HHS Public Access

Author manuscript

Obesity (Silver Spring). Author manuscript; available in PMC 2023 December 01.

Published in final edited form as:

Obesity (Silver Spring). 2022 December ; 30(12): 2404–2413. doi:10.1002/oby.23573.

Recovery from weight regain among long-term weight loss maintainers in WW

Jacqueline F. Hayes[1], **Rena R. Wing**[1], **Suzanne Phelan**[2], **Noemi Alarcon**[2], **Michelle I. Cardel**[3,4], **Gary D. Foster**[3,5]

[1]Warren Alpert Medical School at Brown University & The Miriam Hospital Weight Control & Diabetes Research Center; Providence, RI; USA.

[2]California Polytechnic State University, Department of Kinesiology & Public Health and Center for Health Research; San Luis Obispo, CA.; USA

[3]WW International, Inc.; New York, NY; USA

[4]University of Florida College of Medicine, Department of Health Outcomes & Biomedical Informatics, Gainesville, FL; USA

[5]Perelman School of Medicine, University of Pennsylvania, Center for Weight and Eating Disorders, Philadelphia, PA; USA

Abstract

Objective.—This study sought to understand the process and strategies to recover from regain among weight loss maintainers.

Methods.—Participants in WW (n=2,457) had lost ≥9 kg for ≥1 year and were grouped based on self-reported weight change after maximum loss: Sustained maintenance (“Stable”), ups and downs (“Gain-Lose”) and regain (“Gain”). The groups were compared on weight control strategies, and the Gain-Lose and Gain groups reported on attempts to reverse weight regain.

Results.—Mean weight loss was 28.5 kg and duration of ≥9 kg loss was 3.5 years. During this time, 48% reported weight stability, and the remaining reported some regain (Gain-Lose; 29% or Gain; 23%). Among Gain and Gain-Lose, action to lose regained weight occurred after gaining >4 kg. Compared to Gain, Gain-Lose sustained re-engagement efforts longer (16 vs. 10 weeks) and had better dietary choices (3.4 vs. 3.2), self-monitoring (2.9 vs. 2.7), and psychological coping (2.5 vs. 2.4) scores. Among Gain-Lose, the most successful (< vs. >2.3 kg regain) initiated weight loss efforts after less regain (2.3 vs. 4.5 kg).

Conclusions.—Re-engaging with weight loss after regains may be most successful if focused on diet, self-monitoring, and psychological coping and initiated with less regain.

Contact Information: Jacqueline Hayes, 196 Richmond Street, Providence, RI 02903; Jacqueline_hayes@brown.edu.

Author Contributions:

SP, GDF, MC designed parent study. SP oversaw participant recruitment; JFH, RRW, and SP designed the current supplementary survey measure; SP, NA oversaw data collection; JFH completed the analysis; All authors were involved in writing the paper and had final approval of the submitted and published versions

Keywords

weight loss maintenance; weight regain; commercial weight loss program

Introduction

Although weight loss maintainers have many similar characteristics (1), they are not a homogenous group and have different types of experiences with maintaining their reduced weight over time (2, 3). Even among successful weight loss maintainers, many experience weight fluctuations and gradual, albeit partial, regain over time (1–3). In the National Weight Control Registry (NWCR), individuals who had lost an average of 30 kg and kept it off for 5.7 years were followed over time. Small regains were common, and 35% gained more than 2.3 kgs over a year (3). Among those who gained, some reported a pattern of steady gain (48%) while others reported a series of gains and losses over the year (44%). Smaller weight gains were more easily reversed than larger regains, but other strategies that assisted in reversing regains were not apparent (4). Moreover, given that unsuccessful attempts to reverse weight regain were not documented, it is unclear how many individuals tried but were unable to recover from regain and what distinguished efforts compared to individuals who were better able to reverse weight regain.

Understanding weight patterns and factors that assist in reversing weight regain among weight loss maintainers may be helpful to improve long-term weight loss maintenance. Greater knowledge of effective strategies could have applications for weight loss maintainers who begin to regain weight. Commercial weight loss programs are a common approach to weight loss, and evidence-based programs are recommended by expert organizations (5, 6). WW (formerly Weight Watchers) is a well-known and widely available evidence-based program that focuses on healthy eating, activity, sleep, mindset, and behavioral skills and has demonstrated efficacy for weight loss (7–10). The WW Success Registry has tracked the behaviors and characteristics of long-term weight loss (11–15) maintainers, providing an opportunity to learn more about patterns of regain and their associated strategies in a large sample.

The purpose of this cross-sectional study was to 1) compare the characteristics of successful weight loss maintainers who reported three different patterns of weight change since achieving their lowest weight in WW: maintenance within 5 pounds of their lowest weight, gradual regain, or a series of regains and losses; 2) identify behavioral strategies (i.e., healthy eating, self-monitoring, physical activity, and psychological coping) used by individuals with these three different patterns of weight change; and 3) examine the process of attempts to recover from regains among individuals who did so, including the amount of weight regained before re-engaging in weight loss efforts, reasons for re-engaging, and success with re-engaging.

Methods

Design, Participants, and Procedures

The WW Success Registry (WWSR) is a registry of WW users who achieved a long-term substantial weight loss (11–15). To be a part of the registry, participants had to be 18 years or older and maintain a weight loss of 9.1 kg (20 lb) or more for 1 year or more. All WWSR participants lost weight using WW, but continued enrollment in WW was not required. Although the percentage of weight loss would vary based on an individual's starting weight, a loss of 9.1 kg (20 lb) would be a clinically significant (10%) weight loss for an individual whose starting weight is 91 kg (200 lb). Participants were recruited during workshops focused on weight maintenance strategies. If interested, participants completed online screening, consent, and enrollment on a website hosted by California Polytechnic State University, San Luis Obispo. All questionnaires were administered remotely via REDCap. Automated checks were put in place to confirm any out-of-range values and logic checks were used to prevent survey bots. The survey was distributed 2019–2020.

