A Randomized Controlled Trial of Employer Matching of Employees’ Monetary Contributions to Deposit Contracts to Promote Weight Loss

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Abstract

Purpose: To test whether employer matching of employees’ monetary contributions increases employees’ (1) participation in deposit contracts to promote weight loss and (2) weight loss.

Design: A 36-week randomized trial.

Setting: Large employer in the northeast United States.

Participants: One hundred thirty-two obese employees.

Interventions: Over 24 weeks, participants were asked to lose 24 pounds and randomized to monthly weigh-ins or daily weigh-ins with monthly opportunities to deposit $1 to $3 per day that was not matched, matched 1:1, or matched 2:1. Deposits and matched funds were returned to participants for each day they were below their goal weight.

Measures: Rates of making ≥1 deposit, weight loss at 24 weeks (primary outcome), and 36 weeks.

Analysis: Deposit rates were compared using χ² tests. Weight loss was compared using t tests.

Results: Among participants eligible to make deposits, 29% made ≥1 deposit and matching did not increase participation. At 24 weeks, control participants gained an average of 1.0 pound, whereas 1:1 match participants lost an average of 5.3 pounds (P = .005). After 36 weeks, control participants gained an average of 2.1 pounds, whereas no match participants lost an average of 5.1 pounds (P = .008).

Conclusion: Participation in deposit contracts to promote weight loss was low, and matching deposits did not increase participation. For deposit contracts to impact population health, ongoing participation will need to be higher.

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Purpose
Nearly 7 in 10 adults in the United States are overweight or obese. Two-thirds of large US employers now offer financial incentives to their employees to promote healthy behaviors such as weight loss. One financial incentive strategy that has gained considerable attention as a way to promote weight loss is the use of deposit or precommitment contracts. Deposit contracts are voluntary arrangements in which people who want to achieve a goal (e.g., a weight loss goal) put some of their own money at risk that they stand to lose if they do not meet their goal. This approach aims to augment motivation by leveraging loss aversion, a powerful behavioral economic principle in which people are more affected by losses than an equivalent dollar gain.

Although previous VA studies have demonstrated that deposit contracts can produce high rates of engagement and clinically significant weight loss, a major challenge to wider impact of these programs is getting high proportions of obese people to participate. This is of particular importance because motivation is only augmented through loss aversion in these programs if people actually make deposits. One way to increase participation in deposit contracts in workplace settings might be employer matching of employee deposits, but the degree to which higher rates of participation and weight loss can be achieved through such matching is unknown. Additionally, the previous VA studies were conducted at 1 VA medical center using face-to-face contact with research staff, and it is unclear how well the results of these studies generalize to use of automated mechanisms in workplace settings.

The purpose of this study was to test in a workplace setting and through an automated platform the degree to which differing levels of employer matching of employee deposits increase rates of participation in deposit contracts, characterize the corresponding amount of weight loss, and identify factors associated with nonparticipation in these programs.

Methods
Design
We conducted a 36-week parallel design randomized trial (24 intervention weeks plus 12 weeks of follow-up) at Horizon Healthcare Services, Inc, between May 24, 2011, and March 15, 2012. The 132 participants were randomly assigned to a control group or to 1 of the 3 deposit contract groups, all of which were given the same goal of losing 1 pound per week for 24 weeks. Weights were measured at baseline, 4, 8, 12, 16, 20, 24, and 36 weeks using incentaHEALTH workplace scales that provided precision to 0.2 pounds. All participants had access to a secure website to track their progress and were asked to complete online questionnaires at baseline, 24, and 36 weeks. A subset of participants completed semistructured telephone interviews focused on decisions about participation in deposit contracts. The protocol (#813407) was approved by the institutional review board of the University of Pennsylvania.

Sample
Eligible participants were employees of Horizon Healthcare Services, Inc, who were between ages 18 and 70, had a body mass index (BMI) of 30 to 50 kg/m², and wanted to lose weight. The upper age was set at 70 because there may be less benefit from weight reduction after age 70 than at younger ages. Individuals with a BMI less than 30 were excluded to ensure all participants could safely lose the target weight of 24 pounds over the 24-week intervention. We chose an upper limit on BMI of 50 to minimize the influence of outliers on our primary outcome of weight loss. We also excluded those with conditions that would make participation infeasible (e.g., inability to consent or illiteracy) or potentially unsafe (e.g., current treatment for substance abuse, consumption of >5 alcoholic drinks per day, addiction to prescription medications or street drugs, serious psychiatric diagnoses, myocardial infarction or stroke in the last 6 months, metastatic cancer, diabetes requiring treatment with medication other than metformin, currently pregnant or breast-feeding, or having a history of an eating disorder or unsafe weight loss behaviors such as laxative or diuretic use).

Individuals were recruited through workplace flyers, posters, e-mail messages, and informational sessions. All participants were recruited in May and June 2011.

