Comparing Financial Incentive Structures for Promoting Physical Activity: A Randomized Controlled Trial

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SIGNIFICANCE STATEMENT

We present the results of one of the largest randomized controlled trials of financial incentives for physical activity ever conducted (N=3,515). We experimentally deployed financial incentives to promote physical activity, which can reduce the risk of developing some of the most prevalent and devastating diseases. At least 15 Medicaid programs and ¼ of large employers offer financial incentives for health and wellness, but little is known about the optimal way to design and disburse such incentives to generate behavior change. We find that financial incentives are most effective in motivating physical activity if they are delivered at a constant rate rather than an increasing or decreasing rate. This has implications for the design of incentives to promote healthy behaviors.

ABSTRACT

Background

Few adults engage in recommended levels of physical activity. Financial incentives can promote physical activity, but little is known about the most effective incentive structure. We sought to answer the question—is it most effective to disburse fixed total incentives at a constant, increasing or decreasing rate to encourage sustained physical activity?

Methods

We recruited 3,515 users of Achievement, an online platform that records daily steps of pedometer-wearing users and awards points redeemable for cash, to participate in a two-week four-arm randomized controlled trial. Participants were randomized to either control or one of three intervention groups over two weeks. Control participants received a constant daily rate of $0.00001/step. The three intervention groups received a 20-fold incentive increase ($0.00020/step) distributed differently over two weeks—at a constant, increasing, or decreasing rate.

Results

During the intervention, compared to control, constant incentives generated 306.7 more steps/day (95% CI [91.5,521.9]; p=0.005), decreasing incentives generated 96.9 more steps/day (CI [15.3,178.5]; p=0.020), and increasing incentives generated no significant change (1.5; CI [-81.6,84.7]; p=0.971). One week post-intervention, compared to control, only constant incentives generated significantly more steps/day (329.5; CI [20.6,638.4]; p=0.037). Two and three weeks post-intervention, there were no significant differences compared to control. Overall, for each dollar spent, constant incentives generated 475.5 more steps than increasing incentives and 429.4 more steps than decreasing incentives.

Conclusions

Financial incentives for physical activity are more effective during and following a payment period if offered at a constant rather than an increasing or decreasing rate.

Trial Registration

Clinicaltrials.gov identifier: NCT02154256
https://clinicaltrials.gov/ct2/show/NCT02154256

Keywords: Physical Activity, Habit Formation, Behavioral Economics, Behavior Change, Incentives, Technology

INTRODUCTION

Physical inactivity has been implicated as a major risk factor for disability and death globally, on par with obesity and smoking, yet receives considerably less attention[1,2]. Inactivity accounts for 9% of premature mortality[2]. In the United States, inactive individuals older than 50 years of age would gain 1.3-3.7 years of life expectancy if they became active[3]. Activity alone can reduce the risk of developing diabetes, cardiovascular disease, colon and breast cancers, and improve bone and mental health; however, less than half of adults in the US engage in recommended levels of physical activity[4]. The benefits of activity and the costs of inactivity are clear, but motivating individuals to increase their activity is challenging.

Financial rewards are a useful tool for encouraging healthy behaviors including smoking cessation, eating nutritious foods, physical activity, and weight loss[5–14]. At least 15 state Medicaid programs and over 1/4 of large employers offer financial incentive-based health and wellness programs[15,16].

While financial incentives can encourage healthy behaviors including exercise, it is unclear how to create behavior change that is sustained after incentives are inevitably removed. Among the studies demonstrating the benefits of financial incentives, few have measured post-intervention behavior, and fewer still have demonstrated evidence of behavior change lasting beyond the time period when incentives were offered[7–9]. A critical question is therefore how to disburse incentives for maximal, sustained, impact.

While maintaining the same financial incentive over time has the benefit of simplicity, it may not be the best way to create sustained behavior change after incentives are removed. Starting with a small incentive and increasing it over time may help individuals gradually build a habit. Just as training for a marathon is a progressive process; change is often better tolerated and more sustainable when it happens gradually [17–20]. Yet, starting with a large incentive may help motivate individuals to overcome inertia and initiate a new routine[21,22]. Gradually reducing incentives over time from an initially high level may then help diminish individuals' reliance on financial rewards for motivation to exercise, making it easier to transition to un-incentivized engagement, just as patients need to be weaned off some chronic medications[23–25].

Our primary objective was to compare three different two-week incentive programs with rewards for steps taken to determine which was the most effective for increasing steps both during and post-intervention. Each program offered the same total incentives but distributed differently: increasing, decreasing, or constant over time. In a four-arm randomized controlled trial, we compared the effectiveness of these incentive programs versus a control group.

