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## Examination of whether early weight loss predicts 1-year weight loss among those enrolled in an Internet-based weight loss program

Jessica L. Unick<sup>1</sup>, Tricia Leahey<sup>1</sup>, Kimberly Kent<sup>1</sup>, and Rena R. Wing<sup>1</sup>

<sup>1</sup>Weight Control and Diabetes Research Center, The Miriam Hospital and Brown Medical School, Providence, RI

### Abstract

One-month weight loss (WL) predicts post-treatment WL in face-to-face interventions; however whether this holds true within Internet programs is unknown. This study examined whether 4-week WL predicts WL following a 12-week Internet program and at 6 and 12 months follow-up. 181 participants (BMI=33.4±5.5kg/m<sup>2</sup>; 83.1% female) received a 12-week behaviorally-based Internet WL program consisting of weekly video lessons. Participants were given a daily WL, calorie, and physical activity goal and asked to enter these data on the study website weekly. Personalized feedback was provided. Using 4-week WL, individuals were categorized as ‘early non-responders’ (<2.0% WL) or ‘early responders’ (≥2.0% WL). Early non-responders had significantly lower WL than early responders at 3 (-1.3±3.8% vs. -6.3±4.3%), 6 (-1.7±5.1% vs. -5.8±5.2%), and 12 months (-0.05±6.8% vs. -2.7±6.3%, p’s<0.05). The odds of achieving a ≥5% WL were 8.5 (95% CI:3.3–22.1), 3.4 (95% CI:1.4–8.3), and 2.6 (95% CI:0.93–7.4) times lower in early non-responders, compared to early responders at 3, 6, and 12 months respectively. Compared to early responders, early non-responders viewed fewer video lessons and self-monitored less often across the 12-week intervention (p’s<0.05). This study provides initial evidence that a 4-week WL of <2.0% places an individual at an increased risk of failing to achieve clinically significant WL following an Internet program.

### Keywords

weight loss; obesity

### Introduction

In studies of lifestyle interventions, involving face-to-face sessions, weight loss (WL) during the first two months predicts post-treatment or long-term WL<sup>1-3</sup>. For example, the odds of achieving ≥5% WL at Years 1, 4, and 8 are significantly greater among those losing ≥2% at

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Contact information for Corresponding Author: Jessica Unick, Ph.D., Weight Control and Diabetes Research Center, The Miriam Hospital and Brown Medical School, 196 Richmond Street, Providence, RI 02903, Telephone: 401-793-8966, Fax: 401-793-8944, [junick@lifespan.org](mailto:junick@lifespan.org).

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Month 1, compared to those losing <2%<sup>1,3</sup>. Thus investigators have suggested that providing early intervention to early non-responders may improve obesity treatment outcomes<sup>1,4</sup>. However, it is unknown whether early WL also predicts post-treatment WL within Internet programs, given how these programs differ from face-to-face interventions.

Internet programs overcome some of the barriers of traditional WL programs (e.g., patient proximity, transportation concerns, and time constraints), may appeal to different segments of the overweight/obese population<sup>5-6</sup>, and have increased dissemination potential<sup>6-8</sup>. However, because Internet programs typically produce smaller WL, result in dissimilar weight change trajectories, and may have different ‘active’ treatment components compared to face-to-face programs (e.g., group and interventionist support vs. no support)<sup>6,9-11</sup>, it is unclear whether the association between early WL and post-treatment WL would also be observed. However, if early WL predicts subsequent performance in Internet programs, non-responders could be identified early and provided with additional intervention, as a strategy to ‘rescue’ these individuals and improve overall WL outcomes. This is consistent with the “stepped care” model which suggests starting with a low intensity intervention (e.g., Internet program) and providing a more intense intervention only to individuals who need it<sup>4,12</sup>.

This study extends previous findings from face-to-face programs by examining: 1) whether 4-week WL predicts WL following a 12-week *Internet* program, 2) whether early WL in an Internet program predicts outcome after the conclusion of the program, by continuing to study participants at 6 and 12 months, and 3) whether those with low versus high initial WL differ in program adherence. The results will be the first to elucidate the magnitude of the problem of early non-response in Internet-based initiatives (i.e., the percentage of individuals who fail to respond early in a program and never recover). Further, the identification of behavioral adherence factors associated with non-response could be used to develop appropriate ‘rescue’ treatments to address the needs of non-responders in Internet-based programs.