Measures

All measures were collected at study entry. To avoid bias, validated questionnaires were used where possible.

Demographics and Weight History.—Participants were asked to provide standard demographic information (e.g, age, race/ethnicity, education), weight history (e.g., highest lifetime weight), and self-reported height and weight. Participants also provided WW specific information, including WW start age, starting weight, and the lowest weight achieved in WW.

Criteria for Defining Stable Weight, Gain-lose, and Gain Groups.—All participants were asked to choose one of three statements that best described their weight pattern since achieving their lowest weight in WW. Participants who responded "I have maintained my weight (+/− 5 lbs) and remain at that weight now" were categorized as Stable. Participants who chose, "I have experienced a series of weight re-gains and weight losses before reaching my current weight" were categorized as Gain-Lose. Participants who chose, "I have gradually regained weight until reaching my current weight" were categorized as Gain. This question is similar to the one asked of NWCR participants, although the WWSR question referenced weight pattern since the lowest weight (as opposed to the past year) and did not include an option to endorse a pattern of losing weight (1, 3). These self-reported patterns were used to classify participants into analysis groups and did not consider self-reported weight measurements at the time of the survey.

Coping with Weight Regain Questionnaire.—The Coping with Weight Regain Questionnaire was created by the authorship team and is available as supplementary material. The purpose of the questionnaire was to collect information about if and when individuals attempt to lose regained weight and the methods and motivations behind their decisions, therefore only the Gain-Lose and Gain groups were asked to complete the questionnaire. The Gain-Lose group was asked to indicate the smallest and largest amount

of weight regain before re-engaging in weight loss efforts. Given the Gain group did not report having any further periods of weight loss, they were first asked to indicate if they had attempted to lose regained weight and then if so, at what weight they attempted weight loss. Subsequent questions asked about why participants re-engaged at the weights they had indicated, their use of WW in weight loss re-engagement attempts, and the difficulty, length, and weight loss of typical re-engagement efforts. Many of the items were adapted from those asked in the NWCR and reflected common methods and motivations previously cited in weight loss maintainers about their initial weight losses (1, 3, 4). The Coping with Weight Regain Questionnaire was not previously validated.

Weight Control Strategies Scale (WCSS).—The 30-item WCSS is a self-report questionnaire regarding how often they use specific behaviors thought to facilitate weight loss (16). Four subscales represent different behavioral domains: Dietary Choices, Self-monitoring, Physical Activity, and Psychological Coping. The dietary choices subscale (10 items) involved questions about low-calorie or low-fat food consumption as well as high fat food and caloric beverage consumption. The self-monitoring subscale (7 items) involved questions about recording calories, setting a calorie goal, self-weighing and tracking weight, and tracking exercise. Physical activity questions (6 items) included questions about goal-setting and contingency planning around exercise as well as frequency and duration of exercise. Psychological coping strategies (7 items) involved questions around problem solving setbacks and recognizing and changing negative thought processes related to weight control. Response options are on a Likert scale from 0 (never) to 4 (always) and scores are averaged for a total WCSS score and subscale scores. The scale has good reliability and convergent validity to more detailed measures of diet and physical activity (16).

Three-Factor Eating Questionnaire (TFEQ).—The well-validated and commonly used 51-item TFEQ measures trait eating styles, including dietary restraint, disinhibition, and hunger (17). Higher scores represent greater endorsement of the trait.

Self-Weighing Frequency.—Self-weighing frequency was assessed by the question, “Currently, how often do you weigh yourself?” Response options, which included several times per day, 1 time per day, several times per week, 1 time per week, and 1 time per month, were collapsed into 2 categories for data analysis: at least weekly or less than weekly.

Paffenbarger Physical Activity Questionnaire (PPAQ).—The PPAQ measures leisure-time physical activities. Participants report on walking, climbing stairs, and sports and recreational activities in the past week. For each activity, the amount of kilocalories expended is calculated and summed together to equal total weekly energy expenditure (18).

Statistical Analysis

Data were examined for normality visually using histograms, Q-Q plots, and stem-and-leaf plots. Normally distributed data are presented as means and group differences were assessed using t-tests (2 groups) and Analysis of Variance (ANOVA) (3 groups). Non-normally distributed data are presented as medians and group differences were assessed using

non-parametric Kruskal-Wallis and Mann-Whitney tests. Chi-squared tests were used for categorical variables. If a participant was missing a response to a variable, they were not included in the analysis of that specific variable. To guard against type 1 error due to multiple analyses, statistical significance was set to $p < 0.01$. Comparisons were made between all three weight pattern groups with the exception of the Coping with Weight Regain questionnaire, on which the Gain-Lose and Gain groups were compared. Notably, these categorizations were derived from self-reported weight patterns and were not based on self-reported weight. However, 23% percent of the stable group were not within 2.3 kg of their lowest weight. A sensitivity analysis was conducted with the removal of self-identified stable individuals who were more than 2.3 kg above their lowest weight and results did not change, thus the entire sample is presented. Since some Gain-Lose group had maintained their weight losses more successfully than others, additional analyses compared individuals in the Gain-Lose group who were more successful (were within 2.3kg of their lowest WW weight at the time of the study) to individuals in the Gain-Lose group who were less successful (above 2.3kg of their lowest WW weight). The cut-off of 2.3 kg was chosen as it was the criteria used to define the Stable group (i.e., +/− 5 lbs), has been used previously in weight loss maintainer samples (3), and is approximately 3% regain from the lowest WW weight of the sample, which is a recommended cut-off for defining weight maintenance (19).