METHODS

Study Design

We conducted a field experiment with Achievement (formerly called AchieveMint), an online platform (www.myachievement.com) that automatically records the daily steps of users who wear pedometers and awards them points redeemable for cash. One step earns $0.00001 (i.e., 10,000 steps = $0.10). We tested whether and by how much offering incentives to Achievement users that are twenty times as large as usual over two consecutive weeks changes the steps taken during and after the intervention compared to a control group. This study was approved by the University of Pennsylvania Institutional Review Board and registered with ClinicalTrials.gov (NCT02154256).

Setting and Participants

Participants were Achievement users who logged steps using a pedometer at least once between May 9, 2014 and May 22, 2014 (the date participant selection occurred). At the time of data collection, Achievement users were 79% female with an average age of 37. Users hailed from 63 countries with 91% from the United States. To maximize the health impact of our intervention, we excluded the most active Achievement users and conducted our study among users whose logged steps were in the bottom 70^{th} percentile of all Achievement users between May 9, 2014 and May 22, 2014. We calculated that a sample of 3,515 participants would allow us to detect a difference of 280 steps per day at α=0.05 with 80% power.

Randomization and Interventions

Participants were stratified by pedometer brand and randomly assigned to one of four experimental conditions as outlined in **Figure 1**: a control condition (in which participants received incentives as usual: $0.00001 per step (i.e. $0.10 per 10,000 steps) or one of three treatment conditions. In the three treatment conditions, participants were offered an average of 20x their usual points per step (i.e. $2.00 per 10,000 steps) during the two-week intervention period. In the constant incentive condition, they were offered $0.00020 per step every day. In the increasing incentive condition, they were initially offered $0.00005 per step (i.e. $0.50 per 10,000 steps); this increased by $0.00005 per step every two days up to a maximum of $0.00035 per step (i.e. $3.50 per 10,000 steps) on the last two days. In the decreasing incentive condition, participants were initially offered $0.00035 per step; this decreased by $0.00005 per step every two days down to a minimum of $0.00005 per step on the last two days. The schedule of incentives is detailed in **Table 1** and **Figure 2**.

The day before the intervention began (on Sunday, June 1, 2014), all participants in all four conditions received an email describing the program designed to help them increase their physical activity. In the treatment arms, participants received a precise schedule detailing the incentives they would receive for each step taken on each day over the subsequent two weeks. All study participants who wore pedometers on a given day and "synced" their pedometers with Achievement within seven days were recorded in our dataset, and others were recorded as missing observations, allowing for analyses accounting for missing observations in a variety of ways.

Outcomes and Statistical Analysis

The primary outcome of interest is change in daily steps taken as recorded by participants' pedometers. Our intervention began on June 2, 2014 and concluded on June 15, 2014.

Prior studies have demonstrated that pedometer daily step counts of less than 2,000 are unlikely to be reflective of true daily step count values; we define a missing data day as any day with less than 2,000 steps recorded[26]. To address the possibility that some participants walked without pedometers, we present all analyses in two different ways.

We conduct our primary analysis using an intent-to-treat strategy in which we replace missing data with an average of a given participant's pre-intervention daily step counts greater than 2,000 steps, stratified by day of week to account for person-within-week differences in physical activity (i.e., a participant may routinely get more physical activity on Saturdays compared to Wednesdays). To further minimize the potential for bias, we conduct a sensitivity analysis in which we delete all daily step data recording fewer than 2,000 steps – an approach that would bias towards a null effect.

We use ordinary least squares regression to predict the overall and separate effects of our three treatment arms (*constant, increasing, and decreasing*) on participants' daily steps. We include person-by-day-of-week fixed effects and cluster standard errors by person-by-day-of-week to control for individual differences in steps and further for differences in participant routines that vary by day of week; these fixed effects also capture condition assignment. In addition, we include fixed effects by pedometer brand and for each day of the year to account for seasonal conditions that may influence step count.

RESULTS

The sample (N = 3,515) was distributed randomly among the control (n=879), constant (n=879), increasing (n=881), and decreasing (n=876) conditions. In the three weeks pre-intervention, mean daily steps across all study participants was 6,804.48 (SD = 3,506.91). Pre-intervention, each day on average 83.6% of participants used their pedometer. During the intervention, each day on average 78.5% of participants wore their pedometer. During the intervention, step count data were missing for 23.6% of user-days in the control condition, 20.3% of user-days in the constant condition, 21.0% of user-days in the increasing condition, and 21.0% of user-days in the decreasing condition.

Effect of 20x increase in incentives

Participants collapsed across the three treatment arms took an estimated 135.0 additional daily steps relative to control during the intervention period (CI [41.0, 228.9]; p=0.005). In the three weeks following the intervention, there were no significant differences.

