvements in physical appearance and its consequences (e.g., compliments from others) may be more responsive to the improvement people see in the fit of their clothes compared to other related changes. Moreover, these findings highlight factors that are potentially important for additional investigation and intervention, but further replication is needed before strong conclusions are drawn about which outcomes and experiences are most important to people's satisfaction. The findings from the multivariate analysis also suggest that people's satisfaction is not associated with a specific type of experience, but that different types of outcomes and experiences matter. Specifically, people's satisfaction was associated with affective (i.e., amount of frustration), cognitive (i.e., approach to thinking about weight control, amount of self-control), behavioral (i.e., amount of effort exerted), and appearance-related (i.e., improvement in clothes fitting) outcomes and experiences. Finally, the multivariate model explained 42% of the within-person variation in satisfaction, whereas two of the variables, self-control and effort exerted, separately explained 38% of the within-person variation in satisfaction in the univariate analyses. This suggests that there is shared variance among the ten outcome and experiences variables, as expected, and illustrates the value of the multivariate model to identify which of the variables are the strongest correlates of satisfaction.

Finally, it is interesting to note that all of the significant associations in the univariate analyses were as strong or stronger than the association between the amount of weight people lost and their satisfaction. Moreover, the univariate models all explained additional within-person variance in satisfaction beyond what the amount of weight lost explained. One might assume that changes in the focal outcome (i.e., amount of weight lost) would be the strongest correlate of satisfaction. Instead, this set of findings suggests that people's satisfaction is at least as strongly related to experiences associated with the weight loss process and outcomes other than weight loss per se.

## Implications

The findings reported here suggest that people's satisfaction with weight loss is sensitive to ongoing changes that unfold during the weight loss process, consistent with previous theorizing [3, 4]. In addition to suggesting how people's ongoing weight-loss outcomes and experiences might influence their satisfaction, this also has important implications for how satisfaction should be assessed. Whether considering satisfaction as an outcome or as a critical predictor of the decision to maintain weight loss behaviors, it is important for investigators to recognize that people's satisfaction assessed at any given point in time is dynamic and changes with the day-to-day and week-to-week fluctuations of the weight loss process. This suggests that in prospective designs, satisfaction should be assessed relatively frequently to gain clearer insight to its determinants and to better understand its causal influence on subsequent behavioral decisions.

Although the data reported here are correlational and do not speak directly to what causes people to be satisfied with their weight loss efforts, the findings do suggest that some weight-loss outcomes and experiences might influence people's satisfaction more than others. Tailoring interventions to the experiences and outcomes that are most important to people's satisfaction may prove to be an effective way to facilitate weight loss maintenance. For example, the findings from this study suggest that interventions directing people to focus on outcomes such as improvement in the fit of their clothes, or directing them to increase their weight loss effort may prove particularly effective in influencing their satisfaction. These particular outcomes and experiences may be especially important given

that the negative aspects of weight loss do not diminish during people's initial efforts [18]. At a minimum, the findings from these analyses highlight specific weight-loss-related outcomes and experiences that deserve further investigation to determine their causal influence on people's satisfaction with weight loss and maintenance.

More broadly, the findings provide additional evidence that people's satisfaction with behavior change is systematically associated with the outcomes and experiences related to that change. In smoking cessation, for example, people's satisfaction with cessation has been shown to be associated with related outcomes and experiences such as the feedback from others about one's efforts and the frequency of one's cravings [24]. However, it is interesting to note in our investigation of smoking cessation, the focal outcome (i.e., whether a person had successfully quit smoking for at least 7 days) explained 33% of the within-person variance in satisfaction, whereas in the current investigation in weight loss, the focal outcome (i.e., percentage of baseline weight lost) explained only 18% of the within-person variance. This may illustrate a key difference in these two important behavioral domains that has implications for how people determine their satisfaction. In weight loss, success is less clearly defined than in behavioral domains such as smoking cessation. This is evidenced by the fact that the majority of people who have lost and maintained an objectively "successful" amount of weight report wanting to lose more [14]. In contrast, once a person has quit smoking, he or she cannot quit more. This relative ambiguity in weight loss as an outcome may lead people to derive less of their satisfaction from the focal outcome and rely more heavily on other outcomes and experiences. The ambiguity in weight loss success may also result in less overall satisfaction with weight loss (see [13]) than with other behaviors that have more clearly defined focal outcomes.

