

Recovery from relapse among successful weight maintainers¹⁻³

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ABSTRACT

Background: Little is known about the natural history of weight change among persons who are successful at losing weight.

Objective: This study evaluated the occurrence of weight regain and recovery among 2400 persons in the National Weight Control Registry (NWCR) who had lost an average (\pm SD) of 32.1 ± 17.8 kg and had kept it off for 6.5 ± 8.1 y.

Design: Participants were evaluated prospectively over 2 y.

Results: The mean reported weight change from entry into the NWCR to 2 y later was 3.8 ± 7.6 kg. At year 2, 96.4% of the sample remained $\geq 10\%$ below their maximum lifetime weight. However, small regains were common, and few persons were able to re-lose weight after any weight regain. Of the participants who gained any weight between baseline and year 1 ($n = 1483$; 65.7%), only 11.0% returned to their baseline weight or below at year 2. Of the participants who relapsed, which was defined as a weight regain of $\geq 5\%$ at year 1 ($n = 575$, or 25.5% of the sample), only 4.7% returned to their baseline weight or below at year 2, and only 12.9% re-lost at least half of their year 1 gain by year 2. Logistic regression showed that recovery was related to gaining less at year 1 and to smaller increases in depressive symptoms between baseline and year 1.

Conclusion: Although successful weight losers continued to maintain a large percentage of their weight losses over 2 y, recovery from even minor weight regain was uncommon. *Am J Clin Nutr* 2003;78:1079-84.

KEY WORDS Weight loss, weight maintenance, weight regain, relapse, recovery, obesity, National Weight Control Registry

INTRODUCTION

The well-known problem with obesity treatment is weight regain after treatment termination. About 3-5 y after treatment, $\geq 50\%$ of patients have returned to their baseline weights (1, 2). In an attempt to learn ways to prevent weight regain, researchers have evaluated the characteristics of those persons who are successful at long-term weight loss (3-5). The National Weight Control Registry (NWCR) followed 714 participants who lost an average of 28.9 kg and kept it off for 5.7 y (6). After 1 y of follow-up, 59% of the sample continued to maintain their weight within 2.25 kg (5 lb), whereas 35% gained > 2.25 kg (> 5 lb). The factors associated with weight regain were a shorter duration of weight maintenance, a larger initial weight loss, and higher levels of depressive symptoms and disinhibition at entry into the study. Other research has

evaluated the effects of manipulating treatment components (eg, use of medication, exercise, and increased patient-provider contact; 7) or examined correlates of weight regain (8) to better understand the relapse process and to try to improve the long-term maintenance of weight loss.

An area that has been overlooked in the literature, however, is information about the natural history of recovery. Kramer et al (2) described patterns of weight change over 4 and 5 y in 114 men and 38 women after completion of a 15-wk behavioral weight-loss program. Recovery from regain (defined as gaining half or more of their initial weight loss and then re-losing $\geq 50\%$) occurred in only 26.8% of the participants, and only 7% maintained such recovery for ≥ 2 y. Clinically, behavioral treatment teaches that recovery from relapse exists (9), and that minor fluctuations in weight are to be expected during the weight-loss and maintenance process. Patients are instructed to anticipate dietary lapses (ie, temporary setbacks) and relapses (ie, larger regains) and are taught behavioral skills to predict and cope with these. Whether recovery from weight regain is, in fact, a part of successful weight-loss maintenance is unknown.

The purpose of the present study was to examine patterns of weight change over the course of 2 y among participants in the NWCR. We sought to determine how frequently patients who gained weight between baseline and year 1 were able to recover over the subsequent year and to examine prospectively the variables that distinguished those who recovered from those who did not.

SUBJECTS AND METHODS

Subjects

The NWCR is an ongoing longitudinal study of persons aged ≥ 18 y who have lost ≥ 13.6 kg (30 lb) and have kept it off for

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TABLE 1Participant characteristics at baseline in the National Weight Control Registry¹

Characteristic	Value
Age (y)	47.4 ± 12.5 ²
BMI (kg/m ²)	24.7 ± 4.3
Weight (kg)	70.2 ± 14.8
Weight loss from maximum weight (kg)	32.1 ± 17.8
Duration at 13.6-kg weight-loss criterion (y)	6.5 ± 8.1
Sex (% female)	78.5
Ethnicity (% white)	96.0
Education (%)	
High school	11.2
Some college	34.2
College	25.4
Graduate or professional school	28.9

¹ n = 2400.² $\bar{x} \pm$ SD.

