Financial incentive strategies for maintenance of weight loss: Results from an internet-based randomized controlled trial

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ABSTRACT

Background: Financial incentives have been successful for weight loss, but their efficacy for maintaining weight loss is uncertain.

Objective: To examine different financial incentives for weight loss maintenance.

Design: After an initial period of weight loss, a three-arm randomized trial of 2 financial incentives versus control during months 1-6 (Phase I) followed by passive monitoring during months 7-12 (Phase II).

Setting: Internet-based recruitment via a nationally available commercial weight loss program.

Participants: People aged 30-80 years who lost at least 5 kg during the first 4-6 months in the program.

Interventions: Daily text messaging feedback alone, or combined with a lottery-based incentive or a direct incentive.

Measurements: The primary outcome was weight change 6 months after initial weight loss.

Results: Of 191 participants randomized, the mean age was 49.0 (SD=10.5) years and weight loss prior to randomization was 11.4 (4.7) kg; 92% were women and 89% were White. Mean weight changes during the next 6 months (Phase I) were: lottery -3.0 (5.9) kg; direct -2.9 (5.8) kg; and control -1.4 (5.8) kg (all pairwise comparisons $p>0.1$). Weight changes through end of 12 months post-weight loss (Phase II) were: lottery -1.9 (10.5) kg; direct -0.7 (10.7) kg; and control -0.3 (9.5) kg (all pairwise comparisons $p>0.1$). The percentages of participants who maintained their weight loss (defined as gaining $\leq$ 1.36 kg) were: lottery 79%, direct 76%, and control 67% at 6 months and lottery 66%, direct 62%, and control 59% at 12 months (all pairwise comparisons $p>0.1$).

Limitations: Daily feedback mechanism required a smart phone with texting plan.

Conclusions: Compared with the successful active control of daily texting, lottery-based and direct monetary incentives were similarly effective for weight loss maintenance.

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Keywords: Behavioral economics; financial incentive; obesity; randomized trial; weight loss maintenance; internet-based.

INTRODUCTION

While a number of strategies have been successful in helping people to achieve initial weight loss, maintenance of weight loss once it has occurred tends to be significantly more challenging (1-3). This might be because weight maintenance involves additional, or different, challenges than initial weight loss. One factor may be changes in resting metabolic rate due to lower body weight (4). Other challenges include the fundamentally different processes that are active in weight loss maintenance versus weight loss such as goal, duration, role of activity, and reinforcement (5).

As shown in recent work by our group, an external motivational source such as monetary lottery incentives can be effective in inducing initial weight loss (6-8). Given the additional challenges that arise when the goal shifts to weight maintenance (5), however, it is an open question whether the same types of financial incentives that are effective for weight loss will be effective for weight maintenance. In addition, variable reinforcement using lottery payments may be more effective over time than a fixed incentive that does not vary (9). There is evidence that frequent (e.g., daily) incentives are more effective than infrequent incentives for behavior change, and that regular self-weighing can be helpful in weight management (10). Because a daily incentive also constitutes a daily reminder, and reminders to weigh daily can be sent at low cost using text messaging, we used daily self-weighing with text message feedback as a control. This study compared the efficacy of two monetary incentive strategies (lottery-based or a direct incentive) versus an active control condition for weight loss maintenance over 12 months after initial weight loss.

METHODS

Overview of Study Design

This 3-arm randomized controlled trial had two phases (11). In Phase I, participants received one of three interventions for 6 months: 1) daily text messaging feedback based on daily home weight

measurement results (control), 2) daily text messaging feedback combined with direct monetary incentive (direct payment), or 3) daily text messaging feedback combined with a lottery-based monetary incentive (lottery). In Phase II (months 7-12 after initial weight loss), all participants were observed without intervention for 6 additional months.

Participants and Setting

Participants were recruited from September 2013 to June 2014 using a nationally-available weight loss program (Weight Watchers). Weight Watchers (WW) members who had opted in to receive email communication from Weight Watchers International, Inc., and met eligibility criteria described below, were sent an email with a link inviting participation in the study. The email link transferred potential participants to the Way to Health portal, a web-based platform that integrates clinical trial enrollment and randomization processes, wireless devices (such as scales), messaging (text, email, or voice), self-administered surveys, and distribution of financial incentives (15,19). We recruited from WW centers (n=505) across 41 states that were able to electronically transmit in-person weight objective measurements to a WW coordinating site, allowing verification of self-reported weights. Eligibility criteria were ages 30 - 80 years, BMI 30 - 45 kg/m^2 prior to starting Weight Watchers, documented weight loss of at least 5 kg in the first 4-6 months on the WW meetings plus digital tools (Monthly Pass) program, active WW meetings membership, reliable access to the internet, and a smartphone that could be paired with a wireless scale. Exclusion criteria were the following: substance abuse; bulimia nervosa or related behaviors; pregnancy or breast feeding; medical contraindications to counseling about diet, physical activity, or weight reduction; unstable mental illness; and positive screen for pathologic gambling.