Results

Participants

A total of 2,788 WW members completed the survey, and 2,457 (88%) responded to the question asking about weight pattern, making them eligible for participation in the current study. All 2,457 were included. The majority of participants were female, White, and highly educated, with an average age of 60.2 years and an average current BMI of 26.7 (Table 1). Participants reported that they had lost a median of 26.3 kg (an average of 28.7% of their initial body weight) from the start of the WW program; the median duration of maintenance was 3.5 years. The lowest average weight was 64.4 kg and the median current weight was 69.1 kg.

Characteristics of the Gain-lose, Gain, and Stable Groups

Approximately half of the sample (48.1%) self-identified their weight maintenance pattern as Stable, 28.9% as Gain-Lose, and 23% as Gain. Differences among the groups are presented in Tables 1 and 2. Examining actual weight maintenance (calculated as < 2.3 kg difference between lowest reported weight and current weight), 77% of the Stable group, 24% of the Gain-Lose group, and 5% of the Gain group were 2.3 kg or less above their lowest weight.

Compared to the Stable group, the Gain-Lose and Gain groups were younger, had a higher current BMI and lifetime maximum weight, started WW at a younger age and higher weight, and, despite Gain-Lose losing the most weight (30%), were at a higher weight than Stable when they reached their lowest WW weight) (Table 2). Compared with Stable, the Gain-Lose and Gain groups also reported more difficulty and effort maintaining their current weight and the Gain group was more likely to be employed versus retired.

Compared with Stable group, the Gain and Gain-Lose groups reported less frequent use of nearly all weight control strategies, and the Gain group reported less frequent use than Gain-Lose (Table 2). This pattern was true for most types of weight control strategies, with the exception of physical activity, which was similar among the Gain-Lose and Gain groups. Compared with Stable, the Gain-Lose and Gain groups also scored higher on disinhibition and hunger; no significant differences were found on restraint.

Differences in Coping with Regain among the Gain-lose Group and the Gain Group

Both the Gain-Lose and Gain groups reported regaining 3.6 kg or more before efforts to reverse the gains were pursued. However, the groups differed in duration of maintaining efforts to reverse the regain. The Gain-Lose group maintained their efforts to reverse the regain for 16 weeks vs 10 weeks for the Gain group, lost 2.7 kg more, and reported less difficulty losing regained weight than the Gain group (Table 3).

In response to the question about why weight loss efforts weren't reinitiated sooner, the most common answer given by both groups was that they had thought about reinitiating but had low motivation. The Gain-Lose group was more likely than the Gain group to report that they did not initiate efforts sooner because they were too busy and did not have the time to devote to weight loss, whereas the Gain group was more likely to report that they didn't believe the regain was permanent. When asked why they didn't wait for greater regain before re-engagement, both groups had similar responses ($p=0.605$), with health concerns being the most common response, followed by noticing that clothes were fitting tighter.

Both the Gain-Lose and the Gain groups were very likely to use WW to re-engage, primarily citing the reason to be that WW had been effective previously. When WW was not used, the most common response by the Gain-Lose group was that a different program had been recommended, whereas the Gain group was more likely to report that they felt they could do it on their own. For the Gain-Lose group, the most common strategy for re-engaging after both small and large regains was to start self-monitoring/recording, followed by healthy eating, changing their mindset, and exercise (this question was not asked of the Gain group, as it would have been a pre-requisite that an individual be attempting weight loss).

Analyses within the Gain-Lose group that compared the more successful (who were within 2.3kg of their lowest WW weight at the time of the study; 24%; N = 167) to those who were less successful (above 2.3kg of their lowest WW weight; 76%, N=541) showed that more successful individuals were more likely to re-engage after smaller weight regains than less successful individuals (2.3 vs. 4.5 kg for smallest amount regained before losing, $H=19.75$, $p<0.001$, and 9.1 vs. 13.6 kg for largest amount regained before losing, $H=13.82$, $p<0.001$). No differences in the length of re-engagement attempt, typical weight loss during the attempt, or the difficulty experienced with the attempt were reported by more successful compared to less successful Gain-Lose group members. Furthermore, the reasons for re-engaging were generally similar, although successful individuals were more likely to endorse re-engaging with weight loss attempts due to health concerns than less successful individuals, $X^2=11.21$, $p=0.047$.

Discussion

Approximately half of the long-term successful weight loss maintainers in the WWSR reported maintaining their initial weight loss over more than 3 years whereas the other half reported experiencing some weight regain. Most initiated efforts to lose regained weight via WW and did so after regaining 3.6 kg or more. People who had the most success in losing some of the regained weight tended to act sooner, sustain re-engagement efforts longer, and demonstrated more frequent use of dietary, self-monitoring and psychological coping strategies. These strategies are potentially important for reversing weight regain.

This study sample of long-term successful weight loss maintainers had lost approximately 28% of their starting weight, or about 25 kg, and had only regained about 3 kg after a median of more than 3 years of follow-up. Almost half (48%) of the sample reported that they had continuously maintained their weight loss. This Stable group embodied the characteristics found in previous research in weight loss maintainers to the greatest degree (e.g., high levels of physical activity) (1, 2). The other 52% reported that they had experienced some weight regain over time; 29% reported a series of gains and losses and 23% reported gradual weight regain, which aligns with previous work (3, 4). The percentage of participants reporting weight fluctuations in the WWSR was slightly lower than rates in NWCR (29% vs 39% [recalculated to match current study criteria], respectively) (3). The WWSR sample had a slightly lower magnitude of initial weight loss and were maintaining weight loss for a shorter duration, which may account for the lower rate of fluctuations (1, 3). Moreover, NWCR findings were based on prospective measures of weight over the course of a year while in the current study, patterns were based on retrospective reports that asked about weight changes from lowest weight achieved.