Interventions
All 132 participants (Figure 1) provided their informed consent, were each given a goal to lose 1 pound per week over 24 weeks, and were automatically assigned through a secure website to the 4 study arms using 1:1:1:1 central computerized randomization with variable block sizes of 4, 8, and 12 and stratification by BMI (30-40 or >40-50). The allocation sequence was concealed from all research team members. Arm assignments were communicated to participants via an automated secure website message and e-mail or text message. Neither participants nor the study coordinator could be blinded to condition assignment due to the nature of the interventions. Data analysts and all investigators were blinded to condition assignment until collection of all primary outcome data.

Control arm participants were provided with a link to the Weight-control Information Network (http://win.niddk.nih.gov/) of the National Institute of Diabetes, Digestive, and Kidney Disease and were both scheduled for and reminded via automated e-mail or text message to attend monthly weigh-ins.
Figure 1. Flow of study participants.
on the workplace scales. All weights collected were displayed graphically to each participant through a secure website. After each monthly weigh-in, an automated message was sent to participants that notified them of whether they met or did not meet their weight loss goal for that 4-week period.

Participants in each of the 3 deposit contract arms received the information that control arm participants received. In addition, at the start of each intervention month, participants in a deposit contract arm received an automated e-mail or text invitation to go to the study website to make a deposit of their own money for the upcoming month. Through this website, participants could choose to use their debit card or credit card to deposit between $1 per day and $3 per day for the next 28 days (ie, $28 to $84 total in each month). For each day in that month that participants weighed in and were at or below their goal weight, the funds they had chosen to deposit for that day were returned at the end of the month as a reward, with a match corresponding to group assignment (described below).

The deposit contract interventions sought to leverage 2 common decision errors to make these rewards more effective than a standard economic incentive that would simply pay a reward of this amount. First, individuals tend to be overly optimistic about their prospects for success, which we expected to drive high rates of deposit contract participation. Second, when individuals’ own money is at risk, they may be particularly driven to achieve a goal such as weight loss because they are highly motivated to avoid a financial loss.

The 3 intervention arms featured different levels of deposit matching by the employer to test the degree to which an employer can use matching to increase rates of deposit contract participation and weight loss among employees. In the no match arm, money that participants chose to deposit was refunded at the end of the month for every day in that month they weighed in and were at or below their goal weight. In the 1:1 match arm, money that participants chose to deposit was matched 1:1 and refunded at the end of the month for every day in that month they weighed in and were at or below their goal weight. If, for example, a participant deposited $28 at the beginning of a month and met all of his/her daily weight loss goals, that participant received $56 (his/her original $28 plus the $28 in matching funds) at the end of that month. In the 2:1 match arm, money that participants chose to deposit was matched 2:1 and refunded at the end of the month for every day in that month they weighed in and were at or below their goal weight.

Participants in the 3 deposit contract arms received a daily automated e-mail or text message that stated whether they had been at or below their goal weight for that day, had been above their goal weight for that day, or had failed to weigh in. These messages had 2 goals. First, for participants who chose to make monetary contributions to deposit contracts, the messages provided timely feedback on their earnings and losses. Second, for participants who chose not to make monetary contributions to deposit contracts, the messages highlighted weight loss that could have resulted in earnings if they had deposited money, thus providing motivation to take up subsequent deposit contract opportunities in order to avert future regret.

All participants were invited to measure their weight on the workplace scales as often as they desired and had access to workplace weight loss resources available to all Horizon Healthcare Services, Inc employees such as on-site discounted Weight Watchers and discounted YMCA memberships. Further, all participant weights were depicted on a line graph that each participant could see by logging in to the study website.

We used 2 strategies to maximize retention of study participants, as retention rates in weight loss interventions are often low. First, the weight loss trajectory was revised every 4 weeks for study participants who failed to attain their weight loss goals. In these cases, the slope of the trajectory was increased such that the overall weight loss goal of 24 pounds remained the same, but less successful participants would not have to immediately lose large amounts of weight to meet their monthly goals. Keeping the overall weight loss goal constant made the procedure fair for participants who maintained the ideal trajectory. However, the rate of weight loss was capped at 2 pounds per week when trajectories were revised to ensure a safe rate of weight loss. This approach was used in previous studies and resulted in participant loss to follow-up rates of only 8.7% and 9.1%.

Second, participants received $20 for completing each monthly weigh-in, $50 for completing the 24-week weigh-in, and $50 for completing 1 final weigh-in at 36 weeks (ie, 12 weeks after the deposit contract interventions ended).

Participants were monitored for excessive weight loss that could pose a health risk, defined as losing more than 5 pounds in 1 week, 8 pounds in 2 weeks, or 12 pounds in 4 weeks. If an individual’s weight loss exceeded any of these thresholds, the study coordinator contacted the participant to inquire about their health status and any use of diuretics, diet pills, purging, or excessive exercise to lose weight with a plan to discuss with the study clinician any behaviors that warranted concern.