Informed consent was obtained via the Way to Health portal (https://www.waytohealth.org/). Baseline weight at time of study enrollment was verified by Weight Watchers staff. Once verified, participants completed a baseline survey online, were sent a wireless scale (Withings Corp., Issy-les-

Moulineaux, France) and, after their first weight transmission, were randomized and notified of their arm assignment via the portal. Randomization occurred in a 2:1 ratio for each intervention versus control using variable block sizes and stratification by sex and baseline BMI (BMI 30-37.9 and 38-45 kg/m^2).

Interventions

Each participant selected a personal weekly weight goal of 0, -0.5, or -1 lb., which could be reset monthly if desired. If the participant was above baseline weight, then maintaining weight (0 lb.) was not an allowable option. Using the wireless scale, participants were asked to weigh themselves every morning in minimal clothing before eating or drinking and after urinating. The weight result was transmitted wirelessly to the study database triggering a daily text message on progress relative to the chosen weight goal. Participants in incentive arms also received messages about monetary winnings via the daily text message. Although it does not represent usual care, daily messaging was chosen as the control condition to standardize the type and frequency of participant feedback in order to examine the incremental impact of the incentives since the daily incentives required providing messaging feedback to participants on a daily basis. Weight measurements were verified in person at a WW location at months 3, 6, 9, and 12.

Participants were considered at goal each day their transmitted weight was not above the prior week's end weight on days 1-6 and was at their personal weight goal for the current week on day 7. Participants in the direct payment condition were eligible to receive $2.80 each day their transmitted weight was at goal. Participants in the lottery condition were eligible for a chance to win the daily prize each day their transmitted weight was at goal. Each day, eligible lottery participants had an 18 in 100 chance of winning $10 and 1 in 100 chance of winning $100 for an expected value of $2.80 per day. Each participant selected a 2-digit lottery number that was used for lottery winner determinations throughout participation in the study. This scheme was similar to what we had found successful in

previous studies in achieving initial weight loss and ongoing medication adherence (6, 8). If a participant's lottery number was chosen but the participant did not transmit a weight or weight was above goal that day, a text message was sent indicating that the participant would have won the lottery if requirements had been met, an approach designed to induce anticipated regret and therefore, increase motivation (7). In both incentive conditions, participants received their winnings via check every 3 months. The amount participants actually received depended on their in-person weight measurement at 3 and 6 months, respectively, relative to their goals. In other words, if a participant was 100% of the way toward their goal they'd receive their full winnings; if 50% toward the goal they'd receive 50% of their winnings. All participants were allowed to keep the scales and were compensated up to $160 for participation in the study ($30 for the visit at 3 and 9 months; $50 for the visit at 6 and 12 months).

Measurements

The primary outcome was change in weight from study enrollment (which was after initial weight loss in WW) to 6 months using the in-person weight from WW locations. Weight was measured at each WW site with shoes and heavy items removed. A key secondary outcome was change in weight 12 months after initial weight loss. Participants also completed a web-based questionnaire at 6 and 12 months after initial weight loss. Physical activity was measured using the International Physical Activity Questionnaire (IPAQ)-Long (12). Eating habits were assessed using the Three-factor Eating Questionnaire-R18 (13).

Safety Monitoring

The Institutional Review Boards of the University of Pennsylvania and Duke University approved the study. The study was also monitored by an independent Data Safety Monitoring Board (DSMB) composed of experts in clinical trials, medical economics, general internal medicine, and biostatistics. Daily weight data were used to screen for excessive weight loss. Participants were contacted if they lost

>7 lbs. in one week or 12 lbs. in one month and questions were asked regarding potential unsafe efforts to lose weight.

Statistical Methods

The primary objective was to examine weight changes 6 months after initial weight loss (Phase I) in the following pairwise comparisons: 1) the daily lottery-based financial incentive relative to the control 2) the direct payment incentive relative to the control, and 3) the lottery financial incentive relative to the direct payment financial incentive. A key secondary objective was to compare weight changes 12 months after initial weight loss or 6 months following the cessation of the interventions (Phase II).

All primary and secondary analyses used a modified intent-to-treat strategy, excluding 2 participants found to have exclusion criteria after randomization. Missing in-person weight data were multiply imputed using linear regression adjusted for baseline BMI, baseline weight, weight loss amount in WW prior to randomization, initial weight loss goal chosen the first week of the study, study arm, and patient demographics. Sensitivity analyses were performed with alternate imputation strategies, including a multiple imputation strategy that additionally used post baseline information on weight, subsequent weight loss goals, and WW continued membership, and a single imputation strategy that assumed that participants with missing weight outcome returned to their baseline weight (29). Complete case analyses were also performed, using no adjustment for missing data, as a per-protocol approach. A multivariate analysis of the primary endpoint was performed to obtain an arm comparison adjusted for baseline factors. A post-hoc analysis of the frequency of at-home weight measurements compared arms using a generalized estimating equation (GEE) with an autoregressive (AR-1) working correlation model; mean number of days out of 7 was compared among study arms adjusting for study week and a week by time interaction. Separate models were fit for Phases 1 and 2. A linear mixed effects model with random intercept and slope for week was also considered.

