The effect of barrier underestimation on weight management and exercise change

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Abstract
Over 60% of all Americans are classified as overweight or obese. This represents a major public health concern, as obesity is a risk factor for many other health ailments. While many people intend to lose weight, they often have difficulty changing their current behavioral patterns (as evidenced by modest correlations between intention and behavior). Therefore, one of the major challenges for obesity research is to address the gap between intentions to lose weight and actual behavior. The current study hypothesized that one reason for the intention–behavior discrepancy is that people misestimate the barriers that they will encounter as they follow through with their intentions. Specifically, we hypothesized that people underestimate barriers to exercise and diet, and because of these underestimations, there is a discrepancy between their intentions and behavior. To test these hypotheses, we surveyed faculty and staff at Rutgers University (N = 422) at two time points, 1 year apart. The results indicate that barriers to dieting behaviors are significantly underestimated and this underestimation partially explained the discrepancy between intentions and behavior. The results for barriers to exercise behavior were less consistent, however. As a whole, these results suggest a possible point of behavioral intervention for weight loss.

Keywords: Behavioral barriers, intention, behavior, exercise, weight management

Introduction
Obesity increasingly has become a major public health threat. The prevalence of obesity in American men and women has grown from 10.7% and 15.8% (respectively) in the early 1960s to 27.7% and 34.0% in 2002 (Fiegal, Carroll, Ogden, & Johnson, 2002). The trend is continuing. Since 1995, the proportion of obese residents has significantly increased for each state (Center for Disease Control and Prevention, 2006). Currently, over 60% of all Americans are considered overweight, while nearly 24% are considered obese (CDC, 2006). These high rates of obesity have serious consequences for health and quality of life, including increased risks for coronary heart disease, hypertension, diabetes, and cancer (Fiegal et al., 2002).

Fortunately, people can institute a number of behavioral changes (e.g., increasing exercise, dieting) to reduce their weight and subsequently their risks for various health hazards (CDC, 1996). However, although many people may be aware of the health issues surrounding obesity, and often intend to implement behavioral changes (as anecdotally evidenced by the pervasive New Year’s resolution to “lose weight”), inevitably a large percentage fail to follow
through with the behavioral changes they intended to make. In other words, there is a clear intention–behavior discrepancy for weight-loss behaviors (e.g., Conner, Norman, & Bell, 2002; Sheeran, Trafimow, & Armitage, 2003). Though intention–behavior discrepancies have been well documented in other health-behavior domains (e.g., flu vaccine, DiBonaventura & Chapman, 2005; exercise, Hagger, Chatzisarantis, & Biddle, 2002; alcohol consumption, Johnston & White, 2003; for reviews, see Armitage & Conner, 2001; Godin & Kok, 1996), this phenomenon may be particularly important to weight-loss behaviors, as obesity remains such a preventable threat.

So, what causes these discrepancies between intention and behavior? Several factors have been identified, including intention certainty (e.g., Bagozzi & Yi, 1989; Bassili, 1993; Pieters & Verplanken, 1995), attitudinal versus normative control (e.g., Sheeran, Norman, & Orbell, 1999), past behavior (e.g., Armitage & Conner, 2001), anticipated regret (e.g., Abraham & Sheeran, 2003), and state versus action orientation (Norman, Sheeran, & Orbell, 2003) (for a review of these factors, see Sheeran, 2002; Sutton, 1998). However, this study seeks to focus on behavioral barriers, a relatively understudied explanation for intention–behavior gaps, which may be particularly relevant for weight-loss behaviors.

Behavioral barriers are defined as general obstacles to achieving a health-behavior goal. This construct, which first gained popularity through the Health Belief Model (e.g., Rosenstock, 1974), has long been considered an important determinant in whether or not someone engages in a behavior (for a review, see Sheeran & Abraham, 2003). However, this construct has rarely been examined as an explanation for intention–behavior discrepancies because most methodologies assess barriers at one time point. That is, studies investigating barriers either assess the effect of the barriers at the same time as intention, or assess the effect of the barriers at the same time as behavior, but rarely both. Therefore, little is known as to how accurate people are at estimating the effect of barriers to weight loss and exercise, and whether these misestimations can result in intention–behavior divergence.