### Limitations

It is important to recognize that the vast majority of participants in these analyses were women (87%), were Caucasian (92%), and were relatively well-educated (65% were at least college-educated). Although these demographic characteristics are not uncommon in formal weight-loss interventions, the sample is not representative of the general population and the conclusions that can be drawn about which particular outcomes and experiences are the strongest correlates of satisfaction are limited. For example, the fact that improvement in how clothes fit emerged as one of the stronger correlates of satisfaction may be due to the over-representation of well-educated, Caucasian women in the sample. The small number of men and ethnic minorities in the sample precluded us from running separate analyses for each group. Future work is needed to explore how the relations between people's satisfaction and their weight loss experiences and outcomes might vary as a function of gender, ethnicity, and/or SES.

Another limitation of the current study is that the outcomes and experiences included in these analyses are a limited set of outcomes and experiences that might influence people's satisfaction. Although we have included exemplars that cover a range of different types of outcomes and experiences, it is certainly possible that other experiences (e.g., feelings of anxiety about weight) or outcomes (e.g., improved stamina for daily activities) are strong influences on people's satisfaction as well, and future research might bear that out. Moreover, the distinction we made between outcomes and experiences is a useful categorization heuristic, but one without a clear empirical basis. Future work might consider whether drawing a clear distinction between experiences associated with doing the behavior (e.g., effort exerted, approach to thinking about the behavior) and those that are more clearly consequences of the behavior (e.g., improvement in fit of clothing) is a valuable and empirically valid distinction.

Another important limitation of the current study is that we cannot determine what effect individual differences in how people experience weight loss behaviors may have had on the relations examined here. For example, people's expectations about the changes they experienced might have influenced the associations with satisfaction. Previous work has shown that whether people's expectations about changes are met can affect whether they remain physically active [25], motivated to maintain weight loss, and whether they view their weight loss as worth their effort—a form of satisfaction [14]. In addition, we did not know which outcomes and experiences were most important to each participant. It is possible that people's satisfaction is strongly influenced by changes in the few outcomes or experiences that they feel to be most important, and changes in less important outcomes or experiences are not as influential. The fact that nine of the ten outcomes and experiences had significant associations with satisfaction in the univariate analyses may be evidence that there is variability in which outcomes and experiences people deem important. Moreover, the expectations people have for change, and the importance they place on those changes, may be influenced by factors such as whether people are losing weight for intrinsic (e.g., "It's something I want to do.") or extrinsic (e.g., "It's something my doctor is urging me to do.") reasons. All these factors may be important individual differences that moderate the relation between people's outcomes and experiences and their satisfaction. Ultimately, how the prospective influence of people's experiences on their satisfaction is influenced by their expectations, how people's expectations about weight loss might change as a result of their experiences, and how the relations between these variables are moderated by relevant individual difference are questions best addressed by studies designed to capture the dynamic, reciprocal changes in these variables over time.

Finally, conclusions regarding the current analyses are limited by the concurrent and correlational nature of the data. Although multiple assessments over a 16-month period allowed for conclusions to be drawn about the dynamic nature of the associations not afforded by previous investigations [9, 13, 16, 17], assessments of people's experiences with weight loss (e.g., daily) that have shorter time lags would allow investigators to better understand how people's satisfaction is caused by prior changes in relevant outcomes and experiences.

## Conclusion

People's satisfaction with their weight control efforts is associated with the changes they experience in various weight-loss-related outcomes and experiences. Moreover, people may be responsive to some experiences more than others when determining their satisfaction. Given the influence of satisfaction in people's decisions to maintain behavior changes they have initiated [3, 4, 7, 9, 10], the findings reported here provide important insight about factors related to weight loss that may ultimately contribute to a better understanding of weight loss maintenance.