Sample size was estimated allowing for the Holm-Bonferroni (28) method to sequentially test the three primary comparisons maintaining an alpha of 0.05 and a power of 90%. A sample of N=150 was needed to detect a difference in weight change during Phase I of 5 kg between each incentive group and the control group and 3 kg between incentive groups, assuming a standard deviation in weight change of 5 kg. We estimated loss to follow-up of 20%, resulting in a final target sample size of N=188 participants.

RESULTS

Recruitment and Enrollment

A total of 2,983 Weight Watchers members with access to meetings plus digital tools received an invitation email and ultimately 191 participants were enrolled (Figure 1). The mean (SD) age of the participants was 49.0 (10.5) years; 92% were women, 89% were White, and 62% had at least a college degree (Table 1). The mean measured weight upon starting Weight Watchers was 101.6 (15.7) kg and at study enrollment was 90.2 (14.9) kg for a mean weight loss prior to study enrollment of 11.4 (4.7) kg or 11.2% of original body weight. Mean BMI at randomization was 32.5 (4.1) kg/m^2. In-person weight measurements were available at 6 months after initial weight loss for 90.9% of lottery, 89.2% of direct and 86.8% of control participants. At 12 months, weights were available for 81.8% (lottery), 75.7% (direct) and 81.6% (control).

Self-weighing rates were high at the beginning of the study and declined over time with similar patterns over time across arms (Figure 2). Participants weighed themselves at home approximately 90% of days in the first week, 65% of days in week 26 and 30% of days during the last week of follow-up, with similar patterns over time across arms (Phase 1: p=0.51; Phase 2: p=0.31; Figure 2).

Weight Outcome

For the primary outcome using multiple imputation adjusting for baseline variables, mean (SD) weight changes at 6 months after initial weight loss were: lottery -3.0 (5.8) kg; direct -2.8 (5.8) kg; and control -1.4 (5.8) kg (all pairwise comparisons $p>0.1$) (Table 2 and Figure 3). Mean weight changes at 12 months after initial weight loss were: lottery -1.8 (10.5) kg; direct -0.7 (10.7) kg; and control -0.2 (9.4) kg (all pairwise comparisons $p>0.1$). Within arms, weight change (additional weight loss) was statistically significant from baseline to 6 months in the lottery ($p<0.001$) and direct ($p<0.001$) incentive arms but not the control arm ($p>0.1$). However, weight change was not statistically significant in any of the three arms at 12 months ($p>0.1$). The percentages of participants who maintained their weight (defined as gaining no more than 1.36 kg, i.e., 3 lbs) at 6 months were lottery 79%, direct 76%, and control 67% (all pairwise comparisons $p>0.1$) and at 12 months were lottery 66%, direct 62%, and control 59% (all pairwise comparisons $p>0.1$). There was a trend across all arms that weight loss was greater in those who weighed themselves more frequently (Figure 4; $p<0.001$ at 6 and 12 months). Adjusted models indicated that results were qualitatively similar after adjusting for factors that were measured at baseline (Table 3). Sensitivity analyses for the primary outcome revealed very similar results across all imputation strategies.

Secondary Outcomes

At 6 months and 12 months after initial weight loss, changes in self-reported physical activity or in the three domains of eating behaviors (cognitive restraint, uncontrolled eating, emotional eating) were not statistically significantly different across arms (Table 2).

Over the 6 months of the weight loss maintenance intervention, 98 incentive payments (total of $10,056.00) were made to direct incentive participants (mean (SD) $134.09 ($125.26), maximum $453.60, and minimum $0.00) and 98 payments (total of $11,901.00) were made to lottery incentive participants (mean $154.56 ($186.18), maximum $590.00, and minimum $0.00). The total potential

winnings (i.e., had participants fully met their weight loss goals at 3 and 6 months by maintaining their at-home weight until the in-person verified weight) were $13,090 for direct participants and $15,500 for lottery participants. Lottery participants won $10 a mean of 14.1 times and $100 a mean of 0.8 times over the 180 days of the active phase of the intervention.

Excess weight loss events and other adverse events

A total of 185 weight loss alerts (triggered by loss of ≥7 lbs in one week or ≥12 lbs in one month) occurred. No evidence of unhealthy weight loss behaviors was found; reasons for the triggers included scale calibration error (25%), another family member using the scale (10%), and various less frequent reasons (e.g., weight measured after morning, resumption of diet and/or exercise, illness, or return from vacation). A total of 19 adverse events occurred over the course of the study; none were believed to be related to the study.