Figure 3 shows the unadjusted differences in mean steps taken by treatment participants compared to control participants for 3 weeks before, 2 weeks during, and 3 weeks after the intervention. Treatment participants experienced an increase in physical activity mid-way through the intervention (when Achievement sent a regular Sunday earnings update email), and the increase was particularly large for those in the constant condition.

Effect of incentive structure

During the intervention. **Table 2** presents the results of regressions and Wald tests comparing the effectiveness of each treatment arm relative to control and to each other treatment arm during the two-week intervention. Participants in the constant condition logged 306.7 additional daily steps (95% CI [91.5, 521.9]; p=0.005) relative to those in the control condition, 305.1 additional daily steps (CI [89, 521.2]; p=0.006) relative to those in the increasing condition, and 209.8 additional daily steps (CI [-5.7, 425.3]; p=0.056) relative to those in the decreasing condition. Participants in the decreasing condition demonstrated a small increase in daily steps relative to those in the control condition (96.9 additional daily steps; CI [15.3, 178.5]; p=0.020) and relative to those in the increasing condition (95.3 additional daily steps; CI [11.3, 179.3]; p=0.026). Participants in the increasing condition did not log significantly more steps than those in the control condition (1.5; CI [-81.6, 84.7]; p=0.971).

After the intervention. **Table 3** presents the effectiveness of each treatment arm in the three weeks after the intervention. In the first week post-intervention, participants in the constant condition took 329.5 more daily steps (CI [20.6, 638.4]; p=0.037) than those in the control condition, 397.8 more daily steps (CI [89.2, 706.4]; p=0.012) than those in the increasing condition and 308.6 more daily steps (CI [0.1, 617.1]; p=0.050) than those in the decreasing condition. There were no significant differences between the increasing and decreasing conditions and the control condition (-68.3; CI [-174.6, 38.1]; p=0.208 and 21.0; CI [-84.9, 126.8]; p=0.698, respectively).

In the second week post-intervention, participants in the constant condition logged significantly more daily steps than increasing condition participants (315.2 additional daily steps; CI [6, 624.4]; p=0.046). Constant condition participants also logged more daily steps than those in the control and decreasing conditions, but these differences were not significant (213.5 additional daily steps; CI [-94.8, 521.8]; p=0.175 and 297.1 additional daily steps; CI [-10.9, 605.1]; p=0.059, respectively). There were no significant differences between the increasing and decreasing conditions and the control condition (-101.7; CI [-209.2, 5.8]; p=0.064 and -83.6; CI [-187.7, 20.6]; p=0.116, respectively)

In the third week post-intervention, there were no significant differences in steps taken between the constant condition and the increasing (53.6; CI [-100.5, 207.7]; p=0.773), decreasing (-82.7; CI [-233.8, 68.4]; p=0.177), or control conditions (-22.8; CI [-177.3, 131.8]; p=0.271). There was, however, a significant increase of 136.3 daily steps in the decreasing condition compared to the increasing condition (CI [30.3, 242.3]; p=0.012).

Cost-effectiveness

During the intervention, participants in the constant condition were paid an average of $15.48 per person compared to an average of $14.54 per person in the increasing condition, and an average of $14.67 per person in the decreasing condition.

Compared to control and including post-intervention effects, for each additional $1 paid, there were 582.4 additional steps per participant in the constant condition, 107.0 additional steps per participant in the increasing condition, and 153.1 additional steps per participant in the decreasing condition.

Sensitivity Analyses

In the more conservative model in which we delete all step count data less than 2,000, we find qualitatively similar results except there is no longer a statistically significant effect of decreasing incentives compared to control during the intervention period (80.5; CI [-38.5, 199.4]; p=0.185). Constant incentives demonstrate a sustained effect 1-week post-intervention compared to the increasing (607.4; CI [103.7, 1111.1]; p=0.013) and decreasing incentive conditions (515.4; CI [12, 1018.8]; p=0.042). There is no statistically significant difference in steps 1-week post-intervention between the constant and control conditions (485.4; CI [-20.1, 990.0]; p=0.060).

DISCUSSION

To our knowledge, this is one of the largest randomized controlled trials of financial incentives for physical activity. We leverage advances in technology to rigorously test the impact of different incentive structures on physical activity and find that the structure of an incentive is important for encouraging behavior during and after an intervention[6,11]. Participants in the constant incentive condition engaged in significantly more physical activity than participants in the increasing and decreasing conditions both during and following the intervention.

Even though the incentives offered were of equal value across treatment arms, we found significant and sizable differences in physical activity as a function of the way they were disbursed. The constant incentive condition outperformed the other two incentive conditions during the intervention and 1-week post-intervention, but differences started to diminish in the 2nd and 3rd weeks post-intervention. Similar to prior studies, after the withdrawal of incentives, physical activity tapered in all conditions[14,27]. For the constant condition, however, the heightened physical activity level achieved during the intervention translated into more persistent behavior change post-intervention.