## Methods

### Participants

Participants enrolled in Shape Up Rhode Island [SURI; a 3-month statewide WL campaign shown to produce minimal WL (approximately 1%) at 12 weeks<sup>10</sup>] and also enrolled in a research study designed to improve SURI WL outcomes. Only those randomly assigned to the enhanced SURI (eSURI; see description below) condition in the 2011 or 2012 research studies<sup>10,13</sup> were considered in these analyses (n=181). Inclusionary criteria have been described elsewhere<sup>10</sup>. In short, participants were 18-70 years of age, had a BMI  $\geq 25\text{kg/m}^2$ , and had no serious medical conditions (e.g., cancer). All participants provided written informed consent.

### Intervention

The eSURI program is a 3-month Internet-delivered behavioral WL intervention which has been previously shown to produce a 12-week WL of  $4.2\pm 0.6\%$ <sup>10</sup>. Prior to the start of this intervention, participants attended a one-hour group meeting and were given a WL goal

(lose 1-2 pounds/week), calorie and fat gram goal (starting weight <250 lbs:1200-1500kcal/day, 40-50 grams of fat; starting weight ≥250 lbs:1500-1800 kcal/day, 50 grams of fat), activity goal (gradually increase to 200 minutes of aerobic activity/week), and were taught how to count calories, self-monitor, and use the study website. Participants were instructed to view a weekly, 10-15 minute multimedia lesson presenting standard behavioral WL strategies (similar to those in the Look AHEAD intervention<sup>14</sup>) and enter their weight, calorie, fat gram, and activity information daily. Participants received weekly, automated and personalized feedback on their progress and had access to additional resources on the website, including information on meal plans, meal replacements products, and recipes.

## Outcome measures

**Assessment visits**—Height, weight, and demographic information were obtained at baseline and weight was measured again by assessment staff at 3 (post-treatment), 6, and 12 months. Participants were compensated \$25 (3 and 6 months) or \$50 (12 months) at these visits.

**Weight loss**—Objective measures of weight, obtained at the assessment visits, were used to calculate percent WL at 3, 6, and 12 months. Week 4 WL was calculated using the participant's self-reported baseline weight (logged on the study website on the first day of the program using their home scale) and their self-reported weight at the end of Week 4 (logged on the study website). If a participant did not report a Week 4 weight but reported weights at Weeks 3 and 5, the average of these two weights was used as their Week 4 weight.

**Adherence**—Participant adherence was measured by: 1) number of weeks that the participant logged onto the study website, 2) the number of video lessons viewed (out of 12), and 3) adherence to self-monitoring (i.e., number of days that weight, exercise minutes, and calorie information was reported) on the study website.

## Statistical analyses

Participants were categorized using a previously determined 4-week WL threshold which has been shown to have high specificity for predicting WL at 1-year in face-to-face programs<sup>1</sup>: 1) early responders (WL ≥2.0%), or 2) early non-responders (WL <2.0%). These two groups were compared on demographic variables and adherence metrics using independent samples t-tests and Chi-square analyses. Logistic regression assessed the relationship between 4-week WL categories and achievement or non-achievement of a ≥5% WL at Year 1. A 2-way mixed ANOVA assessed the change in weight over time between early responders and early non-responders. Analyses were conducted using SPSS for Windows (Version 18, Chicago, IL) and statistical significance was set at  $p < 0.05$ .

## Results

### Participants

Of the 181 eligible participants,  $n=27$  were excluded from the analyses due to a missing weight measurement at Week 4. The remaining 154 participants were predominately

Caucasian (93.5%) and female (83.1%), weighed  $91.0 \pm 16.6$  kg, had a mean BMI of  $33.4 \pm 5.5$  kg/m<sup>2</sup>, and were  $46.5 \pm 11.4$  years of age. Retention was high with  $n=146$  (95%),  $n=140$  (91%), and  $n=137$  (89%) completing assessment visits at 3, 6, and 12 months, respectively (see Online Appendix 1).