≥ 1 y (5). Participants are recruited through national and local television, radio, magazine, and newspaper advertisements. Persons interested in participating in the registry are asked to call a toll-free number or log on to a website. A consent form and initial questionnaire packets are then mailed to the interested persons. Participants provide information on their lifetime maximum weight, current weight, and approximate dates at which they were at these weights. This information is used to determine whether they meet the eligibility criterion of maintaining a weight loss of ≥ 13.6 kg (30 lb) for ≥ 1 y. All participants volunteered to participate in the registry and were not compensated for their participation in the study. The study was approved by the Miriam Hospital Institutional Review Board for the Protection of Human Subjects in Research.

Of the 4122 registry participants enrolled, 3234 reached their 2-y follow-up time point (2 y after entry into the study): 2492 of the 3234 (77.0%) completed the 2-y assessment. Independent *t* tests comparing the participants who withdrew with those who completed the 2-y assessment showed significant differences in baseline age, body mass index (in kg/m²), body weight, and magnitude below maximum lifetime weight. At baseline, persons who subsequently dropped out were younger ($\bar{x} \pm$ SD age: 42.4 ± 12.3 compared with 47.1 ± 12.6 y; *P* = 0.0001), weighed more (74.5 ± 17.5 compared with 70.0 ± 14.6 kg; *P* = 0.02), had a higher body mass index (25.2 ± 5.0 compared with 24.6 ± 4.3; *P* = 0.03), and had lost more weight at entry into the registry (34.9 ± 18.5 compared with 31.8 ± 17.6 kg; *P* = 0.009). Chi-square analyses showed no significant differences in dropout as a function of race or sex. After exclusions were made on the basis of self-reported pregnancy, 2400 of the 2492 formed the sample of the present analyses.

The characteristics of these 2400 participants at entry into the registry are shown in **Table 1**. Almost 80% of the participants were women and 96% were white. The participants had lost an average of 32.1 ± 17.8 kg and had maintained their weight loss for 6.5 ± 8.1 y before enrolling in the study.

Methods

The present study included 3 time points. The time when the subjects initially enrolled in the study will be referred to as

baseline, the time corresponding to 1 y after enrollment will be referred to as *year 1*, and the time corresponding to 2 y after enrollment will be referred to as *year 2*.

Two approaches were used to categorize the regainer and recovery groups. First, we defined *regain* as weighing any amount above baseline at years 1 and 2. *Full recovery* was defined as weighing more than baseline weight at year 1 but re-losing back to baseline or below by year 2. Because this approach could misleadingly classify participants who experienced only minor fluctuations in weight (ie, 1 lb, or 0.45 kg, above or below baseline), we also used a second definition that defined *relapsers* as those weighing ≥ 5% above baseline weight at year 1 and weighing more than their year 1 weight at year 2. *Partial recovery* was defined as gaining ≥ 5% at year 1 but then re-losing ≥ 50% of the year 1 gain at year 2. For all analyses, *maintenance* was defined as maintaining weight at or below the baseline value for 2 y.

Baseline assessments

Participants were asked to provide basic demographic information (sex, age, ethnicity, and highest education level) and a detailed weight-loss history. The reliability and validity of the participants' self-reported weight information was documented previously (6). Information on current dietary intake was obtained with the Block food-frequency questionnaire (10), which yields estimates of daily energy intake. This questionnaire has been shown to correlate significantly with 4-d food diaries (11). The Paffenbarger Activity Questionnaire (12) was used to assess current weekly energy expenditure. This questionnaire has been shown to have a high test-retest reliability (12, 13) and to be significantly correlated with measures of cardiovascular fitness (14).