DISCUSSION

In a uniquely designed trial that enrolled and interacted with participants via the internet and provided monetary incentives for weight maintenance or additional weight loss, both direct and lottery-based incentives led to additional weight loss over the 6 months when these incentives were available but the change in weight was not significantly different from that in the control. In pairwise comparisons among the strategies, neither direct nor lottery-based monetary incentive strategies significantly increased weight loss compared with the active control of daily text messaging feedback. The fact that participants across all 3 arms, including the control group, maintained their weight loss during the intervention likely reflects at least in part that participants were a self-selected sample of individuals who were unusually motivated to lose and maintain weight and who had been successful in their first 4-6 months in the Weight Watchers program. Success in maintaining weight loss in all 3 arms

might also partly reflect a beneficial impact of the daily weighing and daily texting common to all of three conditions.

Whereas our study focused on the impact of financial incentives on weight loss maintenance, several previous studies have shown the benefit of financial incentives on initial weight loss (14). One study found that participants who were offered $14 per percentage point of weight loss lost more weight over 3 months (2.1 kg) compared with participants offered $7 per percentage point of weight loss (1.4 kg, $p<0.05$) and control participants (0.9 kg, $p<0.05$) (15). Previous studies confirmed that weight loss could be enhanced by use of deposit contracts, whereby participants in an intensive weight loss program made substantial up-front payments and received a percentage up to the full amount back depending on weight loss (16, 17). In a 24-week intervention, participants who received incentives as a group ($500 per month divided among 5 participants) for meeting weight-loss goals lost more weight (4.8 kg) than participants who received individual ($100 per month) incentives (1.7 kg, $p=0.008$) or control participants (0.5 kg, $p<0.001$) (18); at 36 weeks, group incentive participants maintained greater weight loss than control participants but not individual incentive participants. Another 3-arm study found that participants receiving direct or lottery-based incentives over 16 weeks lost more weight (6.4 kg and 6.0 kg, respectively) than control participants (1.8 kg) but after cessation of incentives, differences were no longer present at 7 months (7).

The financial incentives tested in this study were based on several strategies from the behavioral economics literature. First, research has shown that even small rewards or punishments have strong incentive value if they occur immediately (19, 20) so qualifying participants received immediate feedback about their incentive earnings whereas non-qualifying participants received feedback about whether they would have won had they been adherent. This effect may have been tempered, however, by the requirement of in-person weight measurement every 3 months to receive payouts. Second, avoidance of regret is a powerful influence in decision making under risk (21), which is the reasoning

behind giving lottery participants who did not lose weight feedback about what they would have won had they been adherent. Third, data support that people are motivated by remembering past rewards and contemplating future rewards (22), and are particularly attracted to small probabilities of large rewards (23); therefore, the lottery was designed to offer frequent small payoffs (roughly a 1 in 5 chance at a $10 reward) and infrequent large payoffs (a 1 in 100 chance at a $100 reward). Fourth, lotteries also provide variable reinforcement, which has been demonstrated as more effective in reinforcing behavior than consistent reinforcement, in some settings (9). However, while descriptions of choice probabilities have been shown to lead to overweighting of small probabilities, more recent evidence has suggested that inferred probabilities when people experience episodic rewards may actually be lower than the true probabilities, suggesting that empirically the comparative effectiveness of probabilistic rewards and direct payments is unclear (24).

These incentive strategies, however, had not previously been tested for weight maintenance. The similar results across arms of our study partially reflects the successful maintenance of the control group but may also reflect other unique factors that arise in the case of weight maintenance. When considering strategies to address the key problem of weight maintenance, it is important to recognize that different approaches may be needed than those that work for initial weight loss (25). Further research is needed to examine whether different types of financial incentives might improve weight beyond what occurred with frequent weight self-monitoring and text message feedback in a motivated sample. It could be that the level of incentives needs to be higher, or it could be that the nature of incentives should be changed, to distinguish these types of strategies from the control condition.

The use of technology in this trial was both a strength and a limitation. The use of a wireless scale and text messaging feedback is highly scalable, convenient for participants and efficient for staff who are monitoring participant progress. A potential downside of the reliance on technology is that it may be a barrier for participants who do not own the needed technology or are less savvy with it use;

for example 17 participants required a replacement scale and 24 participants received a scale but did not activate it in time to be enrolled in the study despite a written guide and 3 contact attempts for assistance by study personnel. Partnering with a national weight loss program facilitated enrollment and enhanced geographic generalizability but also may have limited generalizability because participants were predominantly white females. The platform for delivering the intervention, however, can be easily connected with any weight loss program by simply providing an electronic link. The frequent feedback was designed to increase motivation in participants who meet their goals but might further frustrate participants who are not meeting goals. Further, the daily text messaging platform allowed immediate feedback to enhance adherence but the actual payouts were every 3 months and dependent on maintaining weight in the interim.

