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Authors
Lesser, Lenard I
Thompson, Caroline A
Luft, Harold S

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Association Between Monetary Deposits and Weight Loss in Online Commitment Contracts

Lenard I. Lesser, MD, MSHS[1], **Caroline A. Thompson, PhD**[2,3], and **Harold S. Luft, PhD**[2,4]

[1]Quality and Value Team, One Medical Group, San Francisco, CA, USA

[2]Palo Alto Medical Foundation Research Institute, Palo Alto, CA, USA

[3]Division of Epidemiology & Biostatistics, San Diego State University, San Diego, CA, USA

[4]Philip R. Lee Institute for Health Policy Studies, University of California at San Francisco, San Francisco, CA, USA

Abstract

Purpose—To examine the characteristics of voluntary online commitment contracts that may be associated with greater weight loss.

Design—Retrospective analysis of weight loss commitment contracts derived from a company that provides web-based support for personal commitment contracts. Using regression, we analyzed whether percentage weight loss differed between participants who incentivized their contract using monetary deposits and those who did not.

Setting—Online.

Participants—Users (N = 3857) who voluntarily signed up online in 2013 for a weight loss contract.

Intervention—Participants specified their own weight loss goal, time period, and self-reported weekly weight. Deposits were available in the following 3 categories: charity, anticharity (a nonprofit one does not like), or donations made to a friend.

Measures—Percentage weight loss per week.

Analysis—Multivariable linear regressions.

Results—Controlling for several participant and contract characteristics, contracts with anticharity, charity, and friend deposits had greater reported weight loss than nonincentivized contracts. Weight change per week relative to those without deposits was −0.33%, −0.28%, and −0.25% for anti-charity, charity, and friend, respectively ($P < 0.001$). Contracts without a weight verification method claimed more weight loss than those with verification.

Corresponding Author: Lenard I. Lesser, MD, MSHS, One Medical Group 130 Sutter St, Floor 2, San Francisco, CA, 94104 USA. LLesser@onemedical.com.

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Declaration of Conflicting Interests

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Conclusion—Voluntary use of commitment contracts may be an effective tool to assist weight loss. Those who choose to use monetary incentives report more weight loss. It is not clear whether this is due to the incentives or higher motivation.

Keywords

behavioral economics; obesity; commitment contracts; internet-based interventions

Introduction

Many people would have better health if they lost a small to moderate amount of weight, yet most methods encouraging weight control used in a medical setting have minimal effectiveness.[1] One problem is that long-term improvement requires many short-term decisions. Deciding today to snack on carrots instead of cookies is an important incremental step but does not yield improved health for several weeks, months, or, as in the case of cardiovascular disease, years.

Getting an individual to do less of a “bad” behavior, such as eating sugar-laden cookies, traditionally involves education that sugar is not healthy and does harm in the long term. In most cases, people eat unhealthy foods not because they do not know it is harmful but because near-term benefits (taste, immediate pleasure) outweigh avoiding long-term potential harm.[2,3]

New technologies may be one way to modify this calculus by motivating healthier behaviors in the short term. Applications and devices can assist with this by reminding individuals of a bad habit or giving them positive social feedback for a good one. Health-care providers are recommending such applications and devices with some evidence of effectiveness.[4-7] These apps are low cost and, by themselves, are unlikely to cause harm.

Some applications use commitment contracts—a strategy drawn from behavioral economics to help individuals achieve self-defined goals in a specified time period.[8] For example, a professor could ask students to set their own dates for papers due within a semester, with a reduction in grade for each day the paper is late.[9] Although superficially equivalent to the usual approach of taking points off for submissions past the professor-determined due date, this approach involves a personal commitment by the student in setting the date. Many elements can be added to commitment contracts to make them more effective. In one, a deposit contract, individuals put down money to incentivize themselves to complete the goal; if they do not achieve the goal, they lose the money. This is thought to be more effective than offering a monetarily equivalent reward for meeting the goal. This greater motivation from a loss over a gain may be due to loss aversion, a component of prospect theory.[10] Some have hypothesized that one can make the contract even more motivating by designating the money to go to an entity the individual dislikes, for example, an organization antagonistic to one they normally support.[11]

Previous research on commitment contracts has been conducted in experimental situations using randomized controlled trials involving only a relatively small number of individuals. Several commercial websites are now offering commitment contracts to the general public,

allowing an examination of the behavior of people choosing to use such contracts in which they can control the parameters.