Semistructured Interviews
Following completion of the 24-week intervention, we conducted semistructured interviews with participants in the 3 intervention arms to identify factors that influenced their participation in deposit contracts. We used purposive sampling to classify participants as having made 0, some (1 to 3), or many (4 to 6) deposits. We then randomly identified participants in each of these 3 groups and asked them to participate in a brief telephone interview. The interviews consisted of mostly open-ended questions that asked participants to identify all of the reasons, and the most important reason, why they did and/or did not make deposits. We also asked participants what could have led them to make more deposits. Individuals were compensated $20 for participating in these interviews. In each group, we stopped conducting interviews when we reached thematic saturation.
Quantitative Data Analysis

The primary outcome measure was weight loss after 24 weeks. We hypothesized that participants in each deposit contract arm would have greater weight loss than control arm participants and that greater amounts of deposit matching would lead to more weight loss than lesser amounts of deposit matching.

The main secondary outcome measure was participation in deposit contracts. We hypothesized that higher match rates would lead to a higher percentage of participants creating deposits, and a larger median amount of money committed, than among participants in arms with lesser amounts of deposit matching. Other secondary outcomes included weight loss at 36 weeks (ie, 12 weeks after deposit contract opportunities ended) and changes in potential mediators of weight loss such as physical activity, eating behaviors, and participation in weight-related wellness programs from baseline to primary outcome measurement at 24 weeks. Physical activity was measured at baseline, 24, and 36 weeks through online administration of the short form of the International Physical Activity Questionnaire and was operationalized as metabolic equivalent of task minutes of physical activity during the last 7 days. Eating behaviors were measured at baseline, 24, and 36 weeks through online administration of the Three-Factor Eating Questionnaire-R18 and were operationalized as 0 to 100 scores in cognitive restraint, emotional eating, and uncontrolled eating. Participation in weight-related wellness programs (defined as use of employer-sponsored weight loss resources or commercial weight loss programs) was measured at baseline, 24, and 36 weeks through an online questionnaire.

All analyses were intent-to-treat testing for differences between arms. We used t tests or Wilcoxon rank sum tests (F tests or Kruskal-Wallis test for 4 arms) for continuous variables and Pearson χ² tests or Fisher exact tests for categorical variables. Primary analyses used direct comparisons of outcomes by arm; we also assessed the impact of adjusting for demographic variables and adjusting for baseline levels of uncontrolled eating. To maintain the type I error rate while testing the 6 hypotheses of primary interest, we used a Bonferroni correction to define an α of .0083 as our threshold for statistical significance.

For missing 24-week and 36-week weights, we conducted multiple imputation using PROC MI in the SAS software package, with 5 imputations per missing value. The following baseline variables were included as covariates to predict missing weights: treatment arm, age, sex, race, education, household income, baseline weight, importance of controlling weight, and confidence of controlling weight. The expectation maximization (EM) algorithm was used to produce maximum likelihood estimates; because we had monotone missing data patterns, we used the parametric regression imputation procedure assuming multivariate normality and missing at random data. After 5 imputed data sets were obtained, the analyses described were conducted for each data set separately; results from these analyses were combined using the standard formulae presented by Rubin27, as implemented in PROC MIANALYZE in the SAS software package.

We based our sample size on having adequate power to find differences in our primary outcome, weight loss at 24 weeks, between the intervention and control groups. We defined 11 pounds as a clinically significant amount of weight loss in this population. Making the assumption of an 11-pound standard deviation (SD) for weight loss and using an alpha of .0083, 33 participants per arm provided 90% power to detect an 11-pound difference in weight loss between the control and no match groups and a 5-pound incremental difference in weight loss between the no match, 1:1, and 2:1 match groups. This number of participants per arm included a 10% inflation factor to account for potential loss to follow-up. We used pounds instead of kilograms in all communication with study participants and in our power calculations since study participants were much more likely to be familiar with pounds than kilograms.

All hypotheses tests were 2 sided. We used SAS software version 9.3 (SAS Institute, Inc, Cary, North Carolina) to analyze the data.

Qualitative Data Analysis

We coded the interview transcripts using qualitative methods. Three investigators independently reviewed a subset of transcripts using modified grounded theory to identify salient themes. These investigators then met to discuss the themes, refine them, and achieve consensus. There were 7 codes for reasons for making deposits, 19 codes for reasons for not making deposits, and 27 codes for factors that could have led to more deposits.

Once the coding scheme was established, 2 team members independently coded the transcripts in NVIVO software version 9 (QSR International Pty Ltd, Doncaster, Victoria, Australia). First, the 2 raters independently coded the same subset of the transcripts. The unweighted Cohen κ was calculated for each response and then averaged to provide a single index of interrater reliability. The resulting κ indicated excellent agreement (κ = .8225) between the 2 raters. The remaining interview transcripts were then divided evenly between the 2 raters and coded separately.