For example, with weight-loss behaviors, it may be particularly difficult to anticipate the challenges, both environmental and psychological, that may prevent one from performing these behaviors as intended. Small changes in diet and exercise patterns can have a significant impact on weight-loss, however making these changes is likely more difficult than it appears, as evidenced by the relatively modest correlations between intention and weight-loss behaviors (e.g., Verplanken & Faes, 1999). Perhaps the misestimation of the behavioral barriers is what leads to the modest association between intention and behavior. In other words, a person may intend to lose weight and exercise more, and believe that few obstacles (either environmental or psychological) stand in the way. However, soon this person realizes that these obstacles were underestimated and that they will actually prevent the person from changing his or her behavior.

In this study, we were particularly interested in identifying the barriers to weight-loss behaviors and determining (longitudinally) how accurate people are at assessing the degree to which these barriers will influence their behavior. Most importantly, we were interested in determining the impact of misestimations of behavioral barriers on future behavior. Participants reported their intentions for behavioral change and predicted the effect certain barriers would have on behavior change in the next year. One year later, participants retrospectively reported how their behavior changed and the effect these same barriers actually had on their behavior change.

We predicted that participants would generally underestimate the effect that each barrier would have on their behavior (essentially, participants would believe that dieting and exercising would be easier than these behaviors actually would be). We also predicted that the degree to which participants underestimated these barriers would be associated with how
much their behavior satisfied their intentions. Participants who underestimated the effect that barriers would have on their attempts to lose weight and exercise more would subsequently lose less weight and exercise less in the following year.

**Method**

**Participants and procedure**

Data were collected as part of a larger longitudinal mailed questionnaire study on health promotion. The study began in the fall of 1999 and continued until the spring of 2004 with mailings occurring in late November and late March of each year. The current study uses data from the spring 2003 and spring 2004 waves. Participants were faculty and staff employees of Rutgers University. These participants were randomly selected in the fall of 1999 from various employee lists. They were compensated by a small gift, in addition to being placed in a lottery with a chance for a monetary prize. In spring 2003, the questionnaire was mailed to 560 university employees, 492 (87.9%) of whom responded. The spring 2004 questionnaire was mailed to 444 of these participants (the remaining 48 had dropped out during the interim wave in fall 2003), 422 (95.0%) of whom responded.

Only these 422 participants who responded at both time points were included in the current study. These participants were largely female (57%), of European-American descent (84%), and had household incomes higher than $75,000 (63%). The mean age was 46.7 years ($SD = 10.3$). There were no significant differences on any of the spring 2003 variables used in this study between those who would remain in the study and those who would drop out.

**Measures**

**Exercise change.** We used two measures of exercise change. The first was a comparison of how exercise behavior reported at time 2 changed relative to exercise behavior reported at time 1. Exercise behavior was assessed at both time 1 and time 2 through two questions that asked how many times participants exercised per week and the number of minutes of exercise per session. These responses were used to create a weekly average (minutes per session $\times$ number of sessions per week). Participants who did not report this information for both time 1 and time 2 were eliminated from the analyses ($n = 33$).

Our second measure of exercise change was a retrospective item at time 2, which asked how participants had changed their exercise routine in the past year (on a 5-point Likert scale ranging from “exercised a lot less” to “exercised a lot more”). Participants who intended at time 1 to exercise less in the next year were eliminated from the analyses ($n = 5$). In addition, participants who did not report an intention at time 1 or did not retrospectively report how their exercise routine had changed at time 2 were also eliminated from the analyses ($n = 4$).

Through pilot testing and structured interviews, $^1$ six barriers were identified that could prevent people from changing their exercise behavior as intended. These barriers include how busy a participant is (busyness), unexpected injuries or illnesses (injury), how tired a participant feels (tiredness), a lack of willpower (willpower), inclement weather (weather), and the amount of time exercise takes away from other activities (time). The anticipated effects of these six barriers on exercise change intentions were assessed at time 1 on a 5-point Likert scale ranging from “not a hindrance” to “very strong hindrance”. At time 2, the retrospective effects of these same six barriers were assessed. $^2$ All missing values (less than 3% of total responses) for these hindrance ratings were replaced by the item mean. Finally, a
measure of underestimation was created by subtracting each barrier’s anticipated effect (time 1) from the same barrier’s retrospective effect (time 2). Participants who anticipated the effect of a barrier as being less severe than it actually turned out to be would be underestimating the effect of that barrier.