In a pragmatic study that enrolled participants using a passive system for electronic monitoring of weights, we were able to briskly enroll and follow participants in a behavioral program that resulted in weight loss maintenance. However, adding direct or lottery-based incentives to the control condition of daily weighing and text messaging feedback did not provide clear additional benefit. The electronic platform for intervention delivery is a viable option for large scale weight loss programs that might, for example, take place in work place settings or desire efficient strategies to enhance maintenance of weight loss.

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Conflict of interest

Kevin Volpp is a principal in the behavioral economics consulting firm VAL Health and has received consulting income and research funding from CVS as well as research support from Weight Watchers, Humana, Hawaii Medical Services Association, and Merck. Drs. Shaw, Troxel, and Volpp have received research funding from the Vitality Institute. Dr. Foster and Ms. Wojtanowski are employees of Weight Watchers International.

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TABLE 1. Baseline Characteristics of Study Participants Overall and by Arm

Characteristic	Total (n=191)	Lottery (n=77)	Direct payment (n=75)	Control (n=39)	P value*
Age, mean (SD)	49.0(10.5)	48.8(10.3)	48.6(11.0)	50.1(10.0)	0.74
Female gender, n (%)	175(91.6)	70(90.9)	69(92.0)	36(92.3)	0.96
Race, n(%)					0.55
White	170(89.0)	68(88.3)	69(92.0)	33(84.6)	
Black	8(4.2)	3(3.9)	4(5.3)	1(2.6)	
Other	6(3.1)	3(3.9)	1(1.3)	2(5.1)	
Two or more races	7(3.7)	3(3.9)	1(1.3)	3(7.7)	
Hispanic, n (%)	8(4.2)	2(2.6)	4(5.3)	2(5.1)	0.66
Education, n (%)					0.01
Less than college	72(37.7)	26(33.8)	35(46.7)	11(28.2)	
College graduate	55(28.8)	28(36.4)	11(14.7)	16(41.0)	
Post-college degree	64(33.5)	23(29.9)	29(38.7)	12(30.8)	
Household income, n (%)					0.46
<$50,000	23(12.0)	12(15.6)	5(6.7)	6(15.4)	
$50,000 to <$100,000	96(50.3)	36(46.8)	40(53.3)	20(51.3)	
>=$100,000	72(37.7)	29(37.7)	30(40.0)	13(33.3)	
People per household, mean (SD)	3.1(1.4)	3.2(1.5)	3.0(1.4)	3.0(1.2)	0.68
Weight measures, mean (SD)					
Weight at start of Weight Watchers	101.6(15.7)	100.8(15.7)	101.7(16.0)	102.9(15.6)	0.80
Weight at randomization	90.2(14.9)	89.2(14.3)	90.7(15.7)	91.2(15.0)	0.75
Weight loss prior to randomization	11.4(4.7)	11.6(4.4)	10.9(5.1)	11.7(4.3)	0.6
BMI measures					
BMI at start of Weight Watchers, mean (SD)	36.7(4.3)	36.5(4.4)	36.8(4.1)	36.9(4.5)	0.86
BMI at randomization, mean (SD)	32.5(4.1)	32.3(4.1)	32.8(4.3)	32.6(4.1)	0.70
BMI ≥35 at randomization, n (%)	69(36.1)	26(33.8)	29(38.7)	14(35.9)	0.82
Eating behaviors by TFEQ, mean (SD)**					
Cognitive restraint scale	62.3(14.4)	62.0(15.0)	62.6(14.6)	62.4(12.8)	0.97
Uncontrolled eating scale	45.1(16.0)	44.4(15.6)	47.6(16.2)	41.8(16.1)	0.17
Emotional eating scale	59.9(24.5)	58.7(23.8)	63.3(23.5)	55.8(27.2)	0.26
Activity in MET-minutes/week***, median (IQR)					
Vigorous activity MET-	0(0,1080)	0(0,1040)	80(0,1080)	0(0,1440)	0.99

minutes/week					
Moderate activity MET-minutes/week	840(287.5,2096.25)	1030(382.5,2880)	495(165,1440)	830(420,2130)	0.02
Walking MET-minutes/week	486.75(148.5,1410.75)	594(173.25,1773.75)	330(66,1188)	495(297,1072.5)	0.23
Total activity MET-minutes/week	2217(863.5,4732.75)	2299.5(1103.25,5299.	1872(534,4187.5)	2855(973,4712)	0.23

*P-values were calculated using F-test for continuous variables and chi-squared test for categorical variables except for MET-minutes/week activity variables, for which the Kruskal-Wallis test was used due to skewness.