Results

Baseline Characteristics

The sample of 132 participants was predominantly female (87.1%) and African American (54.3%) or white (31.0%). The mean age was 43.9 years, and the mean baseline BMI was 37.3 kg/m². Participants in the 1:1 match arm had higher mean uncontrolled eating scores (41.9) than participants in the control arm (mean 30.3, P = .005). There were no other statistically
significant differences in baseline characteristics of participants in each arm (Table 1).

**Deposit Contract Participation**

Deposit contract participation rates by arm are shown in Table 2. In the first month, 5 (15.2%) of the 33 participants in the no match arm, 8 of the 33 1:1 match participants (24.2%), and 9 of the 33 2:1 match participants (27.3%) made a deposit. There were no statistically significant differences in this initial participation rate across arms. During the full 24-week intervention, 6 (18.2%) of the 33 participants in the no match arm, 12 of the 33 1:1 match participants (36.4%), and 11 of the 33 2:1 match participants (33.3%) made at least 1 monthly deposit. There were no statistically significant differences in the overall participation rate across arms. Among participants who made at least 1 deposit, there were no statistically significant differences by arm in the median sizes of monthly deposits or the median total amounts deposited.

**Twenty-Four-Week Outcomes**

After 24 weeks (Figure 2), 1:1 match participants lost significantly more weight (mean: 5.3 pounds, SD: 10.1) than participants in the control group, who gained an average of 1.0 pounds (SD: 7.6; P = .005). This difference remained statistically significant when we used only the 119 nonmissing 24-week weights. Participants in the no match arm lost a comparable amount of weight to the 1:1 match group (mean: 4.3 pounds, SD: 8.9), but this was not significantly different than the control group (P = .03) after the Bonferroni correction. The 2:1 match participants lost an average of 2.3 pounds (SD: 9.8; P = .29 compared to the control). Unfortunately, the lack of differences in deposit contract uptake limited the ability to draw inferences about the relationship between

### Table 1. Characteristics of the Study Sample.

| Characteristic                      | Control (n = 33) | No Match (n = 33) | 1:1 Match (n = 33) | 2:1 Match (n = 33) | P Value
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td>27 (81.8)</td>
<td>32 (97.0)</td>
<td>30 (90.9)</td>
<td>26 (78.8)</td>
<td>.10</td>
</tr>
<tr>
<td>Age, mean (SD)</td>
<td>45.9 (9.0)</td>
<td>43.5 (9.6)</td>
<td>44.3 (11.5)</td>
<td>42.0 (9.6)</td>
<td>.45</td>
</tr>
<tr>
<td>Initial weight measurements, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight in pounds, mean (SD)</td>
<td>220.3 (34.4)</td>
<td>221.6 (36.6)</td>
<td>213.6 (40.3)</td>
<td>238.1 (49.0)</td>
<td>.09</td>
</tr>
<tr>
<td>Body mass index, mean (SD)</td>
<td>36.6 (4.4)</td>
<td>38.2 (4.9)</td>
<td>35.9 (4.9)</td>
<td>38.5 (5.6)</td>
<td>.11</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.96</td>
</tr>
<tr>
<td>White</td>
<td>10 (30.3)</td>
<td>8 (25.8)</td>
<td>12 (37.5)</td>
<td>10 (30.3)</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>18 (54.5)</td>
<td>19 (61.3)</td>
<td>15 (46.9)</td>
<td>18 (54.5)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>4 (12.1)</td>
<td>4 (12.9)</td>
<td>4 (12.5)</td>
<td>3 (9.1)</td>
<td></td>
</tr>
<tr>
<td>Two or more races</td>
<td>1 (3)</td>
<td>0 (0)</td>
<td>1 (3.1)</td>
<td>2 (6.1)</td>
<td></td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>3 (9.1)</td>
<td>4 (12.1)</td>
<td>5 (15.6)</td>
<td>5 (15.2)</td>
<td>.87</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.15</td>
</tr>
<tr>
<td>Less than college</td>
<td>7 (21.2)</td>
<td>3 (9.1)</td>
<td>3 (9.1)</td>
<td>1 (3.0)</td>
<td></td>
</tr>
<tr>
<td>Some college</td>
<td>8 (24.2)</td>
<td>14 (42.4)</td>
<td>15 (45.5)</td>
<td>17 (51.5)</td>
<td></td>
</tr>
<tr>
<td>College graduate</td>
<td>10 (30.3)</td>
<td>11 (33.3)</td>
<td>13 (39.4)</td>
<td>12 (36.4)</td>
<td></td>
</tr>
<tr>
<td>Postcollege degree</td>
<td>8 (24.2)</td>
<td>5 (15.2)</td>
<td>2 (6.1)</td>
<td>3 (9.1)</td>
<td></td>
</tr>
<tr>
<td>Household income^d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.65</td>
</tr>
<tr>
<td>&lt;$50 000</td>
<td>3 (9.4)</td>
<td>3 (9.4)</td>
<td>6 (18.2)</td>
<td>6 (18.8)</td>
<td></td>
</tr>
<tr>
<td>$50 000 to &lt;$100 000</td>
<td>15 (46.9)</td>
<td>18 (56.3)</td>
<td>18 (54.5)</td>
<td>18 (56.3)</td>
<td></td>
</tr>
<tr>
<td>$100 000</td>
<td>14 (43.8)</td>
<td>11 (34.4)</td>
<td>9 (27.3)</td>
<td>8 (25.0)</td>
<td></td>
</tr>
<tr>
<td>Cognitive restraint, mean (SD)^e</td>
<td>52.5 (17.0)</td>
<td>52.5 (15.4)</td>
<td>47.0 (19.6)</td>
<td>46.3 (17.0)</td>
<td>.29</td>
</tr>
<tr>
<td>Uncontrolled eating, mean (SD)^e</td>
<td>30.3 (16.6)</td>
<td>35.5 (14.4)</td>
<td>41.9 (19.9)</td>
<td>33.7 (13.8)</td>
<td>.04</td>
</tr>
<tr>
<td>Emotional eating, mean (SD)^e</td>
<td>45.1 (26.9)</td>
<td>48.3 (23.7)</td>
<td>50.8 (27.1)</td>
<td>46.8 (22.7)</td>
<td>.82</td>
</tr>
<tr>
<td>MET minutes per week, mean (SD)^f</td>
<td>3290(2892)</td>
<td>2143(2036)</td>
<td>2578(2601)</td>
<td>2288(2425)</td>
<td>.26</td>
</tr>
<tr>
<td>Participation in any weight-related program^g</td>
<td>24 (80.0)</td>
<td>26 (86.7)</td>
<td>23 (79.3)</td>
<td>23 (85.2)</td>
<td>.84</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index, calculated as weight in kilograms divided by height in meters squared; MET, metabolic equivalent of task.