### Weight change by early weight loss category

Twenty-seven percent of participants ( $N=41$ ) were classified as early non-responders while the remaining 73% ( $N=113$ ) were early responders. By definition, 4-week WL was lower in early non-responders ( $-0.78 \pm 1.1\%$ ) compared to early responders ( $-4.02 \pm 1.3\%$ ,  $p < 0.001$ ). As shown in Figure 1, early responders had significantly greater WL at 3, 6, and 12 months compared to early non-responders ( $p < 0.05$ ). Further, a smaller percentage of early non-responders achieved a 5% WL at each time point, compared to early responders (Figure 2). The odds of achieving a 5% WL were 8.5 (95% CI: 3.3–22.1), 3.4 (95% CI: 1.4–8.3), and 2.6 (95% CI: 0.93–7.4) times greater in early responders, compared to early non-responders at 3, 6, and 12 months respectively. Interestingly, participants excluded from the analyses due to a missing weight measurement at Week 4 ( $n=27$ ) achieved very little, if any WL at 3 months ( $0.45 \pm 4.3\%$ ), 6 months ( $0.58 \pm 5.0\%$ ), and 12 months ( $-0.32 \pm 7.4\%$ ).

### Adherence

Weight loss at each assessment time point was positively related to all adherence metrics ( $r$ 's ranging from 0.25 to 0.59;  $p$ 's  $< 0.05$ ). Compared to early non-responders, early responders logged onto the study website more often ( $10.5 \pm 2.1$  vs.  $8.8 \pm 3.2$  days;  $p < 0.001$ ), viewed more video lessons ( $7.1 \pm 3.6$  vs.  $5.7 \pm 3.1$  videos;  $p < 0.05$ ), and self-monitored their calories ( $68.7 \pm 18.0$  vs.  $54.3 \pm 26.6$  days;  $p < 0.001$ ), weight ( $70.2 \pm 17.8$  vs.  $57.0 \pm 25.0$  days;  $p < 0.05$ ), and physical activity ( $44.8 \pm 20.1$  vs.  $36.6 \pm 25.2$  days;  $p < 0.05$ ) on more days throughout the 12-week program. Interestingly, even by Week 4, early non-responders had logged onto the website less often ( $p < 0.001$ ) and reported their weight ( $p = 0.001$ ), calories ( $p < 0.001$ ), and physical activity ( $p = 0.08$ ) on a fewer number of days compared to early responders. However, both groups had viewed a similar number of video lessons by Week 4 ( $p = 0.62$ ).

### Discussion

This study provides preliminary evidence that individuals losing  $< 2\%$  of initial weight following 1-month of an Internet-based WL program have poorer WL at post-treatment and 1-year follow-up, compared to those losing 2% initially. Further, early non-responders were less likely to self-monitor and adhere to program recommendations at both Week 4 and throughout the 12-week intervention. Thus, individuals at risk of failing to achieve clinically significant WL post-treatment may be able to be identified early within an Internet-based WL program.

Given the need for cost-effective and easily disseminated WL interventions, the Internet may be an ideal medium for employing a “stepped care” intervention approach<sup>4, 12</sup>. Many individuals achieve clinically significant WL through low-intensity programs, such as Internet programs<sup>11</sup>; yet others may benefit from more intensive interventions. Deciding who needs which type of program is difficult. The current data are novel and suggest that

those at risk of being unsuccessfully treated through an Internet program may be able to be identified as early as Month 1. This early identification could lead to several treatment alternatives. For example, early non-responders could be provided with a single, brief face-to-face intervention aimed at “rescuing” these individuals before frustration due to poor WL occurs. Conversely, these individuals could be removed from the Internet program and provided with an alternative treatment approach, such as a more intensive face-to-face program, a different dietary program, or pharmacotherapy. Future studies should examine whether such approaches are effective from both a clinical and cost perspective.

This study is strengthened by a fairly large sample size, objective measures of weight at baseline, 3, 6 and 12 months, objective measures of adherence achieved by tracking the use of the Internet program, and a 9-month follow-up period post-intervention. Limitations include a predominately female and Caucasian sample as well as self-reported measures of weight at Week 4. However, we observed a high correlation between self-reported weight from the study website and objectively-measured assessment weight at 3 months ( $r=0.997$ ). This study was also limited by the fact that it did not examine WL beyond 1-year, a time period where weight regain is most prominent. However, it should be noted that 4-week WL also predicted 4 and 8-year WL in a face-to-face intervention<sup>3</sup>; thus longer follow-up periods should also be examined within the context of Internet programs. Moreover, the initial intervention meeting was delivered in-person and it is uncertain how this may have influenced the findings. Finally, 18% of participants were excluded from the analyses due to missing 4-week weight data; thus it is unknown how this may have impacted the results.