Methods

Data Collection

One website that consumers can use to make commitment contracts is stickK.com. Although contracts can be made for any objective, this study focused on contracts for weight loss. Any individual can access the website and set their weight loss goal by entering their current and goal weights. The website then suggests a duration for goal achievement based on a loss of 1 pound per week. Users can adjust this goal lower or higher, from 0.25 to 3 pounds per week.

Participants can add motivation by committing deposits—money paid whenever a weekly goal is unmet (see author note 1). After setting the goal, the participant selects the following type of contract: (1) “anticharity”—money goes to a charity/organization opposing what the individual supports, for example, if the participant favors gun control, she/he could select The National Rifle Association; (2) “charity”—money goes to a general charity fund (ie, not a specific charity selected by the participant); (3) friend—money goes to the participant’s designated “friend”; and (4) no deposits—no money is paid if the goal is not met. Behavioral economics theory suggests anticharity is the most effective motivator, with “no deposits” as the least effective, and the other 2 are intermediate. After choosing the type of contract, the user selects the weekly amount that is forfeited (via a stored credit card number) if the user does not achieve the weekly weight goal or fails to report their weight for the week. Thus, participants can motivate themselves through stickK by their selection of contract type and weekly amount.

The individual may then choose to have a referee, a person who verifies their weight each week. If so, after the participant submits their weekly weight, the website e-mails the referee a weight loss report for verification. The referee can be a spouse, coworker, or friend. The referee and participant decide how the weight is verified, which is usually by direct observation or a dated electronic photo of the scale. The website can be used with a wireless scale that transmits daily weight, and this (like the referee) is considered a verified weight. The user can also provide supporters (eg, friends and family) with access to the online commitment and weekly updates to encourage the user to keep on track.

After the terms are established, the contract begins. Every 7 days, the participant receives an e-mail to input their current weight. If they do not enter their weight within 48 hours after the due date or do not achieve their goal for that week, they lose that week’s deposit. The weekly goal is simply the final desired loss divided by the total number of weeks. For example, if a person weighed 200 pounds and had a goal weight of 180 with a 20 week commitment (ie, 1 pound a week), the goal would be to lose 1 pound each week. Failing to meet a weekly goal does not have a cumulative impact but exceeding it can be beneficial—if

[1] stickK refers to these as “stakes” as they do not technically take money (ie, charge their credit card) unless the user fails to achieve the goal. We use the term “deposit” as this is the common term in the scientific literature.

he/she lost 2 pounds in the first week and simply maintained that weight for the second week, he/she would still meet her goal.

We purchased de-identified data for all weight loss contracts on stickK.com that began in 2013 and had a planned end date on or before April 3, 2014. We cleaned the sample to eliminate those "test" contracts where it seemed the user was just experimenting with the site. All of these were "deposit-less" contracts in which the user never returned after creating the contract, so they did not have any of the key variables analyzed in our study, and we considered them to be uninformative for research purposes. Our main analysis focused on individuals with a first-time contract on the site, as familiarity with the site might lead to setting different goals. We excluded participants over 80 years old (they were outliers in the age distribution and metabolism, and weight goals are likely different at that age) and those who had contracts cancelled by website administration (the only "escape" from the commitment, usually due to unexpected medical conditions or pregnancy). The data set included age, sex, contract details, initial weight, and final weight. We did not have access to additional sociodemographic factors, weekly weights, or height. The Institutional Review Board of Palo Alto Medical Foundation determined that this study was exempt from review.