^P values represent results of omnibus tests for differences across all 4 arms.

^Self-identified by participants on baseline questionnaire. Three participants (2 in the no match arm and 1 in the 1:1 match arm) did not complete the race questions.

^Self-identified by participants on the baseline questionnaire. One participant in the 1:1 match arm did not complete the ethnicity questions.

^Three participants did not complete the household income question on the baseline questionnaire: 1 in the control arm, 1 in the no match arm, and 1 in the 2:1 match arm.

^Measured on a 0 to 100 scale. Higher scores signify more of that behavior.

^MET minutes are a quantification of physical activity that reflect both intensity (in METs) and duration (in minutes) of activity.

^Defined as onsite employer-sponsored weight loss resources or commercial weight loss programs. Sixteen participants did not complete this part of the baseline questionnaire: 3 in the control arm, 3 in the no match arm, 4 in the 1:1 match arm, and 6 in the 2:1 match arm.

Note: Table 1 displays the characteristics of the study sample with the number of participants (N) and their respective percentages (%). The table also includes mean values and standard deviations (SD) for various variables. The P values are provided to indicate the statistical significance of differences across all 4 arms.
There were no statistically significant differences by arm in changes in potential mediators of weight loss such as eating behaviors, physical activity, or participation in weight-related wellness programs (Table 3). In an exploratory analysis, however, there were statistically significant differences in how often participants measured their weights on the workplace scales. In each intervention period month, participants in the deposit contract arms weighed themselves more frequently on the workplace scales than participants in the control group (P values ranged from < .0001 in month 1 to .001 in month 6). Over the entire 24-week intervention period, 2:1 match participants weighed themselves an average of 55.1 times (SD: 32), 1:1 participants weighed themselves an average of 61.8 times (SD: 33), and participants in the no match arm weighed themselves an average of 52.5 times (SD: 33) as compared with the control participants who weighed themselves an average of 17.2 times (SD: 19, P < .0001).

### Thirty-Six-Week Outcomes

After 36 weeks (Figure 2), participants in the no match arm had significantly more weight loss relative to baseline (mean: 5.1 pounds, SD: 11.1) than control arm participants, who gained an average of 2.1 pounds (SD: 7.9; P = .008) compared to baseline. This difference remained statistically significant when we used only the 116 nonmissing 36-week weights. Participants in the 1:1 match arm lost an average of 3.6 pounds (SD: 9.6) compared to their baseline weight, which was no longer significantly different than the control group after the Bonferroni correction (P = .02). The 2:1 match participants lost an average of 2.8 pounds (SD: 10.1; P = .12 compared to the control).