**Weight management.** We used two measures of weight change. The first was a comparison of how current weight at time 2 changed relative to current weight at time 1. Current weight was assessed through a 5-point Likert scale ranging from “very underweight” to “very overweight” at both time 1 and time 2. Participants who did not respond to both questions were eliminated from the analyses \( n = 13 \).

Our second measure of weight change was a retrospective item at time 2, which asked how participants’ weight had changed in the last year using a 5-point Likert scale ranging from “lost a lot of weight” to “gained a lot of weight”. Participants who did not report an intention to manage weight at time 1 or report how their weight had changed at time 2, were eliminated from the analyses \( n = 47 \). Also, in order to ensure weight management was being assessed for participants with similar intentions to change, the few participants who intended to gain weight in the next year were also eliminated \( n = 3 \).

Just as with exercise behavior, through pilot testing and structured interviews, six barriers were identified that could prevent weight change as intended. These six barriers included the amount of junk food kept in the house (junk food), the number of parties/social functions the participant attends (parties), how hungry the participant feels (hunger), how difficult it is to exercise (difficulty exercising), lack of willpower (willpower), and cravings for high calorie foods (cravings). At time 1, participants rated the anticipated effect of these six barriers on weight change intentions on a 5-point Likert scale ranging from “not a hindrance” to “very strong hindrance”. At time 2, participants rated the retrospective effect of these same six hindrances. All missing values for these hindrance ratings were replaced by the item mean. Though the majority of hindrances had fewer than 3% of all observations missing, both the willpower and high calorie foods hindrances at time 2 had approximately 8% of all observations missing. Again, as with exercise behavior, a measure of underestimation was created for each barrier by subtracting each barrier’s anticipated effect (time 1) from the same barrier’s retrospective effect (time 2). That is, participants who anticipated the effect of a barrier as being less severe than it actually turned out to be would be underestimating the effect of that barrier.

**Data analysis**

We had two general hypotheses: (a) barriers would be underestimated and (b) the effect of barrier underestimation would be associated with less positive behavior change (i.e., less exercise change and weight loss). To test our first hypothesis, we ran a paired \( t \)-test for each barrier comparing the retrospective effect (time 2) to the anticipated effect (time 1). To test our second hypothesis, we ran a series of linear regressions. Barrier underestimation was operationalized as the difference score of the two barrier measures (time 2 — time 1). These difference scores were each used as the independent variable in separate linear regressions predicting exercise change or weight loss.

First, for each type of barrier, barrier underestimation was used to predict the exercise change retrospectively reported at time 2. We also used barrier underestimation to predict regressed exercise change scores (i.e., barrier underestimation was used to predict time 2 exercise behavior, controlling for time 1 exercise behavior). Using regressed change scores to examine change is considered superior than using simple difference scores (time 2
exercise behavior minus time 1 exercise behavior; Cohen, Cohen, West, & Aiken, 2003). Because the distributions of exercise behavior at both time 1 and time 2 were non-normal, we used partial Spearman correlations as the non-parametric equivalent to regressed change scores. Essentially, barrier underestimation was correlated with the ranked order of exercise behavior at time 2, controlling for the ranked order of exercise behavior at time 1. Next, we used barrier underestimation to predict retrospective weight change reported at time 2. Lastly, we used barrier underestimation to predict regressed weight change scores (i.e., barrier underestimation was used to predict time 2 weight, controlling for time 1 weight).