** TFEQ=Three Factor Eating Questionnaire . The raw eating scale scores are transformed to a 0–100 scale [((raw score − lowest possible raw score)/possible raw score range) × 100] Higher scores in the respective scales are indicative of greater cognitive restraint, uncontrolled, or emotional eating

*** Measured using the International Physical Activity Questionnaire. MET-minute scores are equivalent to kilocalories for a 60 kilogram person. MET scores are multiples of the resting metabolic rate and a MET-minute is computed by multiplying the MET score of an activity by the minutes performed. Data were missing for 3 participants: Lottery (n=1), Direct (n=2).

TABLE 2. Imputed Change in Weight, Physical Activity and Eating Behaviors at 6 and 12 Months by Arm

	Lottery (n=77)	Direct Payment (n=74)	Control (n=38)	Lottery vs. Control	Direct Payment vs. Control	Lottery vs. Direct Payment
Imputed weight change, kg						
6-month imputed weight change, mean (SD)	-3.01 (5.84)	-2.84 (5.76)	-1.40 (5.77)	-1.61	-1.44	-0.17
95% CI				(-3.81, 0.60)	(-3.71, 0.83)	(-2.02, 1.69)
P-value				0.154	0.215	0.859
12-month imputed weight change, mean (SD)	-1.83 (10.5)	-0.71 (10.7)	-0.25 (9.43)	-1.58	-0.47	-1.12
95% CI				(-5.33, 2.17)	(-4.34, 3.40)	(-4.33, 2.09)
P-value				0.408	0.813	0.494
Total activity MET-minutes/week						
6-month change, mean (SD)	647 (3587)	-86.6 (3347)	1042 (3402)	-394	-1128	734
95% CI				(-2234, 1445)	(-3038,781)	(-697, 2165)
P-value				0.672	0.244	0.312
12-month change, mean (SD)	-170 (4066)	630 (2148)	764 (2462)	-934	-135	-799
95% CI				(-2808,939)	(-1964, 1694)	(-2291,692)
P-value				0.324	0.884	0.289
Cognitive restraint scale, TFEQ						
6-month scale change, mean (SD)	1.47 (17.4)	3.62 (12.2)	3.22 (18.2)	-1.75	0.40	-2.15
95% CI				(-10.1, 6.61)	(-8.21, 9.01)	(-8.56, 4.26)
P-value				0.679	0.927	0.508
12-month scale change, mean (SD)	-2.02 (17.9)	-2.16 (16.2)	2.78 (16.9)	-4.80	-4.94	0.14
95% CI				(-15.1, 5.52)	(-15.1, 5.24)	(-8.02, 8.30)
P-value				0.358	0.337	0.973
Uncontrolled eating scale, TFEQ						
6-month scale change, mean (SD)	-3.49 (13.8)	0.26 (16.1)	-2.14 (15.7)	-1.35	2.40	-3.75
95% CI				(-9.31, 6.61)	(-5.80, 10.6)	(-9.86, 2.36)
P-value				0.738	0.563	0.226
12-month scale change, mean (SD)	-3.7 (15.6)	0.5 (11.9)	-3.2 (14.9)	-0.46	3.76	-4.22

95% CI				(-8.93, 8.00)	(-4.59, 12.1)	(-10.9, 2.48)
P-value				0.914	0.374	0.214
Emotional eating scale, TFEQ						
6-month scale change, mean (SD)	-6.71 (16.5)	-1.29 (18.2)	-4.68 (16.3)	-2.03	3.39	-5.42
95% CI				(-11.1, 7.04)	(-5.69, 12.7)	(-12.4, 1.54)
P-value				0.658	0.474	0.126
12-month scale change, mean (SD)	-4.38 (19.4)	0.00 (14.8)	3.47 (15.0)	-7.85	-3.47	-4.38
95% CI				(-18.0, 2.33)	(-13.5, 6.57)	(-12.4, 3.67)
P-value				0.129	0.493	0.283