There were no statistically significant differences by arm in changes in factors that could potentially mediate weight loss after 36 weeks (data not shown).

### Interviews With Deposit Contract Arm Participants

We conducted 57 interviews with participants in the 3 deposit contract opportunity arms: 9 of 10 participants who made 4 to 6 deposits, 15 of 19 participants who made 1 to 3 deposits, and 33 of 70 participants who made 0 deposits. From these interviews, key themes emerged about the main reasons participants did and did not enter into deposit contracts, and what they felt could have led them to make more deposits (Table 4).

Among the 24 participants who made at least 1 deposit, 2 primary reasons for making deposits were cited by more than 5 participants. The predominant reason, mentioned by 18 participants, was they felt this would provide additional motivation to help them achieve their weight loss goals. One participant, for example, stated that “I figured if I put some money on the line then I would be more compelled to be active, eat healthier, eat right in order to lose weight.”
Table 3. The 24-Week Weight Loss and Behavioral Measures by Arm

<table>
<thead>
<tr>
<th>Measure</th>
<th>Control (n = 19)</th>
<th>No Match (n = 19)</th>
<th>1:1 Match (n = 20)</th>
<th>2:1 Match (n = 21)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MET 24-pound weight loss goal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N (%)</td>
<td>0 (0)</td>
<td>1 (3.5)</td>
<td>3 (10.3)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>95% CI</td>
<td>0.0 to 11.2</td>
<td>0.1 to 17.8</td>
<td>2.2 to 27.4</td>
<td>0.0 to 11.6</td>
</tr>
<tr>
<td>P value</td>
<td>.48</td>
<td>.11</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>Change in physical activity in last 7 days, MET-minutes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>-669.3 (2752.2)</td>
<td>5.6 (2357.3)</td>
<td>-335.1 (2092.6)</td>
<td>65.8 (2474.9)</td>
</tr>
<tr>
<td>95% CI</td>
<td>-1922.1 to 583.4</td>
<td>1067.4 to 1078.6</td>
<td>-1262.9 to 592.7</td>
<td>-933.8 to 1065.4</td>
</tr>
<tr>
<td>P value</td>
<td>.48</td>
<td>.11</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>Change in cognitive restraint around eating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>-1.3 (11.1)</td>
<td>2.1 (16.7)</td>
<td>0.0 (14.1)</td>
<td>8.5 (13.8)</td>
</tr>
<tr>
<td>95% CI</td>
<td>-6.4 to 3.7</td>
<td>-5.5 to 9.7</td>
<td>-6.3 to 6.3</td>
<td>3.0 to 14.1</td>
</tr>
<tr>
<td>P value</td>
<td>.43</td>
<td>.76</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td><strong>Change in uncontrolled eating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>2.6 (12.8)</td>
<td>2.5 (14.7)</td>
<td>-0.7 (16.5)</td>
<td>-1.4 (13.5)</td>
</tr>
<tr>
<td>95% CI</td>
<td>-3.2 to 8.5</td>
<td>-4.2 to 9.2</td>
<td>-8.2 to 6.8</td>
<td>-6.9 to 4.0</td>
</tr>
<tr>
<td>P value</td>
<td>.97</td>
<td>.45</td>
<td>.34</td>
<td></td>
</tr>
<tr>
<td><strong>Change in emotional eating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>-1.1 (20.5)</td>
<td>3.2 (18.6)</td>
<td>-0.5 (18.0)</td>
<td>-2.6 (20.2)</td>
</tr>
<tr>
<td>95% CI</td>
<td>-10.4 to 8.3</td>
<td>-5.3 to 11.7</td>
<td>-8.5 to 7.5</td>
<td>-10.7 to 5.6</td>
</tr>
<tr>
<td>P value</td>
<td>.48</td>
<td>.93</td>
<td>.79</td>
<td></td>
</tr>
<tr>
<td><strong>Started participation in weight-related program</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N (%)</td>
<td>2 (10.5)</td>
<td>1 (5.3)</td>
<td>4 (20.0)</td>
<td>2 (9.5)</td>
</tr>
<tr>
<td>95% CI</td>
<td>1.3 to 33.1</td>
<td>0.1 to 26.0</td>
<td>5.7 to 43.7</td>
<td>1.2 to 30.4</td>
</tr>
<tr>
<td>P value</td>
<td>.56</td>
<td>.42</td>
<td>.92</td>
<td></td>
</tr>
<tr>
<td><strong>Continued participation in weight-related program</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N (%)</td>
<td>13 (68.4)</td>
<td>15 (78.9)</td>
<td>14 (70.0)</td>
<td>18 (85.7)</td>
</tr>
<tr>
<td>95% CI</td>
<td>47.5 to 89.3</td>
<td>60.6 to 97.3</td>
<td>49.9 to 90.1</td>
<td>70.8 to 100</td>
</tr>
<tr>
<td>P value</td>
<td>.46</td>
<td>.92</td>
<td>.20</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; MET, metabolic equivalent of task; SD, standard deviation.