A common characteristic of the weight loss maintainers who regained some weight was to try and reverse the regain. Prior studies have assessed objective weight changes in weight loss maintainers over time (4); however, these objective data do not provide information about how many individuals who experience weight regain *attempt* to lose it. In other words, it is unclear if continued regains that have been observed previously are the result of weight loss maintainers having minimal success reversing weight regain or if they are the result of individuals not trying to counteract weight regain at all. The current study suggests the former explanation and showed that 92% of weight loss maintainers in the Gain group (21% of the total sample) reported trying to re-engage with weight loss efforts after regaining a median of 15 pounds, but did not lose a substantive amount.

Identifying strategies used by the Gain-Lose group that are different from the strategies used by the Gain group may highlight effective strategies weight loss maintainers can use to combat weight regain. The Gain-Lose group differed from the Gain group in a number of ways. For one, the Gain-Lose group appeared to resume weight loss efforts after a smaller amount of regain and sustained their weight loss efforts longer, with the most successful among the Gain-Lose group intervening after the least amount of weight regain. Phelan and colleagues have also demonstrated how important early re-engagement attempts are in successful recovery within long-term maintainers (4). Additionally, a study of young adults in a weight gain prevention program also showed participants were more likely to recover if

they had gained less weight (20). Restarting weight loss endeavors as early as possible after weight regain appears very important in overall success.

Additionally, similar to the Stable group, the Gain-Lose group were more likely than the Gain group to report more frequent self-weighing as well as more frequent self-monitoring and healthy dietary choices, which are robust strategies for weight management and primary components of WW and other evidence-based behavioral weight loss interventions (21). Psychological coping, which includes strategies such as self-reinforcement, problem solving, and restructuring negative thoughts, was also used more frequently by the Gain-Lose group than by Gain group. Weight regain during maintenance has been associated with greater psychological burden, including boredom with weight control efforts, greater effort and lower importance of “staying on track”, and greater temptation to eat high calorie foods and skip planned physical activity (22). Psychological coping strategies may be particularly helpful in addressing these emotional and cognitive difficulties of engaging in weight control behaviors during maintenance.

The most common reason for initiating efforts to lose regained weight by both the Gain-Lose group and Gain group was health concerns. Medical reasons are also one of the most common triggers for losing weight initially in weight loss maintainers and are often associated with better long-term weight maintenance (23–25). Individuals have also been shown to shift their motives while in weight loss maintenance more towards health and well-being (26), perhaps due to observed physical benefits of a lower weight and/or the greater potential for disease as one ages (27). The current study extends these findings to indicate that health issues are also a trigger for re-engagement in weight loss following regain. The second most common reason for taking action to reverse weight gain was noticing clothes were fitting tighter, which was previously reported as a motivator to initiate weight loss among WWSR members (25). Clothes may serve as a physical indicator of sizeable weight regain that is more salient than the number on the scale. The reasons did not differ among the Gain-Lose and Gain groups, despite their differences in reported weight loss following weight loss efforts. It may be that the trigger for the weight loss effort is less significant than the motivation and ability to sustain the behaviors associated with weight loss.

Notably, while differences between the Gain-Lose group and the Gain groups were statistically significant, many of the differences were small - even on a 4-point scale - and not clinically significant. Moreover, both groups were still frequently employing weight loss strategies. For example, scores on the WCSS in the Gain-Lose group were only 0.1 to 0.2 higher than the Gain group and the average scores reflected that both groups were using all the domains of strategies more than half the time. Additionally, only 3% more of individuals in the Gain-Lose group reported self-weighing at least weekly compared to the Gain group (and both were over 90%). Relatedly, both groups remained highly successful despite small regains (which were only a small fraction of total weight lost) and the median amount of weight regained was very similar (the Gain-Lose group regained 5.4 kgs and the Gain group regained 6.8 kgs). This finding suggests that the differences among the groups may be more in the perceptions of their regain pattern, rather than in the actual amount of regain.

A primary limitation the current study was the use of a non-validated questionnaire to assess weight loss reengagement. Relatedly, participants were categorized into groups based on their response to a forced-choice question that did not include all the possible patterns of weight change (e.g., rapid weight regain, regain then a recovery that is maintained, continued weight loss), did not account for the magnitude or previous history of regains/losses, included a specific cut-off for maintenance (± 2.3 kg) which did not take into account starting weight, and did not always align with observed weight regain (e.g., only 77% of the Stable group were actually within 2.3 kg of their lowest weight, although sensitivity analyses indicated removal of those more than 2.3 kg above did not affect outcomes). Questionnaire responses, including weight measurements, were also self-reported and retrospective. The Gain-Lose group may also have increased their use of weight control strategies during periods when they were initiating efforts to lose weight and decreased use during periods when they were weight stable or regaining; such changes in behavior were not assessed and may provide more insight into use of behavioral strategies. Future work could track weight loss maintainers experiences in real time and explore more subtle differences in weight change and behavioral patterns. Additionally, this study focused exclusively on long-term successful weight loss maintainers in WW, with participants who lost approximately 28% of their starting weight, or over 25 kg, and only regained about 3 kg. This is not typical of most participants in behavioral weight loss programs, who achieve less weight loss and greater regain than this sample (12,13), so it may be difficult to generalize these findings to those who are less successful or weight loss maintainers who used a different program to lose weight. Generalizability is also limited to primarily White, higher income populations. Rates of obesity and related comorbidities are higher among Black and Hispanic populations (28) as well as in individuals, particularly women, of lower socioeconomic classes (29). Research into the experiences of individuals who have lost less weight or regained back more as well as more socially disadvantaged groups are important in future research. The sample was also one of convenience and included only the individuals who attended the weight maintenance workshops and chose to participate in the survey. Individuals who did not participate in these workshops or chose not to respond may have been less successful in their weight loss or weight loss maintenance efforts. On the other hand, strengths of the study include a large sample size from an empirically validated and widely available weight management program and comparisons among different self-reported patterns of weight change following successful weight loss.