The 20-item Center for Epidemiologic Studies Depression scale (15) was used to assess depressive symptoms. The validity of this scale in assessing such symptoms has been reported in population-based studies (16). The Eating Inventory (17) was used to assess dietary restraint and disinhibition. Items on the restraint subscale reflect behaviors used to control dietary intake (eg, "consciously control my intake" and "count calories"). The dietary disinhibition subscale measures a person's reported loss of control while eating. Both scales have been found to have good test-retest reliability and internal consistency (17, 18). Stress was assessed by using the 10-item version of Cohen's Perceived Stress Scale (19–21). Items contain information about perceptions of stress over the past month. Test-retest reliability and predictive validity are adequate (19, 20).

Follow-up assessments

At year 1, participants were asked to report their present weight and to again complete the behavioral measures (ie, food-frequency and activity questionnaires) and the psychological measures (Center for Epidemiologic Studies Depression scale, Eating Inventory, and Perceived Stress Scale). At year 2, participants were asked to report only their present weight.

Statistics

SAS version 8.0 (SAS Institute Inc, Cary, NC) was used for all analyses. Descriptive statistics are presented in the tables as either means ± SDs (unadjusted) for continuous measures or as percentages for categorical responses. Normality tests were

TABLE 2
Proportion of participants below their maximum lifetime weight

Relation to maximum weight	Baseline (<i>n</i> = 2400)	Year 1 (<i>n</i> = 2258)	Year 2 (<i>n</i> = 2400)
		%	
At or above maximum weight	0	0.0	0.4
1–9% below maximum weight	0	0.9	3.2
10–19% below maximum weight	11.6	20.1	23.7
20–29% below maximum weight	44.5	41.0	39.3
30–39% below maximum weight	28.2	24.8	22.2
≥ 40% below maximum weight	15.8	13.2	11.3

conducted on continuous variables and indicated that the dependent measures were not normally distributed. Log and square root transformations were attempted to normalize the data but were not successful. Therefore, bivariate relations between participants' characteristics and weight regain or recovery status were examined by using Wilcoxon's test. If there was a significant difference between the weight regain and recovery groups, the variables were entered into a logistic regression model with a stepwise selection procedure. The stepwise procedure was used to evaluate which characteristics measured at baseline, at 1 y, and as the change between baseline and 1 y would predict weight regain or recovery at 2 y. Change scores were calculated as year 1 values minus baseline values. Ranks for the change values were analyzed by using PROC GLM, which carried out analyses of covariance to test the difference between the weight regain and recovery groups with adjustment for the corresponding baseline values.

RESULTS

Regain over 2 y

On average, the participants gained 3.8 ± 7.6 kg between baseline and year 2. Most participants (72.2%; *n* = 1630) were above their baseline weight when reassessed at year 2. However, 99.6% of the sample remained well below their maximum lifetime weight (mean amount below: 28.3 ± 17.8 kg), and 96.4% (*n* = 2314) of the participants remained ≥ 10% below their maximum lifetime weight (Table 2).

Recovery from regain and relapse

Between baseline and year 1, 1483 participants (65.7% of the sample) gained weight above baseline. Of the participants who gained between baseline and year 1, only 11.0% returned to their baseline weight or below at year 2. This represented 7.2% of the entire sample (Figure 1). Even small weight regains were rarely recovered from. Of the participants who gained between 1% and 3% of their initial body weight at year 1 (*n* = 456), only 17.5% were able to return to their baseline weight or below at year 2. Of the participants who gained 3–5% of their initial body weight at year 1 (*n* = 284), only 14.4% were at their baseline weight or below at year 2. Larger weight regains reduced the chances of recovery even more (*P* = 0.0001; Figure 2).