*The response rate for the 24-week survey was 68%.

bBased on 119 nonmissing 24-week weights: 31 in the control arm, 29 in the no match arm, 29 in the 1:1 match arm, and 30 in the 2:1 match arm.

cP values correspond to the pairwise comparisons between the control arm and each deposit contract arm. None of these pair-wise comparisons were statistically significant using a Bonferroni-corrected α of .0083 as our threshold for statistical significance.

Table 4. Themes and Representative Quotes from Interviews with Deposit Contract Arm Participants.

Desire for extra motivation to lose weight was primary reason for deposit contract participation

"The first month, especially the first month we made the deposit as like encouragement for me to actually like lose some weight. I figured if I put some money on the line then I would be more compelled to be active, eat healthier, eat right in order to lost weight."

"Well I figured that participating in that respect would give me extra encouragement to stick with it. I need all the encouragement I can get. I just felt it was an extra incentive to keep me on track."

Lack of confidence in meeting weight loss goals limited participation in deposit contracts

"I just honestly didn’t feel confident about like everything that was going on. I'm currently in school full-time and working full-time. I'm like—I'm not really gonna dedicate myself. I was gonna try, but I knew the likelihood of me actually like dedicating myself 100 percent to the study wasn't there. I didn’t see a point in making the deposits."

"It was just harder for me to lose weight then for whatever reason. Each month I would try to look at it and go, you know I’m never gonna make this weight. Even if it was recalculated after a while, it was like I’m never gone lose this."

Fear of—and prior experience with—losing money also limited participation

"Basically I didn’t want to take any chances on losing any money."

"... I had a good momentum in the beginning. Then I started to lose that momentum. I think like towards August I was actually losing some money, so then I told myself you know what, I’m not gonna do it because I’m losing out."

Greater personal commitment to weight loss could have led to more deposits

"Nothing your company did or nothing the study did. It had to come from me actually."

"... It would have to be definitely on me, and being more of—more strict with making that effort to actually lose weight."
Among the 54 participants who passed up at least 1 opportunity to make a deposit, 3 primary reasons for not making deposits were each cited by more than 4 participants. The most frequent reason, cited by 14 participants, was a lack of confidence in achieving weight loss goals. One of these participants stated that “I guess I still have not hit that level of confidence and self-assuredness that I would succeed.” A related reason that 12 participants cited was fear of losing, or experience with losing, money they had deposited when they did not meet weight loss goals. One participant who had been making deposits, but then stopped, explained that “towards August I was actually losing some money, so then I told myself ‘you know what, I’m not gonna do it because I’m losing out.” A less common reason, mentioned by 4 participants, was that the time periods in which they could make their deposits each month did not correspond well with their pay periods. One participant said, “The last date to make deposits was on a Wednesday. At the time our payroll would hit our bank accounts on Thursday. I remember that one month… I just didn’t have it to spare. Had it been the next day, I could have done it.”

When asked about the principal changes that could have led to more deposits, 3 issues were each identified by at least 4 of the 54 participants who could have made more deposits. The most common change, mentioned by 24 participants, was being more committed to, and making a greater effort to achieve, weight loss. One participant, for example, stated, “Nothing your company did or nothing the study did. It had to come from me actually.” A less common change that could have potentially led to more deposits, cited by 5 participants, was if the monthly window in which they could make deposits had immediately followed their payday instead of preceded it. Finally, 4 participants thought they might have made more deposits if they had simply paid greater attention to the automated study messages that described how and when to make deposits.

**Discussion**

Relatively few study participants assigned to deposit contract conditions took up opportunities to enter into deposit contracts designed to promote weight loss, and employer matching of employee deposits did not increase participation. Nevertheless, there was greater weight loss in 2 of the deposit contract arms after 24 and 36 weeks than in a control group.

Although the overall 29.3% deposit contract participation rate in this study is comparable to participation rates in other settings in which deposit contracts have been tested,31-33 they are substantially lower than the participation rates of 89.5%11 and 95.5%12 that were observed in 2 other studies that offered deposit contracts to promote weight loss. These differences in participation rates are unlikely due to differences in participant characteristics, as participants in these 2 previous studies were generally of lower socioeconomic status than participants in the current study and thereby might have been expected to be less financially able to enter into deposit contracts. Instead, differences in the designs of the deposit contract interventions may help explain the differences in participation rates. In the 2 previous studies,11,12 participants were veterans who made their deposit contract decisions at a scheduled in-person medical center study visit in which they had just received $20 for completing a monthly weigh-in. In the current study, in contrast, participants made deposit contract participation decisions through a website without face-to-face contact with research staff, and they had not just received a payment that could easily be turned into a deposit. These differences suggest that human contact and money to seed the deposit account might be important ways to maximize participation in these interventions.