## Conclusion

The positive relationship between early WL and long-term WL which has been previously observed with in-person behavioral WL programs is also observed within Internet-based treatment programs. Future studies should examine whether providing additional intervention (e.g., in-person contact) to individuals with poor early WL can cost-effectively improve obesity treatment outcomes within Internet programs.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

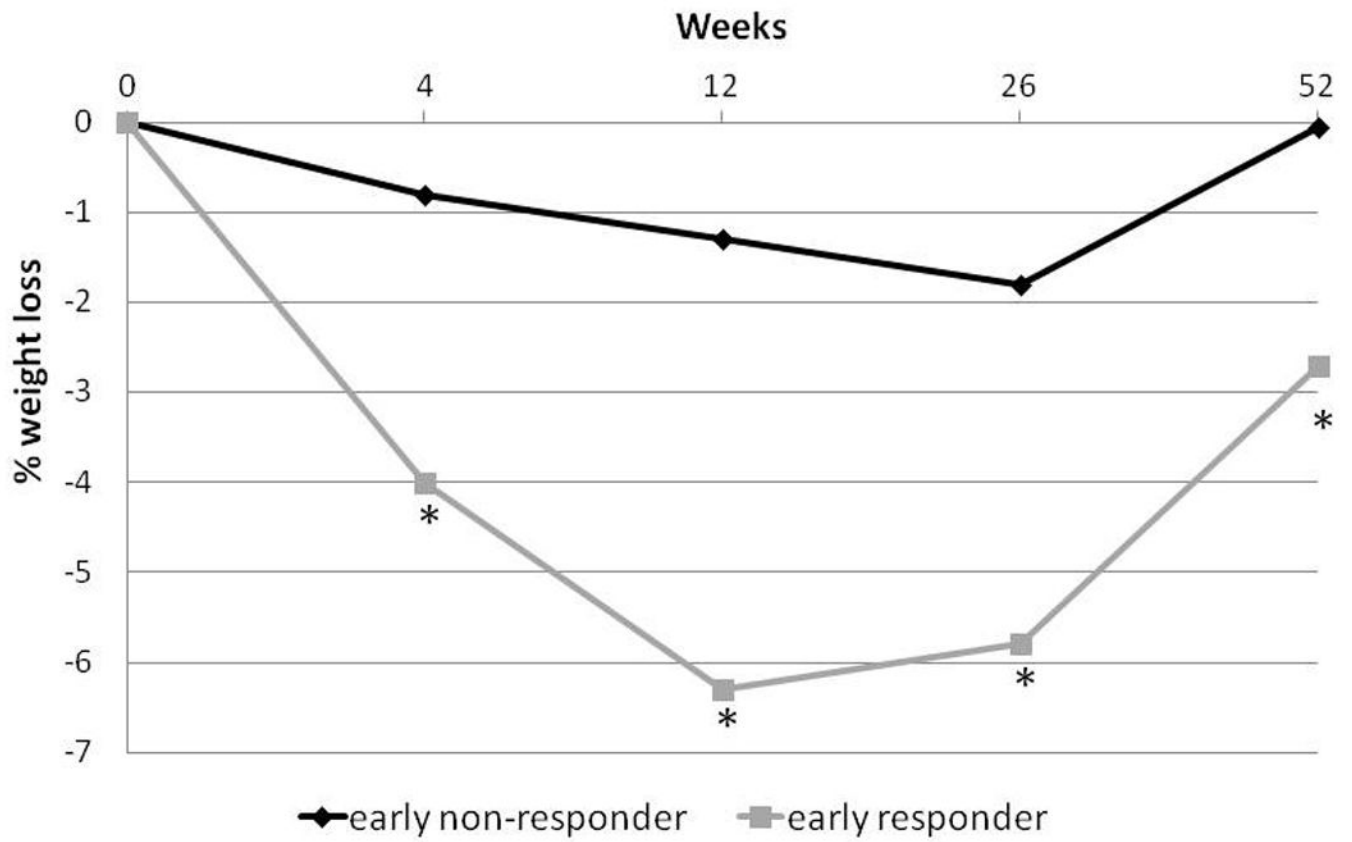
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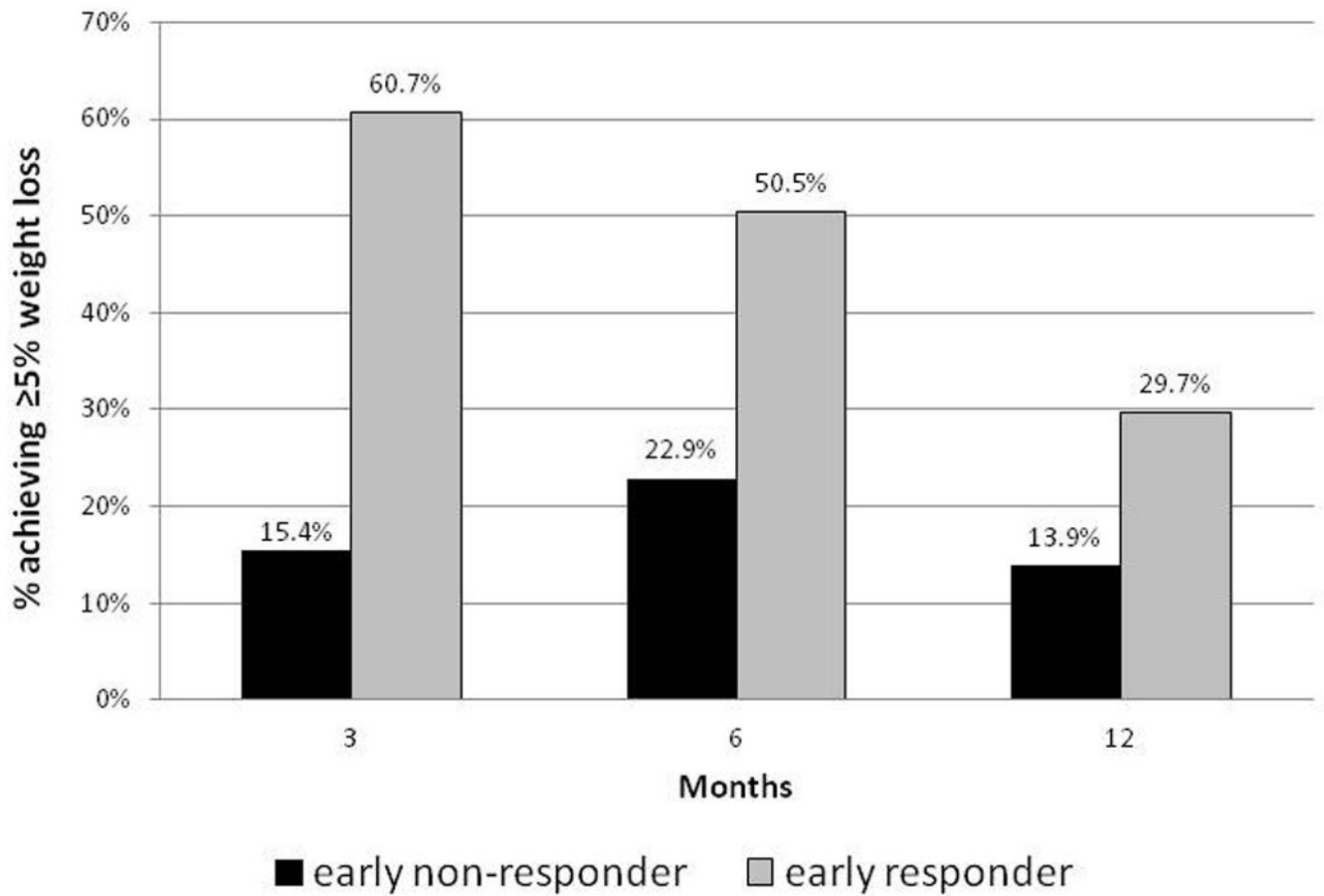
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**Figure 1.** Percent weight change over a 1-year period, stratified by early weight loss categories. \* indicates that early non-responders and early responders are significantly different from one another ( $p < 0.05$ ); ANOVA results: Time:  $p < 0.001$ , Early weight loss category:  $p < 0.001$ , Time  $\times$  early weight loss category ( $p = 0.02$ ).



**Figure 2.** Percentage of participants achieving a ≥5% weight loss at each time point, stratified by early weight loss category. P-values for Chi-square analyses comparing early non-responders to early responders within any given month