Statistical Analysis

First, we report on the available demographic data in our main sample using proportions for categorical variables, mean (standard deviation [SD]) for normally distributed data, and median (interquartile range [IQR]) for skewed data. We compared the differences in the distribution of these variables by contract type using analysis of variance (ANOVA; for continuous variables) and χ^2 tests (for categorical variables). We use multivariable linear regression modeling with our following key independent variables: (1) type of contract, and (2) amount of deposit per week. The dependent variable was average percentage weight loss per week:

$$\left(\frac{(\text{Final weight in pounds} - \text{Initial weight in pounds})/\text{Initial weight in pounds}}{\text{Total number of contract weeks}}\right)\times 100\%.$$

We used this metric because we did not have the data to calculate BMI and wanted to control for the length of contract. We controlled for hypothesized confounding factors and potential predictors of reporting weight loss success: demographic characteristics; whether the weight loss was verified (ie, the participant had a referee or used a wireless scale); and length of contract (<12 weeks or ≥12 weeks), a variable chosen based on a recent meta-analysis of commercial weight loss trials (none were less than 12 weeks in duration[12]). We tested interactions in our initial models and used the findings to specify additional models stratified by important effect modifiers.

For sensitivity analyses, we used robust regression modeling to address concerns about outlier observations (eg, contracts with very high weight loss and/or a large deposit amounts). In addition, to account for heteroskedasticity in the residuals of our model, we performed a weighted least squares and ordinary least squares (OLS) regression with robust standard errors. Neither of these models differed appreciably from the OLS model, so we

only present the final OLS models. We also performed a separate analysis to include people who had previous contracts and compared first-time contracts to follow up contracts. We used STATA version 14 (College Station, Texas) for analysis.

Results

The data provided by stickK.com included 10,524 weight loss commitment contracts. We excluded 4650 as test contracts, 20 contracts for participants older than 80 years, 199 contracts cancelled by the website administrator, 1716 from repeat users of the site, 63 with a delayed final weight report or a contract extending beyond the cutoff date, and 19 with missing data for 1 or more variables needed for our regressions. Our final core study sample included 3857 contracts. Characteristics of the study population and their contracts are presented in Table 1. Females predominated in all contract groups, but particularly so for the "no deposit" group ($P < 0.001$). There was a significant difference between contract types by age ($P < 0.001$), with older participants somewhat more likely to be in contracts that were expected to have stronger motivation (eg, anticharity). The average initial weight in pounds for males was 212.2 (SD = 37.1, $P = 0.5$ for difference across contract groups) and 167.8 (SD = 35.4) for females ($P < 0.001$ for difference across contract groups).

The average length of contracts ranged from 14 weeks in the anticharity group to 17 weeks in the no-deposit group (ANOVA; $P < 0.001$). The median weekly deposits were $10 (IQR = $15) in the anticharity and friend groups and $8 (IQR = $5) for the charity group (ANOVA; $P < 0.001$). Average weight loss goals were 15% of initial body weight in the no-deposit group but lower in the anticharity (11.5%), charity (12.4%), and friend (12.8%) groups (ANOVA; $P < 0.001$). Overall, the average weight change per week was −0.39% (SD = 0.40), with no differences between the verified and nonverified groups ($P = 0.43$) without stratification by contract groups (results not shown). Fewer participants in the no-deposit group achieved their final weight goal (χ^2; $P < 0.001$), and they were less likely to login and report a weekly weight (χ^2; $P < 0.001$).

When controlling only for age and sex, people with deposit contracts lost more weight per week than those choosing no deposit (Table 2, model 1). In our main model (model 2), we controlled for short duration (<12 weeks) contracts and whether weight was verified. Weekly weight loss was greater with anticharity contracts (−0.33% per week), charity (−0.28%), and friend (−0.25%; $P < 0.001$ for each compared with "no deposit"). Short duration contracts reported more weight loss per week than longer ones, by −0.30%. Verified contracts reported less weight loss per week than unverified, by 0.04%. Further exploratory analyses, adding interaction terms to model 2 (results not shown), revealed 2 significant interactions with the type of contract: short duration contracts yielded more reported weight loss, which varied by deposit ($P = 0.027$), and referee validation effects varied by contract type ($P = 0.0002$). To reduce heterogeneity, we repeated the regressions with only the "long" (≥12 weeks) contracts and further stratified by nonverified (model 3) and verified (model 4) contracts. The reported weight losses by deposit type were similar for the verified and nonverified groups, except that the verified reported somewhat less weight change. This final model (model 4) represents the group most similar to weight loss interventions in clinical practice, as they include verification and are at least 3 months in length. In this model, all the

deposit groups had greater percentage weekly weight loss than the no-deposit group: anticharity (−0.26), charity (−0.19), friends (−0.17) groups ($P <$ for all estimates).