Our results have important implications for practitioners and policy makers. For example, the interviews we conducted with deposit contract arm participants identified ways in which deposit contracts might be structured to maximize participation. The most frequently identified reasons for not making deposits and factors that could have led to more deposits all related to confidence in achieving weight loss goals. This suggests that approaches that either simultaneously enhance confidence in losing weight (eg, offering deposit contract opportunities alongside an effective weight loss intervention) or target participants whose confidence in weight loss is already high (eg, those who have already lost weight and are trying to keep it off) could be a way to enhance participation. Some participants also stated that they might have made more deposits if the time period in which they were asked to make deposits followed their payday. This slight modification to the deposit schedule could catch participants during a time in which they are feeling most financially able to make a deposit34 and therefore might lead to greater participation rates.

Additionally, we found differences in weight loss between intervention groups and the control group despite the low deposit contract participation rates, which could have been owing to the daily automated feedback participants in the deposit contract arms received and more frequent weigh-ins among the deposit contract arm participants. First, the automated feedback may have helped deposit contract arm participants stay more focused on weight loss than the control arm participants who did not receive these messages. Several recent randomized controlled trials have tested automated messaging to promote weight loss. Napolitano et al found that overweight or obese college students who received daily text messages and access to a Facebook group lost an average of 5.9 pounds more over 8 weeks than those who had been given access to a Facebook group alone.35 Haapala et al found
that overweight or obese adults who used a mobile phone weight loss program that responded to participant data entry with an automated text message lost an average of 7.5 more pounds over 12 months than a control group.\textsuperscript{36} Patrick et al found that overweight or obese adults who received daily tailored text messages over 16 weeks lost an average of 4.3 pounds more than those who did not.\textsuperscript{37} Although each of these studies tested automated messaging in the context of interventions with other active components, these findings suggest that frequent automated feedback can be an effective tool for promoting weight loss and in our study may have been an important component in the success of the incentive intervention.

Second, more frequent weigh-ins among deposit contract arm participants—perhaps spurred by daily automated feedback—could have been another source of greater weight loss among intervention arm participants. Recent randomized trials have shown that daily self-weighing can be an effective minimal weight loss strategy. Steinberg et al found that overweight adults in a daily self-weighing weight loss intervention lost significantly more weight (4.4\% vs 0.4\%) over 6 months compared to the control group.\textsuperscript{38} In another trial, Steinberg et al found that overweight adults who weighed themselves each day lost 13.4 pounds more over 6 months than individuals who weighed themselves most days of the week.\textsuperscript{39}

Our study has limitations. We are unable to determine the independent effects of deposit contracts and daily automated feedback on weight loss outcomes, as we did not have an arm that received daily automated feedback alone. Our follow-up data are limited to 12 weeks after incentives ended. A Bonferroni correction for the 3 pairwise comparisons may be overly conservative. The data we collected in semistructured interviews with deposit contract participants may be prone to recall and social desirability biases.

In conclusion, most large US employers are offering financial incentives to promote healthy lifestyle activities among employees,\textsuperscript{2} and there is high interest in the use of deposit contracts to motivate behavior change in this setting. The Patient Protection and Affordable Care Act recently allowed US employers to further increase the magnitude of outcome-based incentives to 30\% of total health insurance premiums.\textsuperscript{40} As employers’ use of financial incentives to motivate healthy behaviors accelerates, this study suggests that simply offering an opportunity to enter into deposit contracts—even when deposits are matched—does not lead to high enough rates of sustained engagement to produce substantial weight loss. However, deposit contract opportunities with frequent automated feedback may lead to modest weight loss in these settings. Further work should explore ways to increase rates of engagement in these types of programs, identify which individuals might benefit most from deposit contract opportunities, and achieve synergy between this approach and other evidence-based weight loss strategies.

**SO WHAT? Implications for Health Promotion Practitioners and Researchers**

**What is already known on this topic?**

Two randomized trials have shown that deposit contracts can promote weight loss among obese people who want to lose weight. A major challenge to wider impact of deposit contracts is getting high proportions of obese people to participate.

**What does this article add?**

This study is the first to test employer matching of employee deposits as a way of increasing employee participation in deposit contracts to encourage weight loss. We found such matching did not significantly increase participation. Modest weight loss in 2 deposit contract arms may have been facilitated by frequent automated feedback these individuals received.

**What are the implications for health promotion practice or research?**

Future work should explore alternative ways to increase rates of initial and ongoing participation in deposit contracts. Automated feedback could be an efficient strategy to promote weight loss in workplaces and merits more evaluation.

**Authors’ Note**

Trial Registration: ClinicalTrials.gov registration number: NCT01167634. The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States government. Neither the sponsors nor the funders had any role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript.

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References


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