Using our second classification, we found that 25.5% (*n* = 575) of the population relapsed (ie, gained ≥ 5%) between baseline and year 1. Of those, only 12.9% re-lost at least half of their year 1 gain by year 2. Full recovery, defined as a return

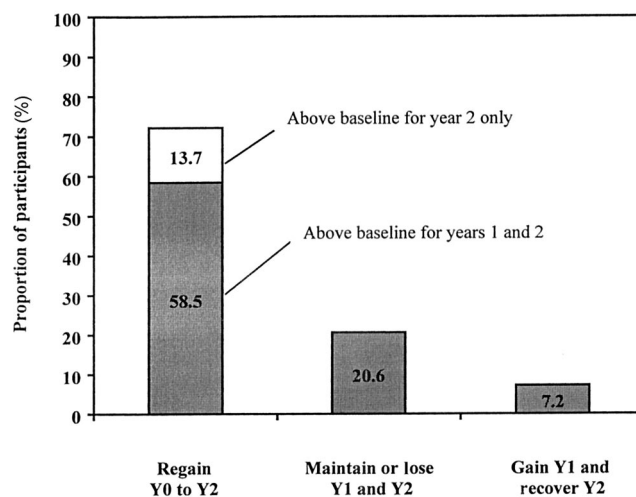


FIGURE 1. Proportion of participants in the National Weight Control Registry who regained weight, maintained their weight, or recovered from weight gains over 2 y. Y0, baseline; Y1, year 1; Y2, year 2. The total number of subjects in each group was as follows: regain Y0 to Y2, *n* = 1630 (above baseline both years: *n* = 1320; above baseline Y2 only: *n* = 310); maintain or lose Y1 and Y2, *n* = 465; and gain Y1 and recover Y2, *n* = 163.

to baseline weight, occurred in only 4.7% (*n* = 27) of the participants who gained ≥ 5% at year 1.

Predictors of relapse compared with recovery

We also examined baseline variables and change between baseline and year 1 to predict who would continue to regain (≥ 5% at year 1, and year 2 ≥ year 1) compared with relapse and partially recover (gained ≥ 5% at year 1 and lose ≥ 50% of weight gain at year 2) at year 2. The following variables were entered into the logistic regression model: magnitude of weight regain, duration of weight maintenance, sex, age, maximum weight, and baseline weight. The results indicated that the magnitude of the weight regain from baseline to year 1 was the only significant predictor of recovery (parameter estimate: 0.045; *P* = 0.02, *r*² = 0.02). Those who recovered had re-

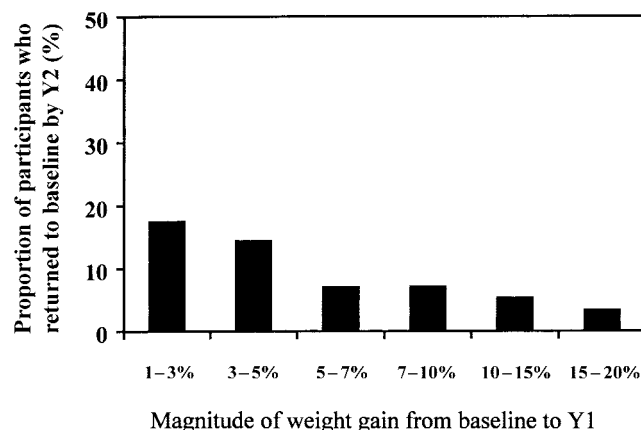


FIGURE 2. Proportion of weight maintainers who recovered (returned to baseline weight) by year 2 (Y2) after gaining various amounts of weight from baseline to year 1 (Y1). The total number of subjects for each group was as follows: 1–3%, *n* = 456; 3–5%, *n* = 284; 5–7%, *n* = 157; 7–10%, *n* = 210; 10–15%, *n* = 170; and 15–20%, *n* = 90. Chi-square = 631.8; *P* = 0.0001.