Conclusion

In this sample of highly successful weight loss maintainers, approximately half reported that they were still maintaining their weight loss more than 3 years later. The others were divided between those who reported that they had gained and then lost weight over time and those who gradually gained weight. An important factor in success appeared to be taking action in response to small weight gains, and lack of motivation often prevented these actions. Frequent use of self-monitoring (weight, energy-balance behaviors), dietary, and psychological coping strategies may be beneficial to include in interventions designed to reverse regains and support long-term weight loss maintenance.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding:

This research was supported by a grant from WW International, Inc. JFH is supported by NIH NIDDK (K23 DK128561)

Disclosure:

SP reports receiving a research grant from WW International, Inc.; MIC and GDF are employees and shareholders in WW International, Inc; RRW is on the advisory board of Noom

References

1. Thomas JG, Bond DS, Phelan S, Hill JO, Wing RR. Weight-loss maintenance for 10 years in the National Weight Control Registry. American journal of preventive medicine. 2014;46(1):17–23. [PubMed: 24355667]
2. Ogden LG, Stroebele N, Wyatt HR, Catenacci VA, Peters JC, Stuht J, et al. Cluster analysis of the national weight control registry to identify distinct subgroups maintaining successful weight loss. Obesity. 2012;20(10):2039–47. [PubMed: 22469954]
3. McGuire MT, Wing RR, Klem ML, Lang W, Hill JO. What predicts weight regain in a group of successful weight losers? Journal of consulting and clinical psychology. 1999;67(2):177. [PubMed: 10224727]
4. Phelan S, Hill JO, Lang W, Dibello JR, Wing RR. Recovery from relapse among successful weight maintainers. The American journal of clinical nutrition. 2003;78(6):1079–84. [PubMed: 14668267]
5. Garvey WT, Mechanick JI, Brett EM, Garber AJ, Hurley DL, Jastreboff AM, et al. American association of clinical endocrinologists and American college of endocrinology comprehensive clinical practice guidelines formedical care of patients with obesity. Endocrine Practice. 2016;22:1–203.
6. Jensen MD, Ryan DH, Apovian CM, Ard JD, Comuzzie AG, Donato KA, et al. 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society. Journal of the American college of cardiology. 2014;63(25 Part B):2985–3023. [PubMed: 24239920]
7. Gudzune KA, Doshi RS, Mehta AK, Chaudhry ZW, Jacobs DK, Vakil RM, et al. Efficacy of commercial weight-loss programs: an updated systematic review. Annals of internal medicine. 2015;162(7):501–12. [PubMed: 25844997]
8. Ahern AL, Wheeler GM, Aveyard P, Boyland EJ, Halford JC, Mander AP, et al. Extended and standard duration weight-loss programme referrals for adults in primary care (WRAP): a randomised controlled trial. The Lancet. 2017;389(10085):2214–25.
9. Pinto AM, Fava JL, Hoffmann DA, Wing RR. Combining behavioral weight loss treatment and a commercial program: a randomized clinical trial. Obesity. 2013;21(4):673–80. [PubMed: 23404824]
10. Johnston CA, Rost S, Miller-Kovach K, Moreno JP, Foreyt JP. A randomized controlled trial of a community-based behavioral counseling program. The American Journal of Medicine. 2013;126(12):1143. e19–. e24.
11. Pascual RW, Phelan S, La Frano MR, Pilolla KD, Griffiths Z, Foster GD. Diet quality and micronutrient intake among long-term weight loss maintainers. Nutrients. 2019;11(12):3046. [PubMed: 31847176]
12. Phelan S, Roake J, Alarcon N, Ng SM, Glanz H, Cardel MI, et al. In their own words: Topic analysis of the motivations and strategies of over 6,000 long-term weight-loss maintainers. Obesity. 2022.
13. Roake J, Phelan S, Alarcon N, Keadle SK, Rethorst CD, Foster GD. Sitting time, type, and context among long-term weight-loss maintainers. Obesity. 2021;29(6):1067–73. [PubMed: 34029443]