Results

Exercise \((n = 380)\)

At time 1, participants performed an average of 88.9 minutes of exercise per week \((SD = 93.6)\). The majority of participants \((70.2\%)\) planned to exercise more in the next year; the remainder planned to maintain current exercise levels. At time 2, participants performed an average of 90.9 minutes of exercise per week \((SD = 108.7)\). Both of the distributions for the self-reported exercise behavior variables were non-normal based on the Kolmogorov–Smirnov test for normality \((exercise \text{ time } 1: D = 0.17, p < .01; exercise \text{ time } 2: D = 0.20, p < .01)\), so hypotheses that included these variables relied upon Spearman correlations rather than Pearson correlations or linear regressions. However, the difference score between exercise behavior at time 1 and exercise behavior at time 2 was normally distributed, so no alternative statistical tests were needed when this change variable was included.

Means for the anticipated effect and the retrospective effect of the hindrances are listed in Table I. A difference score, subtracting anticipated effect from retrospective effect, represents a measure of underestimation for that barrier. The level of underestimation for each barrier is also listed in Table I. Several hindrances were actually significantly overestimated, meaning participants anticipated these barriers as having a more profound effect on exercise behavior change than they actually did: busyness \((t(379) = 3.23, p = .0013)\), injury \((t(379) = 7.49, p < .0001)\), tiredness \((t(379) = 1.98, p = .049)\), and weather \((t(379) = 3.29, p = .0011)\). The remaining hindrances, willpower \((t(379) = 0.71, \text{ns})\) and amount of time exercise takes \((t(379) = 0.55, \text{ns})\) were not significantly overestimated, although both had a trend toward overestimation.

Our primary hypothesis was whether underestimation would be associated with less exercise behavior change. When we used the single item of retrospective exercise behavior change (assessed at time 2) as the dependent variable, we found that higher levels of

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Anticipated effect</th>
<th>Retrospective effect</th>
<th>Underestimationa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busyness</td>
<td>3.42</td>
<td>3.18</td>
<td>−0.25**</td>
</tr>
<tr>
<td>Injury</td>
<td>2.59</td>
<td>2.00</td>
<td>−0.59***</td>
</tr>
<tr>
<td>Tiredness</td>
<td>2.67</td>
<td>2.55</td>
<td>−0.12*</td>
</tr>
<tr>
<td>Willpower</td>
<td>2.51</td>
<td>2.47</td>
<td>−0.05</td>
</tr>
<tr>
<td>Weather</td>
<td>2.35</td>
<td>2.12</td>
<td>−0.22**</td>
</tr>
<tr>
<td>Time</td>
<td>2.43</td>
<td>2.39</td>
<td>−0.04</td>
</tr>
</tbody>
</table>

aUnderestimation was calculated by subtracting the anticipated effect from the retrospective effect, thus positive values indicate underestimation and negative values indicate overestimation. *\(p < .05\); **\(p < .01\); ***\(p < .001\).
underestimation (or less overestimation) was associated with less behavior change. In other words, as hypothesized, the more participants underestimated the detrimental effect of exercise barriers, the less they increased their exercise behavior. As shown in Table II, barrier underestimations for busyness ($F(1, 378) = 7.56, p = .0063$), willpower ($F(1,378) = 6.78, p = .0096$), weather ($F(1, 378) = 5.85, p = .0161$), and time ($F(1, 378) = 4.27, p = .0396$) were all associated with less exercise behavior change. When using a combined index for all barrier predictions (i.e., the average of all barriers), this composite measure for barrier underestimation was also associated with less exercise behavior change ($F(1, 378) = 7.59, p = .0061$).

It could be argued that because both retrospective behavior change and retrospective effect of the behavioral barriers were assessed at the same point in time, any failure to change behavior could have resulted in (rather than being the result of) a post-hoc rationalization of reporting a higher retrospective effect of the behavioral barriers. That is, a participant who reports that they did not change their exercise routine as they had intended may subsequently inflate the retrospective effects of behavioral barriers as an “excuse” for a failure to change exercise behavior. To address this limitation, the same analysis was conducted using two items, a year apart, to represent behavior change, instead of a single retrospective item at time 2.