TFEQ=Three Factor Eating Questionnaire

Figure 1. Flow of Study Participants

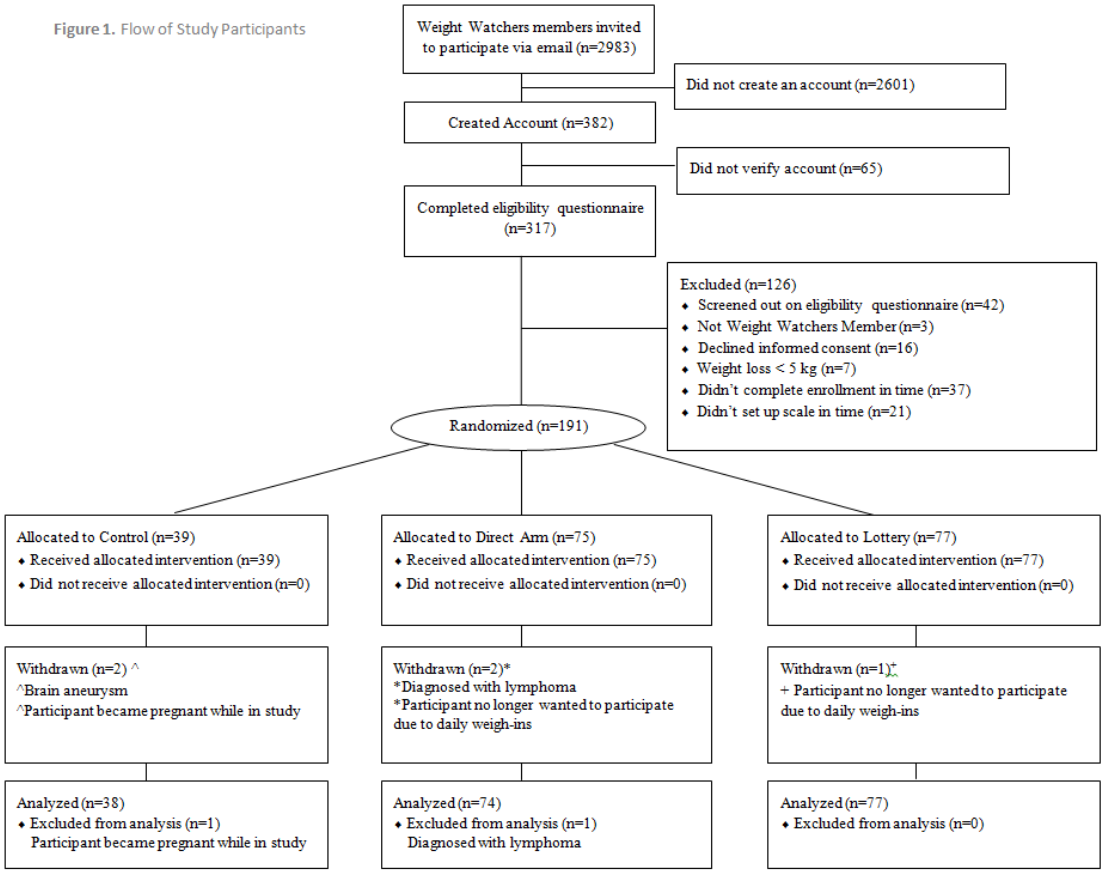
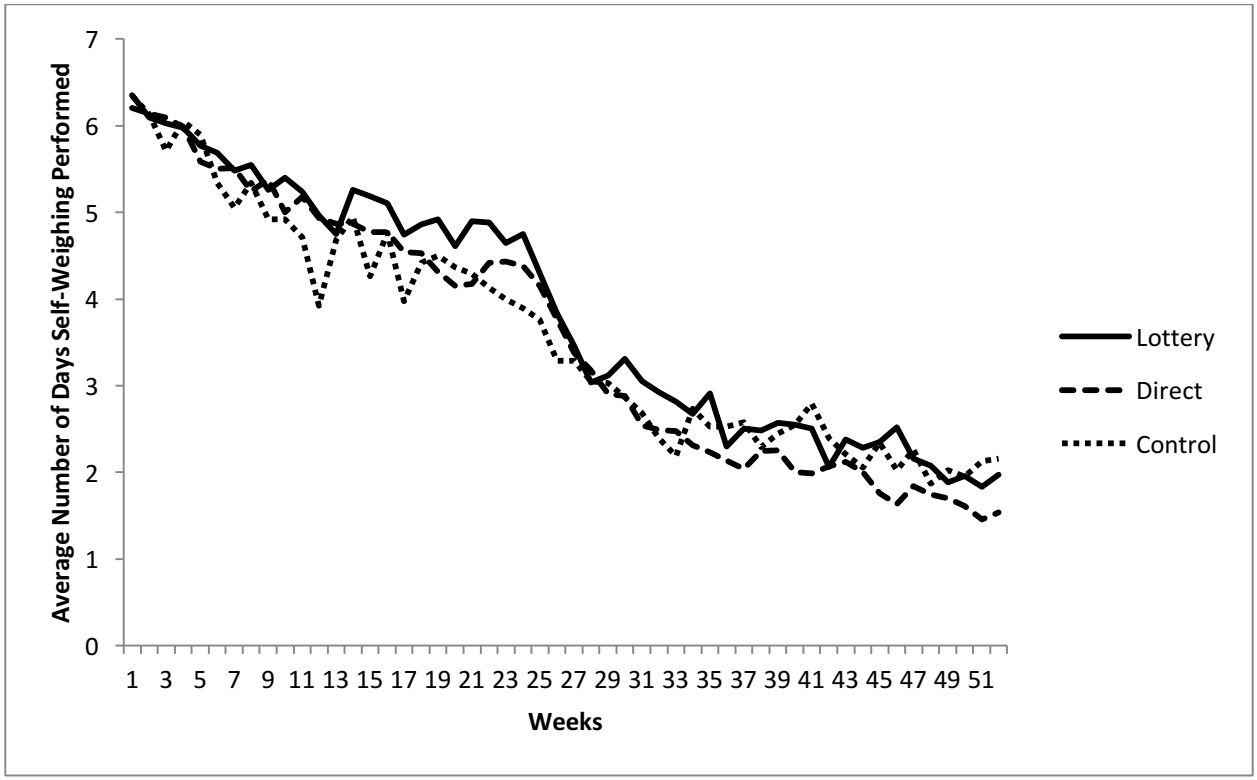