14. Young J, Phelan S, Alarcon N, Roake J, Rethorst CD, Foster GD. Factors associated with food choice among long-term weight loss maintainers. Journal of Human Nutrition and Dietetics. 2021.
15. Phelan S, Halfman T, Pinto AM, Foster GD. Behavioral and psychological strategies of long-term weight loss maintainers in a widely available weight management program. Obesity. 2020;28(2):421–8. [PubMed: 31970912]
16. Pinto AM, Fava JL, Raynor HA, LaRose JG, Wing RR. Development and validation of the weight control strategies scale. Obesity. 2013;21(12):2429–36. [PubMed: 23512914]
17. Stunkard AJ, Messick S. The three-factor eating questionnaire to measure dietary restraint, disinhibition and hunger. Journal of psychosomatic research. 1985;29(1):71–83. [PubMed: 3981480]
18. Paffenbarger RS Jr, Wing AL, Hyde RT. Physical activity as an index of heart attack risk in college alumni. American Journal of epidemiology. 1978;108(3):161–75. [PubMed: 707484]
19. Stevens J, Truesdale KP, McClain JE, Cai J. The definition of weight maintenance. International journal of obesity. 2006;30(3):391–9. [PubMed: 16302013]
20. Hayes JF, Tate DF, Espeland MA, LaRose JG, Gorin AA, Lewis CE, et al. Patterns of weight change in a weight gain prevention study for young adults. Obesity. 2021;29(11):1848–56. [PubMed: 34549535]
21. Burke LE, Wang J, Sevick MA. Self-monitoring in weight loss: a systematic review of the literature. Journal of the American Dietetic Association. 2011;111(1):92–102. [PubMed: 21185970]
22. Ross KM, Qiu P, You L, Wing RR. Week-to-week predictors of weight loss and regain. Health Psychology. 2019;38(12):1150. [PubMed: 31566400]
23. Klem ML, Wing RR, McGuire MT, Seagle HM, Hill JO. A descriptive study of individuals successful at long-term maintenance of substantial weight loss. The American journal of clinical nutrition. 1997;66(2):239–46. [PubMed: 9250100]
24. Gorin AA, Phelan S, Hill JO, Wing RR. Medical triggers are associated with better short-and long-term weight loss outcomes. Preventive medicine. 2004;39(3):612–6. [PubMed: 15313102]
25. Phelan S, Roake J, Alarcon N, Ng SM, Glanz H, Cardel MI, et al. In their own words: Topic analysis of the motivations and strategies of over 6,000 long-term weight-loss maintainers. Obesity (Silver Spring). 2022;30(3):751–61. doi: 10.1002/oby.23372. [PubMed: 35137557]
26. Poulimeneas D, Anastasiou CA, Kokkinos A, Panagiotakos DB, Yannakoulia M. Motives for weight loss and weight loss maintenance: results from the MedWeight study. Journal of Human Nutrition and Dietetics. 2021;34(3):504–10. [PubMed: 33493356]
27. LaRose JG, Leahey TM, Hill JO, Wing RR. Differences in motivations and weight loss behaviors in young adults and older adults in the National Weight Control Registry. Obesity. 2013;21(3):449–53. [PubMed: 23404944]
28. Stierman B, Afful J, Carroll M, Chen T, Davy O, Fink S, et al. National health and nutrition examination survey 2017–march 2020 prepandemic data files-development of files and prevalence estimates for selected health outcomes. National Health Statistics Reports. 2021.
29. Ogden CL, Fakhouri TH, Carroll MD, Hales CM, Fryar CD, Li X, et al. Prevalence of obesity among adults, by household income and education—United States, 2011–2014. MMWR Morbidity and mortality weekly report. 2017;66(50):1369. [PubMed: 29267260]

Study Importance Questions:

- What is already known about this subject?
  - Many long-term successful weight loss maintainers regain some weight and can have difficulty reversing regains
- What are the new findings in your manuscript?
  - Re-engaging with weight loss efforts following regain was common in weight loss maintainers, and most restarted efforts after regaining 4 kg or more.
  - Individuals with less regain and those who had better scores on dietary choices, self-monitoring, and psychological coping strategies scales had greater success reversing weight regain
- How might your results change the direction of research or the focus of clinical practice?
  - Weight loss re-engagement efforts should occur after small weight regains and include a focus on diet, self-monitoring, and coping

Table 1.

Participant Baseline Characteristics (N= 2457) presented as N(%) or M±SD

Variable	Total N=2457	Gain-Lose N= 709 (29%)	Gain N=565 (23%)	Stable N=1183 (48%)	Test Statistic	p
Gender					X^2=0.62	0.617
Male	125 (5.1%)	5.6%	4.4%	5.1%		
Female	2332 (94.9%)	94.4 %	95.6%	94.9%		
Age	60.2 ± 10.8	59.7 ± 10.9 [a]	58.9 ± 10.7 [a]	61.2 ± 10.7 [b]	F=10.14	<0.001
Race					X^2=4.62	0.329
White	2303 (93.7%)	666 (94.6%)	517 (91.8%)	1096 (93.4%)		
Black	82 (3.3%)	20 (2.8%)	21 (3.7%)	34 (2.9%)		
Other	16 (0.7%)	18 (2.6%)	25 (4.4%)	44 (3.7%)		
Ethnicity					X^2=0.52	0.773
Hispanic	75 (3.1%)	23 (3.3%)	19 (3.4%)	33 (2.8%)		
Non-Hispanic	2342 (96.9%)	674 (96.7%)	540 (96.6%)	1128 (97.2)		
BMI	26.7 ± 5.4	26.8 (6.2)[a]	26.9 (6.6)[a]	24.1 (3.8)[b]	H=339.95	<0.001
BMI Category					X^2=279.5	<0.001
<25	1103 (44.9%)	215 (30.3%) [a]	172 (30.5%) [a]	716 (60.6%) [b]		
25 – 29.9	883 (35.9%)	291 (41.0%) [a]	225 (39.9%) [a]	367 (31.0%) [b]		
>30	469 (19.1%)	203 (28.6%) [a]	167 (29.6%) [a]	99 (8.4%) [b]		
Household Income					X^2=17.48	0.133
Less than $25,000	75 (3.1%)	19 (2.7%)	25 (4.4%)	31 (2.6%)		
$25,000-$49,999	246 (10.0%)	75 (10.6%)	66 (11.7%)	105 (8.9%)		
$50,000 – $74,999	444 (34.8%)	121 (17.1%)	105 (18.6%)	218 (18.4%)		
$75,000 – $99,999	412 (16.8%)	136 (19.2%)	79 (14.0%)	197(16.7%)		
$100,000 – $149,999	525 (21.4%)	161 (22.7%)	132 (23.4%)	232 (19.6%)		
$150,000 – $199,999	255 (10.4%)	64 (9.0%)	64 (11.3%)	127 (10.7%)		
$200,000 and more	232 (9.4%)	72 (10.2%)	48(8.5%)	112 (11.0%)		
Missing	268 (10.9%)	61 (8.6%)	46 (8.1%)	161 (13.6%)		
Highest Education					X^2=8.90	0.351
High School or less	151 (6.1%)	35 (5.0%)	40 (7.1%)	76 (6.4%)		
Vocational Training	95 (3.9%)	24 (3.4%)	21 (3.7%)	50 (4.2%)		
Some College (less than 4 years)	469 (19.1%)	122 (17.3%)	121 (21.4%)	226 (19.2%)		
College/University Degree	829 (33.7%)	245 (34.7%)	187 (33.1%)	397 (33.7%)		
Graduate/Professional Degree	907 (36.9%)	281 (39.7%)	196 (34.7%)	430 (36.5%)		
Employment Status					X^2=29.69	<0.001
Employed for wages	1048 (42.7%)	312 (44.0%)[a,b]	279 (49.4%) [a]	457 (38.6%) [b]		
Self-employed	149 (6.1%)	37 (5.2%) [a]	30 (5.3%) [a]	82 (6.9%) [a]		
Retired	990 (40.3%)	274 (38.6%) [a]	193 (34.2%) [a]	523 (44.2%) [b]		
Other	91 (3.7%)	51 (7.2%) [a]	40 (7.1%) [a]	56 (4.7%) [a]		
Missing	123 (5%)	35 (4.9%)	23 (4.1%)	65 (5.5%)		