For models 3 and 4, we performed a comparison of the contract groups within each regression using *pwcompare* in STATA, controlling for multiple comparisons using Tukey's method with an overall P value of .05. In the nonverified group (model 3), all deposit groups reported significantly greater weight loss than the no-deposit group, but the deposit groups were not significantly different from each other. In the verified group (model 4), the anticharity group was significantly different from the charity and friend groups (the latter 2 were not statistically significant from each other). As in model 3, all deposit groups reported significantly more weight loss than the no-deposit group.

We then examined whether the amount of money the model 4 participants (verified group with contracts of at least 12 weeks) put at risk was associated with percentage weight loss (Table 3). Controlling for type of deposit, sex, and number of friends/supporters, each $10 per week increase in deposit was associated with a −0.1% weight change per week ($P <$ 0.001).

We added back the contracts for users who had a previous contract within our data set and performed an exploratory analysis comparing first and subsequent contracts. We constructed a sample of 5592 contracts, of which 25% (n = 1398) were subsequent contracts. Using a t test, we found that subsequent contracts were 6.8 weeks shorter ($P < 0.001$) and reported a 0.06% greater weekly weight loss ($P < 0.001$; results not shown).

Discussion

Based on this analysis, individuals motivated to use commitment contracts appear to lose weight. With an average weight of 167 (female) and 212 (male) pounds, our sample is similar to the overweight population in the United States. Overall, reported change in weight was approximately −0.39% per week. For a 200-pound male with a contract of 16 weeks, this is approximately a 10.5-pound weight loss (an overall 5% loss). Greater loss aversion (ie, greater undesirableness of losses) appeared to bolster weight loss in the verified group by a small amount.

The amount of weight loss reported in this study is similar to other interventions for weight loss. Dietary trials of 6 to 12 months achieve about 4% to 5% weight loss.[13] Importantly, enrolling in such trials typically involves a substantial degree of motivation. A commitment contract is not a weight loss intervention but simply a behavioral economic mechanism to help an individual adhere to a weight loss intervention such as a change in diet or increased physical activity. For patients who are motivated and know what they need to do to adopt a healthy lifestyle, a commitment contract may be an inexpensive supplement to help achieve their goals. Motivated patients without the skills to improve their lifestyle would need to pair the contract with an evidence-based intervention for lifestyle change. Future research in this area could identify which types of weight loss interventions are best paired with commitment contracts.

Some weaknesses are inherent in our study. Self-selection is obviously present—our population (1) was motivated to lose weight, (2) had knowledge of and access to the commitment contract website, (3) in the case of those using deposits, are financially able to "lose" money if they do not meet their goals, and (4) chose the type of contract, weight loss target, and deposit to place at risk.

Reporting unsupervised weights invites reporting bias, which may be magnified when financial incentives are involved. Our finding that verification (through a referee or wireless scale) reduced reported weight loss across all deposit groups points to such reporting bias. However, the difference between those with and without verification (about 0.1% per week) is substantially smaller than the overall reported weight loss (−0.39% per week). This indicates the reporting bias was smaller than the overall effect of the contracts, giving us confidence that the entire difference was not due to reporting bias.

There are several potential unmeasured confounders or variables that may be associated with the type of contract chosen and predictive of the user's weight loss success. These include participant motivation, knowledge, and self-efficacy, among others. Motivated users might be more inclined to elect financial contracts and thus also more likely to lose weight. Some motivation could also be a result of the type of contract chosen, which would be part of the total effect of interest. Participants in our study sample are all at least sufficiently motivated to access the database and complete their contracts; this could be seen as advantageous because it reduces heterogeneity in these unmeasured "motivation" variables. Randomized trials are clearly better suited for conclusions about causality. However, our "real-world" data can give information to professionals about how voluntary commitment contracts work outside laboratory settings. People cannot be forced into deposit contracts, so even a randomized trial in this realm would lack external generalizability because only participants who accept being in a deposit intervention would be studied.[14]

Other studies have shown that financial incentives can help achieve weight loss in the short term (ie, 16 weeks), but this weight loss may not hold with a longer (ie, 36 weeks) duration of follow-up.[15] Adding group incentives, where a group receives a payout when all of its members lose weight, to commitment contracts may enhance weight loss over the short term.[16] A recent meta-analysis found that contracts were helpful with weight loss.[17] Consistent with our study, the meta-analysis found that when the participant set his/her own deposit size, there was greater weight loss during treatment. However, after the "treatment phase" was over in these studies, there was no long-term significant effect of the contracts on weight loss.