However, instead of using barrier underestimation as a predictor of simple exercise change (time 2 exercise behavior minus time 1 exercise behavior), we used barrier underestimation as a predictor of regressed exercise change (time 2 exercise behavior controlling for time 1 exercise behavior). Regressed change scores are generally preferred over simple difference scores as they account for initial values (Cohen et al., 2003). In other words, regressed change scores account for the fact that it is easier to increase exercise when a participant is engaging in very low levels of exercise than when a participant is engaging in very high levels of exercise. Simple difference scores (using time 2 minus time 1) do not account for this.

Because both exercise behavior variables (at time 1 and time 2) violated normality assumptions, partial Spearman correlations were conducted as the non-parametric equivalent to regressed change scores. The results demonstrated the expected pattern, as shown in Table II. For most barriers, higher levels of underestimation were associated with

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Retrospective $F^a$</th>
<th>$\beta$</th>
<th>Self-reported $r_s^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busyness</td>
<td>7.56</td>
<td>-.14**</td>
<td>-.26**</td>
</tr>
<tr>
<td>Injury</td>
<td>0.67</td>
<td>.04</td>
<td>.06</td>
</tr>
<tr>
<td>Tiredness</td>
<td>0.92</td>
<td>-.05</td>
<td>-.05</td>
</tr>
<tr>
<td>Willpower</td>
<td>6.78</td>
<td>-.13*</td>
<td>-.19**</td>
</tr>
<tr>
<td>Weather</td>
<td>5.85</td>
<td>-.12*</td>
<td>-.14**</td>
</tr>
<tr>
<td>Time</td>
<td>4.27</td>
<td>-.11*</td>
<td>-.14**</td>
</tr>
<tr>
<td>Combined</td>
<td>7.59</td>
<td>-.14**</td>
<td>-.18**</td>
</tr>
</tbody>
</table>

Negative weights indicate that higher levels of barrier underestimation were related to less exercise behavior change. 

$^a$Degrees of freedom are (1, 378) for all models; $^b$Because the normality assumption was violated with the self-reported exercise variables, partial Spearman correlations were conducted ($r_s$ represents the association between each barrier and time 2 exercise, controlling for time 1 exercise); $^c$Combined barrier represents the average of all barriers. $^p < .05$; $^{**}p < .01$. 

Table II. The relationship between barrier underestimation and exercise change (self-reported and retrospective).
less exercise behavior change. Specifically, underestimation for busyness ($r_s = -.26$, $p < .0001$), willpower ($r_s = -.19$, $p = .0002$), weather ($r_s = -.14$, $p = .0087$), and time ($r_s = -.14$, $p = .0077$) were all associated with less exercise behavior change. Again, a combined index of barrier underestimation was created, demonstrating higher levels of underestimation resulted in significantly less exercise behavior change ($r_s = -.18$, $p = .0003$).

We also explored some alternative hypotheses that arise because of our reliance on difference scores as independent variables. It is possible, for example, that only anticipated barriers (time 1) or retrospective barriers (time 2) are related to exercise change, and one of those associations is driving the observed correlation between barrier underestimation (time 2 – time 1) and exercise change (since both time 1 and time 2 barriers are naturally correlated with the difference score of time 2 – time 1). To investigate these types of possibilities, we examined the bivariate correlations between the components of these difference scores. We found that while barrier underestimation has an inverse association with exercise change behavior ($r = -.17$, $p = .001$), this appears primarily due to the inverse relationship barriers at time 2 have on exercise change behavior ($r = -.22$, $p < .0001$). That is, participants were less likely to increase their exercise if, at time 2, they perceived the barriers to be strong hindrances, and this was true regardless of how they perceived the barriers at time 1 (the relationship between anticipated barriers and exercise change was not significant, $r = .05$).

**Weight management (n = 358)**

At time 1, participants described themselves as slightly overweight ($M = 3.67$, $SD = 0.78$). The majority of participants (67.6%) intended to lose weight for the upcoming year; the remainder intended to maintain their weight. At time 2, participants again described themselves as slightly overweight ($M = 3.67$, $SD = 0.80$).