Figure 2. Average Number of Days per Week Self-weighing Was Performed by Arm over Time (Randomization is Time 0).*



*P=0.51 for Phase 1 (Weeks 0-24) and P=0.31 for Phase 2 (Weeks 24-52) for comparison of mean number of days among study arms.

Figure 3. Percent Weight Change by Arm from Entry into Weight Watchers Program over Time (Randomization is time 0).

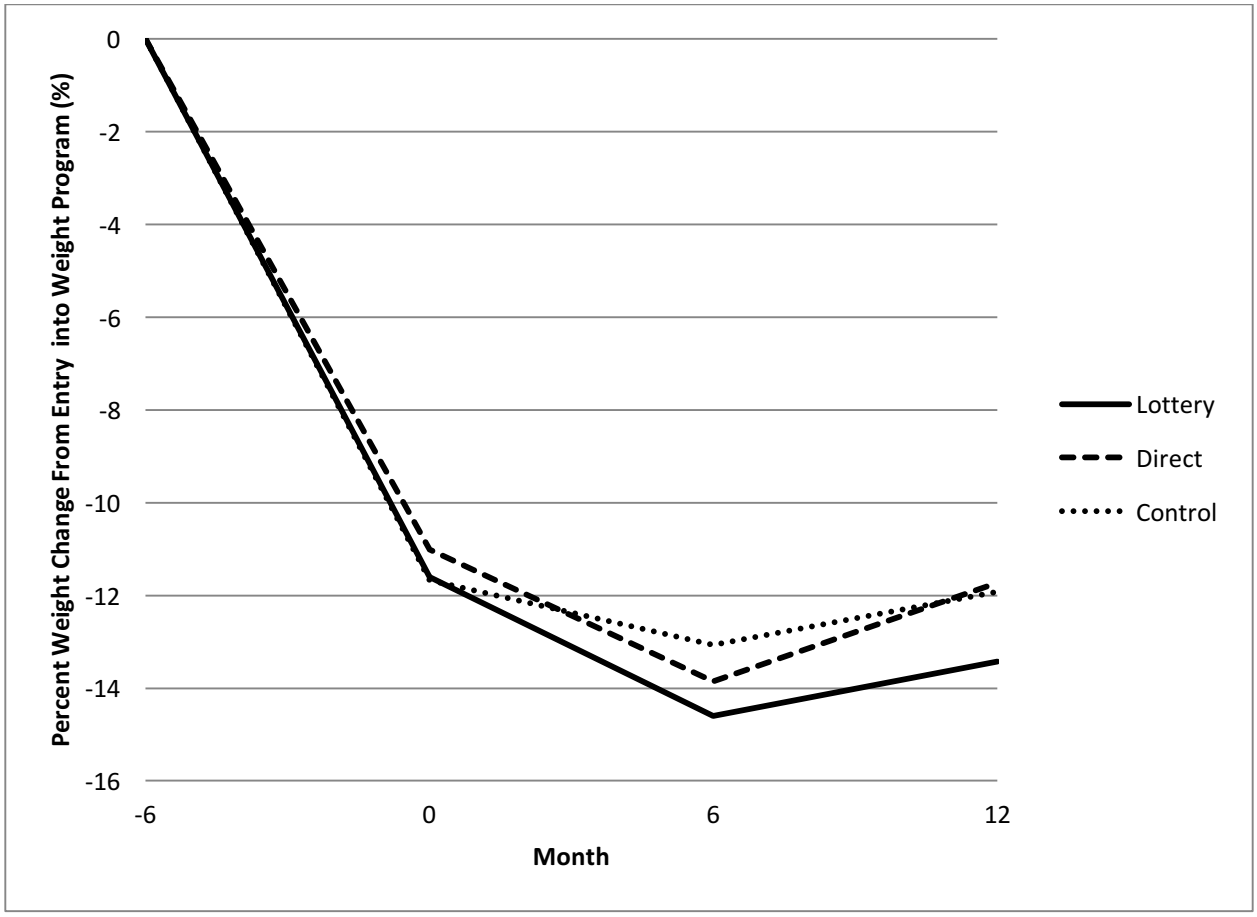


Figure 4. Mean Weight Change in kg at 6 Months in All Arms Combined by At-home Self-Weighing Frequency