Randomized trials have not yet tested different types of contracts, such as anticharity and charity. Such contracts may enhance weight loss over the short term. If using commitment contracts is voluntary, however, then the lack of randomization may be less problematic.

Most patients trying to lose weight want the long-term success. However, focusing solely on weight may contribute to potentially harmful weight cycling without the long-term behavior changes necessary for a healthy lifestyle. For patients interested in weight loss, commitment contract-based interventions may be helpful supplements to a behavior change program.

Overall, including losing money in a commitment contract appears to be associated with weight loss comparable to that found in published trials of weight loss interventions. The type of contract and size of deposit matter little. Not surprisingly, when people do not have their weight verified, they report somewhat greater success. All these data are from motivated volunteers, but even within this group, motivation seems important. Clinicians may want to recommend a financial commitment contract to motivated patients who want assistance with adhering to their own goals.

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SO WHAT? Implications for Health Promotion Practitioners and Researchers

What is already known about this topic?

Deposit contracts can assist individuals with short-term weight loss.

Research in this area has usually tested commitment contracts in which the individual is given money by the researcher.

People are increasingly using online platforms to help themselves achieve health goals.

What this study adds

People who place their own money at risk based on achieving a weight loss goal lose more weight than those who do not.

Having money go to a charity that an individual does not like may be more motivating than other types of deposit contracts.

People likely underreport their weight when using online tools. Having another individual or a wireless scale verify the weight can reduce underreporting.

What are the implications for health promotion practice or research?

Encouraging motivated people to place their own money at risk to achieve weight loss may be effective outside research settings.

Practitioners should encourage those using online weight loss tools to have a verification method, such as a friend or a wireless scale.

Table 1

Characteristics of Participants, Contracts, and Outcomes.[a]

Deposit Group: Participant Characteristics	Anticharity, n = 1008	Charity, n = 436	Friend, n = 407	No Deposit, n = 2006	P [b]
Sex					
Male (%)	339 (33.6)	137 (31.4)	147 (36.1)	482 (24.0)	<0.001
Female (%)	669 (66.4)	299 (68.6)	260 (63.9)	1524 (76.0)	
Age, mean (SD)	40.4 (12.7)	39.0 (12.8)	37.5 (11.2)	36.6 (12.5)	<0.001
16-34 (%)	414 (41.1)	203 (46.6)	196 (48.2)	1089 (54.4)	<0.001
35-44 (%)	239 (23.7)	98 (22.5)	108 (26.5)	411 (20.5)	
45-54 (%)	190 (18.8)	71 (16.3)	64 (15.7)	279 (13.9)	
55+ (%)	165 (16.4)	64 (14.7)	39 (9.6)	224 (11.2)	
Initial weight in lbs, mean (SD)					
Male (%)	212 (35)	208 (34)	213 (39)	213 (39)	0.50
Female (%)	165 (33)	163 (32)	166 (35)	170 (37)	<0.001
Contract characteristics					
Chosen contract duration, median (IQR), weeks	14 (14)	14 (13)	15 (14)	17 (19)	<0.001
Goal weight loss: % of initial weight (SD)	11.5 (6.8)	12.4 (7.5)	12.8 (7.7)	14.9 (9.1)	<0.001
Has friends[c] (%)	28 (2.8)	13 (3.0)	28 (6.9)	58 (2.9)	<0.001
Has supporters[d] (%)	156 (15.5)	49 (11.2)	117 (28.8)	210 (10.5)	<0.001
Stakes per week in US$; median (IQR)	10 (15)	8 (5)	10 (15)	NA	<0.001
Has referee (%)	484 (48.0)	167 (38.3)	275 (67.6)	601 (30.0)	<0.001
Uses wireless scale (%)	33 (3.3)	11 (2.5)	18 (4.4)	26 (1.3)	<0.001
Weight outcomes					
% weight change/week (SD)	−0.58 (0.40)	−0.55 (0.45)	−0.48 (0.41)	−0.24 (0.31)	<0.001
% weight change/week					
Nonverified	−0.62 (0.44)	−0.61 (0.46)	−0.54 (0.44)	−0.24 (0.32)	<0.001
Verified[e] (SD)	−0.53 (0.36)	−0.45 (0.41)	−0.46 (0.39)	−0.24 (0.29)	
Achieved final commitment weight goal, percentage of total group	37.1	24.1	21.1	5.1	<0.001
Percentage of weeks reporting a weight, median (IQR)	85.7 (38.7)	73.7 (51.6)	66.7 (48.8)	18.8 (31.7)	<0.001