The anticipated effect and the retrospective effect of the barriers are listed in Table III, as well as the measure of underestimation, created by subtracting the anticipated effect from the retrospective effect of each barrier. The greater the difference between the anticipated effect and the retrospective effect, the greater the amount of underestimation for that barrier. Contrary to exercise, a few barriers were underestimated, meaning their anticipated effect was reported as lower than their retrospective effect: difficulty exercising ($t(357) = -4.03$, $p < .0001$), willpower ($t(357) = -2.32$, $p = .021$), and cravings for high calorie foods ($t(357) = -3.62$, $p = .0003$). The remaining barriers were not significantly misestimated, although they were in the direction of overestimation: amount of junk food in the house.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Anticipated effect</th>
<th>Retrospective effect</th>
<th>Underestimationa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junk food</td>
<td>2.27</td>
<td>2.27</td>
<td>-0.01</td>
</tr>
<tr>
<td>Parties</td>
<td>2.08</td>
<td>2.06</td>
<td>-0.03</td>
</tr>
<tr>
<td>Hunger</td>
<td>2.76</td>
<td>2.73</td>
<td>-0.04</td>
</tr>
<tr>
<td>Difficulty exercising</td>
<td>2.53</td>
<td>2.81</td>
<td>0.28***</td>
</tr>
<tr>
<td>Willpower</td>
<td>2.62</td>
<td>2.76</td>
<td>0.14*</td>
</tr>
<tr>
<td>Cravings</td>
<td>2.71</td>
<td>2.91</td>
<td>0.20***</td>
</tr>
</tbody>
</table>

aUnderestimation was calculated by subtracting the anticipated effect from the retrospective effect, thus positive values indicate underestimation and negative values indicate overestimation. *$p < .05$; **$p < .01$; ***$p < .001$. 

Barrier underestimation 117
Our primary hypothesis was that barrier underestimation would result in less weight loss, as not anticipating the difficulties of weight change would hamper the fulfillment of the intention to lose weight. Using the single item of retrospective weight change as the dependent variable, we found that higher levels of underestimation for the behavioral barriers was associated with less weight loss. Specifically, the higher the level of underestimation for difficulty exercising ($F(1, 356) = 25.71, p < .0001$) and willpower ($F(1, 356) = 7.89, p = .0052$), the less weight loss occurred. Underestimation for all other barriers was not associated with retrospective weight change (Table IV). When using a combined index for all barrier predictions, this composite measure for underestimation was associated with less weight loss, $F(1, 356) = 8.11, p = .0046$.

Again, as stated for exercise behavior, it could be argued that since both retrospective weight change and retrospective effect of the behavioral barriers were assessed at the same point in time, any failure to lose weight could have resulted in (rather than being the result of) a post-hoc rationalization of reporting a higher retrospective effect of the behavioral barriers. That is, a participant who reports that they did not lose weight as they had intended, may subsequently inflate the retrospective effects of behavioral barriers as an “excuse” for a failure to lose weight. To address this limitation, we used regressed change scores (predicting weight at time 2 from underestimated barriers after controlling for weight at time 1) and found similar results as with the previous analyses. Specifically, underestimation for hunger ($F(1, 355) = 12.08, p = .0006$), willpower ($F(1, 355) = 10.12, p = .0016$), and high calorie cravings ($F(1, 355) = 3.91, p = .0487$) were associated with less weight loss. Underestimation for difficulty exercising was marginally associated with less weight loss ($F(1, 355) = 3.75, p = .0535$), while all other barriers had no association. Again, a combined index of underestimation for all barriers was created, demonstrating that higher levels of underestimation were associated with less weight loss ($F(1, 355) = 9.43, p = .0023$).

Just as with exercise, we explored some alternative hypotheses that arise because of our reliance on difference scores. For example, perhaps weight change is only related to barriers at time 1 or barriers at time 2, and one of those associations is driving the observed correlation between barrier underestimation and weight change (since barriers at time 1 and barriers at time 2 are naturally correlated with barrier underestimation). However, this does not seem to be the case. Barrier underestimation had a stronger effect on weight change.

Table IV. The relationship between barrier underestimation and weight change (self-reported and retrospective).