TABLE 3Behavioral and psychological characteristics of the regainer and recovery groups¹

Behavioral or psychological variable	Regainer group (n = 426)	Recovery group (n = 74)
Block questionnaire, calories consumed (kcal/d)		
Baseline	1385.4 ± 566.3	1411.8 ± 575.7
Year 1	1456.7 ± 638.7	1450.6 ± 572.5
Change	54.3 ± 494.5	4.9 ± 414.0
Paffenbarger Activity Questionnaire (kcal/wk)		
Baseline	2555.0 ± 2213.0	3445.8 ± 3761.9
Year 1	1985.9 ± 1912.4	2373.4 ± 2721.0
Change	-583.4 ± 2007.2	-1013.3 ± 3306.9
CES-D Scale		
Baseline	10.7 ± 9.6	10.1 ± 11.1
Year 1	15.0 ± 11.8	11.8 ± 11.7
Change	4.2 ± 10.0	1.7 ± 10.6 ²
Eating Inventory, restraint		
Baseline	14.8 ± 3.7	15.4 ± 3.8
Year 1	13.8 ± 3.8	14.4 ± 3.9
Change	-1.0 ± 3.1	-0.9 ± 3.7
Eating Inventory, disinhibition		
Baseline	7.8 ± 3.7	7.6 ± 3.7
Year 1	9.0 ± 3.9	8.7 ± 4.4
Change	1.2 ± 2.7	1.0 ± 2.6
Perceived Stress Scale		
Baseline	5.3 ± 3.1	5.0 ± 3.3
Year 1	6.2 ± 3.4	5.1 ± 3.2
Change	1.0 ± 2.9	0.1 ± 3.4

¹ $\bar{x} \pm$ SD. The Block food-frequency questionnaire (10, 11) was used to measure dietary intake, the Paffenbarger Activity Questionnaire (12–14) was used to assess weekly energy expenditure, the Center for Epidemiologic Studies Depression (CES-D) scale (15, 16) was used to assess depressive symptoms, the Eating Inventory (17, 18) was used to assess dietary restraint and disinhibition, and the 10-item version of Cohen's Perceived Stress Scale (19–21) was used to assess stress.

² Significantly different from the regainer group, $P = 0.05$ (analysis of covariance).

gained significantly less at year 1 than did those who failed to recover (6.2 ± 3.0 compared with 7.7 ± 5.6 kg). Both analyses done with and without adjustment for the magnitude of weight regain showed similar findings.

In general, the behavioral characteristics (eg, energy intake and exercise) measured at baseline and year 1 did not differentiate recovery from regain. Psychological differences, however, were found (**Table 3**). Specifically, recovery was significantly related to a smaller overall increase in depressive symptoms from baseline to year 1 ($P = 0.05$). Depression scores in the regainer group increased from 10.7 to 15.0, whereas scores in those who subsequently recovered increased from 10.1 to only 11.8. Logistic regression analyses that controlled for magnitude of initial weight regain showed no significant effect for depressive symptoms or change in depressive symptoms.

DISCUSSION

This is the first longitudinal study to evaluate weight regain and recovery patterns among persons who have been successful at long-term weight loss. The findings indicated that small

weight regains are common, and that few persons recover from even minor lapses of 1–2 kg. This was true whether recovery was defined as a return to baseline weight or as re-losing $\geq 50\%$ of the initial weight regain.

These findings should not overshadow the overall success of the participants in this sample. Although many of the subjects gained weight over the course of 2 y, the weight regains were modest (ie, 3.8 kg). Furthermore, after 2 y, 96.4% of the sample remained $> 10\%$ below their maximum lifetime weight, and the average percentage weight loss from maximum weight was $26.6 \pm 10.7\%$. This amount is 2.5 times what is considered successful by current obesity treatment standards (22).

The small weight gains observed in this study could be considered normative. Population-based prospective studies typically show weight gain occurring in most subsets of the population and averaging 0.70 kg/y (23, 24). Weight regain is even more pronounced in persons who have previously lost weight. In a prospective study of female nurses, for example, participants who lost $\geq 10\%$ of their initial body weight over the course of 2 y gained an average of 2.3 kg/y over the subsequent 4 y (25). The rate of weight regain among registry participants was similar (1.9 kg/y).

In addition to evaluating patterns of weight change, a goal of this study was to identify prospectively who would reverse their weight regain or continue to gain weight. Specifically, we examined changes between baseline and year 1 to predict what would happen between years 1 and 2. The magnitude of the weight regain at year 1 was the strongest predictor of outcome. Participants who gained the most weight at year 1 were the least likely to re-lose weight the following year—both when recovery was defined as a return to baseline weight and when it was defined as re-losing $\geq 50\%$ of the year 1 gain. These findings suggest that reversing weight regain appears most likely among those who have gained the least. Identifying ways to prevent minor lapses from turning into relapses should be a focus of future research.