Abbreviations: IQR, interquartile range; NA, not applicable; SD, standard deviation.

[a] Numbers indicate counts (column percentage) and means (standard deviations), except where noted. Participants were located in various locations (online) from 2013 to 2014.

[b] Comparisons across groups use analysis of variance (ANOVA) for continuous variables and χ^2 for binary variables.

[c] Has friends who are connected on website (not contract specific).

[d] Has contacts on website that are specifically supporting this contract.

[e] Verified contracts have weights verified by another individual or a wireless scale.

Table 2

Type of Stakes and Percentage Weight Loss per Week.[a,b]

Number of Cases	Model 1[c], Beta, N = 3857	95% CI	Model 2[d], Beta, N = 3857	95% CI	Model 3[e], Beta, n = 1540	95% CI	Model 4[f], Beta, n = 1079	95% CI
Type of deposit								
Anticharity	**− 0.36**	−0.39 to −0.33	**− 0.33**	−0.36 to −0.31	**− 0.32** [g]	−0.35 to −0.29	**− 0.26**	−0.30 to −0.23
Charity	**− 0.32**	−0.36 to −0.28	**− 0.28**	−0.31 to −0.25	**− 0.30** [g]	−0.34 to −0.26	**− 0.19** [g]	−0.24 to −0.13
Friends	**−0.25**	−0.29 to −0.21	**− 0.25**	−0.29 to −0.22	**−0.26**[g]	−0.32 to −0.21	**− 0.17** [g]	−0.22 to −0.13
No deposit	Ref		Ref		Ref		Ref	
Contract <12 weeks			**− 0.3**	−0.32 to −0.28				
Has verified contract			**0.04** [h]	0.02 to 0.06				
Has supporters on website			0.03	0.00 to 0.06	**0.05** [i]	0.00 to 0.10	0.02	−0.02 to 0.05
Has friends on website			0.02	−0.04 to 0.08	0.01	−0.09 to 0.10	0	−0.06 to 0.07

Abbreviations: CI, confidence interval; Ref, reference category.

[a] Participants were located in various locations (online) from 2013 to 2014.

[b] Bolded values indicate *P* value of <0.001.

[c] Includes all contracts, controlling for age and sex.

[d] Includes all contracts, controlling for sex, age, number of friends, length of contracts, and verification status.

[e] Includes contracts 12 weeks or more that were not verified (i.e. no referee or wireless scale), controlling for above factors.

[f] Includes contracts 12 weeks or more that were verified, controlling for above factors.

[g] Groups that are not statistically different from each other at the overall $P = 0.05$ level in models 3 and 4.

[h] $P = 0.001$.

[i] $P = 0.03$.

Table 3

Amount of Deposits and Percentage Weight Loss per Week in Verified Long Contracts Who Put Deposits Down.[a,b]

	Beta	95% CI
Type of deposit		
Anticharity	−0.09[c]	−0.14 to −0.04
Charity	−0.01	−0.08 to 0.06
Friends	Reference	
Stakes per week (in $10s)	−0.01[d]	−0.02 to −0.01
Has supporters on website	0.03	−0.02 to 0.09
Has friends on website	0.00	−0.10 to 0.09

Abbreviation: CI, confidence interval.

[a] n = 624.

[b] Model also controls for age and sex. Participants were located in various locations (online) from 2013 to 2014.

[c] $P = 0.001$.

[d] $P < 0.001$.