Table 2.

Weight History and Behavioral Characteristics of Gain-Lose (series of weight gains and losses, N=709), Gain (gradual weight regain, N=565), and Stable (weight ±5 lbs. lowest weight, N=1183) groups

	TOTAL	Gain-Lose N= 709 (29%)	Gain N=565 (23%)	Stable N=1183 (48%)	Test Statistic	p-value
Current weight	69.1 (17.2)	72.6 (20.0)^{a}	73.5 (18.1)^{a}	65.3 (13.2)^{b}	H=284.97	<0.001
Highest weight	95.3 (29.5)	99.3 (33.1)^{a}	97.5 (26.8)^{a}	92.5 (29.9)^{b}	H=44.48	<0.001
Difficulty maintaining current weight (1–7 scale)	4.0 ± 1.1	4.2 ± 1.1^{a}	4.3 ± 1.1^{a}	3.8 ± 1.0^{b}	F=67.68	<0.001
Effort maintaining current weight (1–7 scale)	4.6 ± 1.3	4.7 ± 1.3^{a}	4.7 ± 1.3^{a}	4.4 ± 1.3^{b}	F=19.15	<0.001
WW start age	52.3 ± 12.1	50.7 ± 12.4^{a}	50.7 ± 11.7^{a}	54.0 ± 11.8^{b}	F=23.44	<0.001
WW start weight	90.7 (27.2)	95.3 (30.4)^{a}	92.5 (25.4)^{b}	87.5 (25.9)^{c}	H=67.71	<0.001
Months maintaining 20 lbs or more weight loss	42 (72)	45 (87)$^{a, b}$	44 (75)^{a}	39 (64)^{b}	H=9.65	0.008
Lowest weight achieved in WW	64.4 (14.1)	65.8 (15.9)^{a}	65.3 (15.0)^{a}	63.5 (13.2)^{b}	H=31.07	<0.001
Percent change from start WW weight to lowest weight in WW	28.7 ± 9.4	30.3 ± 10.0^{a}	28.4 ± 8.6^{b}	28.0 ±9.2^{b}	H=28.91	<0.001
Regain from lowest weight to current weight	2.9 (5.0)	5.4 (7.3)^{a}	6.8 (6.4)^{b}	1.4 (1.4)^{c}	H=1080.8	<0.001
Percentage <2.3 kgs above lowest WW weight	45.1%	23.6% ^{a}	5.3% ^{b}	76.9% ^{c}	X^2=976.4	<0.001
WCSS Total (0–4) ^{a}	2.9 ± 0.5	2.8 ± 0.5^{a}	2.7 ± 0.6^{b}	3.0 ± 0.4^{c}	F=67.19	<0.001
WCSS Dietary Choice	3.4 ± 0.5	3.4 ± 0.4^{a}	3.2 ± 0.6^{b}	3.4 ± 0.4^{c}	F=45.64	<0.001
WCSS Self-Monitoring	2.9 ± 0.7	2.9 ± 0.7^{a}	2.7 ± 0.8^{b}	3.0 ± 0.7^{c}	F=28.67	<0.001
WCSS Physical Activity	2.5 ± 1.0	2.4 ± 1.1^{a}	2.3 ± 1.0^{a}	2.6 ± 1.0^{b}	F=26.62	<0.001
WCSS Psychological Coping	2.6 ± 0.7	2.5 ± 0.7^{a}	2.4 ± 0.7^{b}	2.7 ± 0.6^{c}	F=45.99	<0.001
Percentage with self-weighing frequency ≥ weekly	97%	98%^{a}	94.6%^{b}	97.6%^{a}	X^2=14.30	0.001
TFEQ Restraint	11.3 ± 1.9	11.2 ± 1.9	11.2 ± 2.1	11.4 ± 1.9	F=4.06	0.017
TFEQ Disinhibition	9.6 ± 3.0	10.5 ± 2.8^{a}	10.3 ± 3.1^{a}	9.6 ± 2.8^{b}	F=83.79	<0.001
TFEQ Hunger	5.4 ± 2.2	5.8 ± 2.2^{a}	5.7 ± 2.2^{a}	5.1 ± 2.0^{b}	F=26.00	<0.001
Total weekly energy (kcal) expenditure from physical activity	1400 (2268)	1235 (2139) ^{a}	1147 (2045) ^{a}	1680 (2408) ^{b}	H=30.96	<0.001

Normally-distributed variables are presented as means ± SDs and non-normally distributed data are presented as medians (IQR); Different superscripts denote statistical differences. WCSS=Weight Control Strategies Scale; TFEQ=Three Factor Eating Questionnaire;

^{a}0=Never, 1=Occasionally, 2=About half of the time, 3=Most of the time, 4=Always

Table 3.