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**Table 1**

Means, SDs, and sample sizes of study variables across the 16-month follow-up period

	Months after baseline assessment									
	2	4	5	6	8	11	13	15	18	
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	
Satisfaction	4.45 (2.18) n=234	3.88 (2.09) n=191	3.73 (2.12) n=183	3.70 (2.19) n=212	3.87 (1.96) n=157	3.60 (2.07) n=155	3.62 (2.07) n=123	3.61 (1.96) n=131	3.42 (2.02) n=192	
Percentage change in weight from baseline	3.08 (2.97) n=216	2.69 (3.97) n=193	2.99 (4.56) n=181	3.03 (5.42) n=205	3.53 (6.47) n=159	3.47 (6.62) n=154	3.37 (7.09) n=119	3.74 (7.40) n=130	2.38 (7.15) n=185	
Weight-loss-related outcomes										
Amount of perceived self- control	4.66 (1.95) n=235	3.80 (2.05) n=192	3.64 (2.13) n=185	3.36 (2.08) n=213	3.54 (2.09) n=157	3.35 (2.12) n=155	3.18 (2.04) n=123	3.39 (1.95) n=130	3.88 (1.92) n=192	
Perceived attractiveness	4.20 (1.74) n=233	3.80 (1.83) n=193	3.75 (1.82) n=185	3.74 (1.87) n=214	3.75 (1.92) n=159	3.76 (1.89) n=155	3.92 (1.76) n=123	3.64 (1.92) n=130	3.76 (1.89) n=191	
Amount of positive feedback about weight	2.03 (2.27) n=235	1.82 (2.23) n=192	1.96 (2.33) n=184	1.90 (2.41) n=213	1.99 (2.38) n=158	1.65 (2.33) n=154	1.62 (2.19) n=123	1.89 (2.25) n=131	1.70 (2.22) n=191	
Amount of negative feedback about weight	0.69 (1.43) n=235	0.85 (1.61) n=192	0.72 (1.47) n=185	1.01 (1.88) n=213	0.75 (1.56) n=156	0.90 (1.71) n=155	0.56 (1.24) n=123	0.71 (1.50) n=131	0.86 (1.59) n=190	
Improvement in how well clothes fit	3.10 (2.22) n=233	2.95 (2.47) n=193	2.43 (2.40) n=185	1.61 (1.97) n=44	2.28 (2.41) n=158	2.01 (2.38) n=154	2.23 (2.37) n=123	2.26 (2.48) n=130	-	
Weight-loss-related experiences										
Amount of effort following weight control plan	4.55 (2.28) n=234	3.91 (2.15) n=191	3.63 (2.09) n=185	3.39 (2.27) n=213	3.60 (2.20) n=159	3.50 (2.39) n=156	3.46 (2.13) n=123	3.31 (2.18) n=131	3.61 (2.10) n=192	
Miss foods high in fat and/or calories	4.15 (1.99) n=233	3.67 (2.08) n=190	3.51 (2.08) n=180	3.79 (1.85) n=209	3.43 (2.16) n=155	3.52 (2.35) n=150	3.49 (2.17) n=120	3.50 (2.11) n=129	3.61 (1.92) n=189	
Frequency of frustration dealing with weight	4.02 (2.19) n=233	4.26 (1.98) n=191	4.13 (2.04) n=184	4.17 (2.14) n=212	4.30 (2.16) n=158	4.38 (2.23) n=155	4.59 (2.03) n=123	4.37 (2.19) n=131	4.45 (2.13) n=192	
Number of days weighing oneself	4.53 (2.57) n=234	4.27 (2.62) n=192	3.89 (2.74) n=184	3.29 (2.71) n=213	3.66 (2.50) n=157	3.52 (2.63) n=155	3.25 (2.55) n=122	3.63 (2.52) n=130	3.08 (2.67) n=191	
Approached thinking about weight control efforts	3.64 (1.38) n=233	3.78 (1.82) n=190	3.43 (1.82) n=182	3.34 (2.02) n=213	3.56 (1.93) n=157	3.31 (2.03) n=153	3.17 (2.00) n=121	3.31 (2.10) n=130	3.52 (1.97) n=188	

As vary because of missing values. The variables were standardized so that the values reported in the table are all on a 0-8 scale. Because of an administrative error, improvement in clothes fitting was only measured among those participants at 6 months who completed the assessment via mailed questionnaire and it was not measured at 18 months



Univariate between-person and within-person associations between satisfaction and weight loss, outcomes related to weight loss, and experiences related to the weight loss process over 16 months