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Retrospective</th>
<th>Self-reported</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>$F^a$</td>
<td>$F^b$</td>
</tr>
<tr>
<td>Junk food</td>
<td>1.37</td>
<td>0.12</td>
</tr>
<tr>
<td>Parties</td>
<td>0.07</td>
<td>0.03</td>
</tr>
<tr>
<td>Hunger</td>
<td>0.26</td>
<td>12.11</td>
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<tr>
<td>Difficulty exercising</td>
<td>25.71</td>
<td>3.76</td>
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<tr>
<td>Willpower</td>
<td>7.89</td>
<td>10.11</td>
</tr>
<tr>
<td>Cravings</td>
<td>0.07</td>
<td>3.92</td>
</tr>
<tr>
<td>Combined$^c$</td>
<td>8.11</td>
<td>9.42</td>
</tr>
</tbody>
</table>

Positive weights indicate that higher levels of underestimation were related to less weight loss. $^a$Degrees of freedom are (1, 356) for all retrospective barriers; $^b$Degrees of freedom are (1, 355) for self-reported barriers, as all models control for weight at time 1; $^c$Combined barrier represents average of all barriers. *$p < .05$; **$p < .01$; ***$p < .001$. 

(t(357) = 0.10, ns), number of parties attended (t(357) = 0.41, ns), and how hungry the participant felt (t(357) = 0.64, ns).
(r = .15, p = .005) than did barriers at time 1 (r = -.10, p = .05) or barriers at time 2 (r = .02, ns). These results rule out the possibility that the results are due to the use of difference scores, and provide further evidence that underestimating barriers for weight change is associated with less weight loss.

Discussion
This study had several aims. First, we sought to replicate the weak intention–behavior relationship for dieting and exercise behaviors, as noted in previous literature (e.g., Conner et al., 2002; Sheeran et al., 2003). Next, we sought to establish how accurate people are at estimating the effect of dieting and exercise barriers on behavior change. Finally, we sought to establish whether the misestimation of the effect of these barriers was contributing to the observed intention–behavior discrepancy.

As hypothesized, the results from this study provided support for a large intention–behavior inconsistency with dieting and exercise behaviors. Self-reported exercise patterns and weight levels remained almost identical from year 1 to year 2, even though all participants included in the analyses intended to exercise more and lose weight. Despite these noble intentions, however, something prevented these participants from changing their behavior.

This study also demonstrated that several behaviors were misestimated, though not exactly in the way we had predicted. The effects of the barriers to weight loss were generally underestimated, as we hypothesized. In other words, participants found that the obstacles to losing weight were much more of a hindrance than they expected. Interestingly, however, barriers to exercise were almost uniformly overestimated (four significantly so). This indicated that participants generally found the obstacles to exercise to be much less of a hindrance than expected.

It is unclear why this underestimation/overestimation pattern would be different in these two behaviors. One clue may be the fact that the “willpower” barrier, which served as a barrier for both behaviors, is underestimated for weight loss but overestimated for exercise. Though purely speculative, this may indicate that the motivation and drive during the period of behavior change, for whatever reason, is much more problematic for dieting than for exercise. Exercise and dieting differ in a number of respects. Exercise entails activation of response (engaging in energetic behavior), whereas dieting entails primarily inhibition of response (resisting the urge to eat; avoiding forbidden foods). Dieting involves “hot” emotions or drive states (e.g., hunger, craving, temptation) (Loewenstein, 1996, 2005) more so than does exercise. It is possible that people systematically underestimate the barriers to avoiding temptation but overestimate the barriers to activating a response. Clearly, more research is necessary to replicate this intriguing pattern of results in dieting and exercise, and investigate possible explanations for it.

Lastly, this study provided evidence that the misestimation of behavioral barriers is associated with gaps in the intention–behavior relationship. Using linear regressions and Spearman correlations to predict behavior change, we found that the underestimation of behavioral barriers predicted less exercise change and less weight loss. Since all participants included in the analyses intended to increase the amount they exercise and decrease their weight, these results indicate that underestimation of the barriers to these behaviors can partially explain the reason for intention–behavior discrepancies.