Characteristics of Weight Loss Re-engagement Attempts by the Gain-Lose group (n=709), who self-report a series of weight gains and losses, and the Gain group (n=565), who self-report gradual weight regain

	TOTAL	Gain-Lose	Gain	Test Statistic	p-value
Have you ever tried to lose any of the weight you've regained (% Yes) [1]		-	91.7%	-	-
How much weight did you regain before deciding to actively try losing weight again? [1]		-	6.8 (7.7)	-	-
What is the smallest amount of weight you've regained before restarting weight loss efforts?		3.6 (4.5)	-	-	-
When you've tried to re-lose this small amount of weight, what has been your primary strategy?				-	-
Changed mindset		15%	-		
Restarted healthy eating		33.9%	-		
Restarted healthy exercise		2.4%	-		
Starting recording		44.6%	-		
Why didn't you initiate weight loss efforts with<u>more</u>regain (e.g. why didn't you wait until you regained a larger amount of weight)?				X^2=3.62	P=0.605
Already noticing clothes were tighter	22.1%	20.7%	23.9%		
Told by a medical professional	2.9%	3%	2.8%		
Receiving comments about regain	0.7%	0.6%	0.8%		
Felt physical effects of regain	13.1%	13.3%	12.8%		
Unhappy with appearance	15.6%	14.8%	16.8%		
If didn't act soon, health would suffer	45.6%	47.6%	43.0%		
What is the largest amount of weight you've regained before restarting weight loss efforts?		13.6 (15.9)	-	-	-
When you tried to re-lose this larger amount of weight, what was your primary strategy?				-	-
Changed mindset		14.9%	-		
Restarted healthy eating		29.2%	-		
Restarted healthy exercise		2.4%	-		
Starting recording		49.7%	-		
Why didn't you initiate weight loss efforts with<u>less</u>regain (e.g. a smaller amount of weight regained)?				X^2=58.19	P<0.001
Believed not permanent regain	25%	17.1%[a]	34.1%[b]		
Busy and no time	17.6%	22.8%[a]	11.6%[b]		
Didn't realize	12.9%	14.0%[a]	11.6%[a]		
Thought about it, but no motivation	38.9%	38.9%[a]	38.9%[a]		
Thought about it, but too much effort	3.8%	5.1%[a]	2.2%[b]		
Avoidance of neg emotions/discomfort	1.8%	2.1%[a]	1.6%[a]		
When you've re-started weight loss efforts, how often have you used WW?				X^2=26.39	P<0.001
Never	1.5%	1.7%[a]	1%[a]		
Occasionally	4.3%	4.6%[a]	4%[a]		
Sometimes	5.8%	6.6%[a]	4.7%[a]		

	TOTAL	Gain-Lose	Gain	Test Statistic	p-value
Often	23.6%	28.2%[a]	17.4%[b]		
Always	64.8%	58.9%[a]	72.9%[b]		
When you have re-started WW, what was the primary reason? (n=1179) [2]				X^2=16.75	P=0.001
Worked the first time	80.5%	84.3%[a]	75.4%[b]		
Already knew how to use	17.6%	13.9%[a]	22.6%[b]		
WW costs less	1.2%	1.3%[a]	1.0%[a]		
Didn't know other options	0.7%	0.4%[a]	1.0%[a]		
When you have<u>not</u>re-started WW, what was the primary reason? (n=396) [3]				X^2=13.86	P=0.008
Bored and wanted something new	8.6%	8%[a]	9.9%[a]		
WW too much effort	15.1%	17.1%[a]	10.7%[a]		
Going back would mean I failed	15.9%	14.5%[a]	19.0%[a]		
Different program recommended	33.5%	37.5%[a]	24.0%[b]		
Felt I could do on my own	27.0%	22.9%[a]	36.4%[b]		
Typically, how easy/difficult has it been to follow a program/diet when trying to lose the regained weight compared to your weight loss experience the time you lost 20 pounds or more using WW?				X^2=15.19	P=0.004
1 - Much easier	12.0%	12.5%[a]	11.3%[a]		
2	8%	9%[a]	6.6%[a]		
3 – About the same	31.2%	34.4%[a]	26.8%[b]		
4	27.3%	24.7%[a]	31.0%[b]		
5 – Much more difficult	21.5%	19.4%[a]	24.3%[b]		
Typically, how long did you stick with a weight loss program/diet when trying to lose the regained weight? (weeks)	12 (44)	16 (46)	10 (22)	H=27.71	P<0.001
Typically, how much weight have you lost when trying to lose regained weight?	4.5 (6.8)	5.4 (7.7)	2.3 (2.5)	H=162.74	P<0.001

Normally-distributed variables are presented as means ± SDs and non-normally distributed data are presented as medians (IQR); Response items have been shortened, but are available in their full version in supplementary material; Different superscripts denote statistical differences;

[1]The gain-lose group were not asked these questions because they had lost weight multiple times by definition;

[2]Only asked if respondents reported using WW occasionally or more often when restarting weight loss efforts;

[3]Only asked if respondents reported using WW often or less frequently when restarting weight loss efforts