**Table 2**

Model/experience variable	Coefficient	Standard error	t value	p value	R <sub>ε</sub> <sup>2</sup>
Percentage change in weight model	0.158	0.013	11.72	.0001 <sup>a</sup>	0.178
Weight-loss-related outcomes models					
Amount of self-control					0.380
between-person association	0.331	0.044	7.44	.0001 <sup>a</sup>	
within-person association	0.476	0.034	13.93	.0001 <sup>a</sup>	
Perceived attractiveness					0.265
between-person association	0.173	0.045	3.82	.0002 <sup>a</sup>	
within-person association	0.462	0.044	10.49	.0001 <sup>a</sup>	
Amount of positive feedback					0.233
between-person association	0.161	0.043	3.75	.0002 <sup>a</sup>	
within-person association	0.256	0.030	8.57	.0001 <sup>a</sup>	
Amount of negative feedback					0.209
between-person association	-0.122	0.056	-2.17	.03	
within-person association	-0.198	0.044	-4.48	.0001 <sup>a</sup>	
Improvement in clothes fitting					0.291
between-person association	0.340	0.043	7.97	.0001 <sup>a</sup>	
within-person association	0.380	0.028	13.38	.0001 <sup>a</sup>	
Weight-loss-process experiences					
Amount of effort exerted					0.380
between-person association	0.200	0.044	4.51	.0001 <sup>a</sup>	
within-person association	0.433	0.032	13.52	.0001 <sup>a</sup>	
Missing foods high in fat and/or calories					0.210
between-person association	-0.102	0.044	-2.33	.02	
within-person association	-0.046	0.037	-1.24	.22	
Amount of frustration					0.289

Model/experience variable	Coefficient	Standard error	t value	p value	$R^2_{\epsilon}$
between-person association	-0.311	0.037	-8.44	.0001 <sup>a</sup>	
within-person association	-0.377	0.036	-10.54	.0001 <sup>a</sup>	
Number of days of self-weighting					0.229
between-person association	0.017	0.033	0.52	.61	
within-person association	0.155	0.035	4.38	.0001 <sup>a</sup>	
Approach to thinking about weight control					0.307
between-person association	0.464	0.059	7.93	.0001 <sup>a</sup>	
within-person association	0.343	0.034	10.10	.0001 <sup>a</sup>	

<sup>a</sup>Denotes statistically significant effect at  $p < .005$ ;  $R^2_{\epsilon}$  = estimate of within-person variance in satisfaction explained by the model

**Table 3**

Multivariate between-person and within-person associations between satisfaction and weight loss, outcomes related to weight loss, and experiences related to the weight-loss process over 16 months

Model/experience variable	Coefficient	Standard error	<i>t</i> value	<i>p</i> value
Weight-loss-related outcomes				
Amount of self-control				
between-person association	0.135	0.068	1.97	.05
within-person association	0.153	0.044	3.46	.0006 <sup>a</sup>
Perceived attractiveness				
between-person association	-0.118	0.055	-2.15	.03
within-person association	0.083	0.048	1.71	.08
Amount of positive feedback				
between-person association	-0.062	0.054	-1.16	.24
within-person association	0.035	0.031	1.12	.26
Amount of negative feedback				
between-person association	-0.007	0.059	-0.12	.91
within-person association	-0.102	0.043	-2.39	.02
Improvement in clothes fitting				
between-person association	0.220	0.057	3.84	.0002 <sup>a</sup>
within-person association	0.121	0.033	3.64	.0003 <sup>a</sup>
Weight-loss-process experiences				
Amount of effort exerted				
between-person association	0.087	0.066	1.31	.19
within-person association	0.180	0.038	4.80	.0001 <sup>a</sup>
Missing foods high in fat and/or calories				
between-person association	-0.002	0.043	-0.05	.96
within-person association	-0.055	0.032	-1.73	.08
Amount of frustration				
between-person association	-0.294	0.056	-5.28	.0001 <sup>a</sup>
within-person association	-0.144	0.036	-4.00	.0001 <sup>a</sup>
Number of days self-weighing				
between-person association	-0.020	0.032	-0.62	.54
within-person association	-0.053	0.032	-1.65	.10
Approach to thinking about weight control				
between-person association	0.149	0.077	1.94	.05
within-person association	0.070	0.032	2.15	.03

<sup>a</sup>Denotes statistically significant effect at  $p < .005$