However, because our analyses involved the use of differences scores, both as independent and dependent variables, we decided to rule out correlations between the component variables as alternative explanations. While the pattern for dieting behavior
indicated that, indeed, barrier underestimation was associated with less weight loss, the pattern for exercise was slightly less convincing. It appeared that the relationship between barrier underestimation and exercise change was primarily driven by a relationship between the barriers at time 2 and behavior change. In other words, it was not the underestimation of barriers that predicted less behavior change; rather, it was just the fact that the barriers reported at time 2 were inversely associated with exercise behavior change from time 1 to time 2. Notably, when barriers were underestimated (as they were for dieting), the extent of misestimation predicted behavior change. In contrast, when barriers were overestimated (as they were for exercise), it was time 2 barrier ratings that predicted behavior change, rather than the barrier misestimation per se. Thus, the situation in which barrier misestimation is critical for understanding successful behavior change is when people intend to improve health behavior but have a net tendency to underestimate the impact that barriers will have.

One limitation of this study is the reliance on self-report measures of exercise behavior and weight management, which may be susceptible to biased responses for the purposes of self-presentation. Note, however, that we investigated behavior change, and it is unlikely that any self-presentation effects would have more of an influence at time 1 than at time 2. Therefore, while the mean exercise ratings and weight levels may not be perfectly correlated with objective measures, there is little reason to expect systematic bias in the behavior change scores.

In sum, these results provide support for previous findings in that intention–behavior discrepancies plague both exercise and dieting behaviors. Though the pattern is less clear for exercise behaviors, it certainly seems to be the case that barriers to dieting are generally underestimated and that these underestimations partially explain the intention–behavior gap. Taken as a whole, these results may have important implications for addressing the obesity threat. All participants included in this study intended to decrease their weight, yet struggled to do so. Therefore, one way in which to increase the performance of dieting and exercise may be to further investigate the intention–behavior discrepancy. As evidenced here, one way in which to potentially close this gap is by addressing the misestimation of behavioral barriers. Perhaps by preparing people for the true effect that these obstacles will have, or by preparing people to develop contingency plans (or “action plans”, e.g., Diefenbach & Leventhal, 1996) in the face of these obstacles, their behavior will match their intentions.

However, correcting misestimation of the impact of barriers may not be easy. In the current study, change in dieting behavior was predicted by underestimation of hunger, willpower, and cravings (Table II). These three barriers all entail “hot” emotions or drive states. Recent research on hot/cold empathy gaps (e.g., Loewenstein, 2005) demonstrates that when one is in a cold state, it is difficult to predict the impact on decision making and behavior of a later hot state. Thus, for example, someone in a cool state (say, at the end of Thanksgiving dinner) who resolves to start dieting tomorrow will have difficulty predicting the impact that subsequent hot states (e.g., hunger and craving experienced after a week of calorie restriction) will have on future behavior, even if the person has experienced dieting in the past.

Notes

1. The authors formulated a list of 10 behavioral barriers to exercise. Faculty and staff (n = 8) who were not part of the larger study were recruited to participate in a pilot test of all our measures. These participants provided feedback and explained how they were interpreting the items as they completed the questionnaire. Participants also were given
the opportunity to suggest additional barriers that were not included (though no other barriers were mentioned). Exercise barriers that exhibited ceiling or floor effects on their hindrance rating and/or exercise barriers that the pilot study participants misinterpreted or found difficult to answer were removed. The four barriers for exercise that were removed included: the fitness center schedule, availability of a workout partner, travel time, and soreness.

2. Cronbach’s alpha for anticipated and retrospective barriers was .72 and .69, respectively. Although a principal axis factor analysis revealed a two-factor structure (factor 1: time, busyness; factor 2: injury, tiredness, willpower, weather), neither of these factors exhibited reliability better than a single factor consisting of all six items, so this two-factor structure was discarded.

3. As with exercise, 10 weight management barriers were originally pilot tested. Four barriers exhibited ceiling/floor effects or were difficult to answer and these were removed. These barriers were: the frequency of eating out, unsupportive comments from others, your body’s tendency to regain lost weight, and family members’ lack of support.

4. Cronbach’s alpha for both anticipated and retrospective barriers was .78. A principal axis factor analysis revealed only one factor.

References