Aside from the magnitude of the initial weight regain, the only other significant predictor of recovery was smaller increases in depression in the year preceding weight regain. Greater depressive symptoms preceding weight regain was found in other large-scale studies (6, 26). Similarly, Grilo et al (27) identified negative affect (ie, feeling “blue”) as the trigger that almost always resulted in overeating. Rosenthal and Marx (28) noted that approximately one-half of lapses in dieters occur during negative-affect situations when the individual is alone. Drapkin et al (29) reported that participants who rated the negative-affect situations as most difficult were more likely to later lapse in situations involving negative affect. Higher depressive symptomatology may deplete resources previously dedicated to weight control, ultimately leading to relapse.


The present study provided no indication that persons who relapsed between years 1 and 2 could be distinguished by adverse changes in eating and exercise behaviors at year 1. On the one hand, this finding is surprising, because one would expect evidence of behavioral problems developing before weight gain. However, the difference in weight regain between the regainer and recovery groups at year 1 was small (ie, 1.5 kg), and measures of eating and exercise behavior are likely not sensitive enough to detect such small differences (30). The year 1 measures might have been too far removed from the year 1 to year 2 weight regain to capture an effect. It is likely that

differences in exercise and energy intake between the regainer and recovery groups would have been observed at year 2, as was found in other studies (31).

The clinical implications of these findings underscore the importance of thwarting even seemingly minor weight regains from progressing further. Practitioners may need to encourage patients to react immediately to reverse even seemingly minor lapses (eg, 2 lb) and, more importantly, to identify specific strategies for prevention of even small regains. In addition, monitoring patients' depressive symptoms may help practitioners to identify patients at risk of continued relapse. This sample consisted of successful weight losers who, more than anyone, had likely developed the skills necessary to recover from lapses in weight. Given the rarity of recovery in this sample, the chances of recovery in typical samples of dieters could be even smaller.

The major strengths of this study are the large sample size of highly successful weight losers and the prospective design, which allowed us to identify who was at risk of regain or recovery. Prior research examining relapse has generally relied on cross-sectional designs or had limited follow-up. The present study, however, also had several limitations. Because assessments were collected only annually, it was difficult to study the events that immediately preceded or followed weight regain and the factors related to recovery (eg, coping). Obtaining more frequent, detailed assessments could better determine the stability of weight over time, the behavioral and psychological changes that immediately precede weight regain, and the behavioral and psychological processes used by those who regain temporarily but subsequently re-lose the weight. The variables included in this study accounted for only a small proportion of the variance. Inclusion of additional variables (eg, coping) and more frequent assessments might increase the magnitude of variance explained.

Although the follow-up rate was adequate (77%), a response bias may still exist such that persons who chose not to answer the follow-up questionnaires might have been more likely to gain weight. Moreover, participants in the NWCR volunteer to join the study and thus may be healthier, more highly educated, and more motivated than the general population. However, studies evaluating successful weight-loss maintainers have reported weight-control behaviors similar to those reported by the registry participants (32).

In conclusion, we found that recovery from even minor weight regain was rare in this group of successful weight losers. The more weight a person gained, the smaller his or her chances of recovery. Information about participants' psychological status was more useful than information about their behavior in predicting who was likely to recover from relapse 1 y later. Considering these findings, clinicians may need to shift their focus from ways to reverse small weight gains to ways to prevent any amount of weight regain from happening in the first place. 

SP developed the study's research question, oversaw data collection and analysis, and wrote the manuscript. JOH is cofounder of the NWCR and provided significant consultation in the manuscript's preparation. WL conducted the statistical analyses for the study and provided advice in the manuscript's preparation. JRD was responsible for research coordination, including participant recruitment, retention, and data collection. RRW is cofounder of the NWCR and provided significant consultation in developing the research question, data collection and analyses, and manuscript

preparation. The authors had no financial or personal interest in the organization sponsoring this research.

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