It is important to recognize that the control effectively received an incentive at a constant rate, just 20-fold lower than the treatment conditions. The constant rate structure was so effective that during the intervention, the control performed equally as well as a 20-fold greater incentive delivered at an increasing rate and only marginally worse than a 20-fold greater incentive delivered at a decreasing rate.

Our results on the comparative effectiveness of constant versus decreasing incentives are consistent with findings from a working paper by Carrera *et al* directly comparing the impact of a constant incentive and a decreasing incentive on gym initiation and attendance over eight weeks among employees of a Fortune 500 company[27]. They find that among non-gym members the constant and decreasing incentives were equally effective in increasing gym join rates. However, among existing gym members, the constant incentive was significantly more effective than the decreasing incentive in motivating physical activity during and after the intervention. They complement a host of recent studies exploring different payment disbursement schemes for motivating physical activity[8–11,27–29] .

Only a handful of studies providing financial incentives for exercise and physical activity have measured and demonstrated persistent behavior change post-intervention[8–10,27,30]. These studies differ from the current study in a number of ways – almost all incentivized and measured gym attendance rather than step count, lasted four weeks or longer, provided an incentive with a daily expected value more than twice that of the current study ($1.40), and recruited samples fewer than 1000 participants [8–10,27,30].

Our findings raise the question of why incentives delivered at a constant rate proved more effective than other disbursement strategies. One potential explanation is that the constant incentive was easier to remember and therefore more salient and impactful in promoting sustained physical activity[31]. By contrast in the other disbursement strategies, getting paid different amounts for doing the same thing may have been confusing, or even felt unfair, potentially contributing to their relative ineffectiveness[32]. Further research exploring these and other possibilities would be valuable.

Prior work suggests a differential and often lower impact of financial incentives among those with existing exercise habits[9,27]. Users of the Achievement platform have higher daily step counts than the average US adult, which is why for our study we sampled from Achievement users in the bottom 70% of physical activity. As a result, our study findings reflect a population with similar baseline physical activity as the US population[33]. However, we cannot say as much about how our incentive conditions might impact those who are on the extremes of physical activity including those who are sedentary.

Our study has several limitations. First we were dependent on participants' device-wearing behaviors. We could not detect steps if a participant did not wear the pedometer, resulting in missing data. Missing data is a common challenge when conducting experimental research in real-world settings. Prior studies have dealt with missing or partially recorded step data by excluding or replacing the data with a uniform step number. These approaches have their own shortcomings because deleting the data biases towards a null effect and replacing missing data with zeros biases towards finding an effect because of better observability in treatment groups (who are more incentivized to wear pedometers). Instead, as described in the methods section, we took a more conservative approach, replacing missing data with the average of pre-intervention steps greater than 2,000 and employed an intent-to-treat analytic strategy. This approach has a slight bias towards a null effect but is more balanced than prior approaches to the common occurrence of missing step data. Furthermore, all analyses are presented using an even more conservative approach of deleting all step data below a certain threshold, consistent with prior research[29].

Second, pedometers restricted us to step count, even though other metrics such as metabolic equivalents or minutes of moderate-vigorous physical activity might be more relevant to long-term health outcomes.

Third, despite randomization, there was a significant difference in pre-intervention mean daily steps between the decreasing and increasing conditions. We attempted to minimize this bias through a focus on change in mean daily steps and inclusion of fixed effects to account for time-invariant differences among participants. Importantly, this limitation does not apply to comparisons with the constant condition since there were no significant differences in pre-intervention mean daily steps between the constant and increasing, decreasing, or control conditions.

Fourth, compared to prior experiments on incentives for health behaviors, our intervention time period of two weeks was relatively short and our incentive relatively small. On the other hand, it is impressive that the incentives, in particular the constant ones, had an effect despite their size. Incentives delivered over a longer period of time may lead to greater behavior change during and after an intervention, but they are also more expensive[7–10,27].

Fifth, the study was not well-powered to detect step differences two or three weeks post-intervention. Nonetheless, we see significantly greater steps in the constant condition compared to the increasing condition as far out as two weeks post-intervention.

In summary, this is one of the largest randomized controlled trials of financial incentives for physical activity. For the same possible earnings, daily incentives of constant value are more effective in promoting physical activity compared to incentives of increasing or decreasing value and can lead to behavior persistence at least half the duration of the intervention. These findings have implications for policymakers, practitioners, and the psychology of sustained behavior change. Future research should continue to explore strategies to improve health through incentives and remote technology with an eye towards building persistent behaviors that lead to habit formation.

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ROLE OF FUNDER

Evidation and Humana had no role in the design and conduct of the study; analysis and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

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Figure 1. Study Flow Diagram

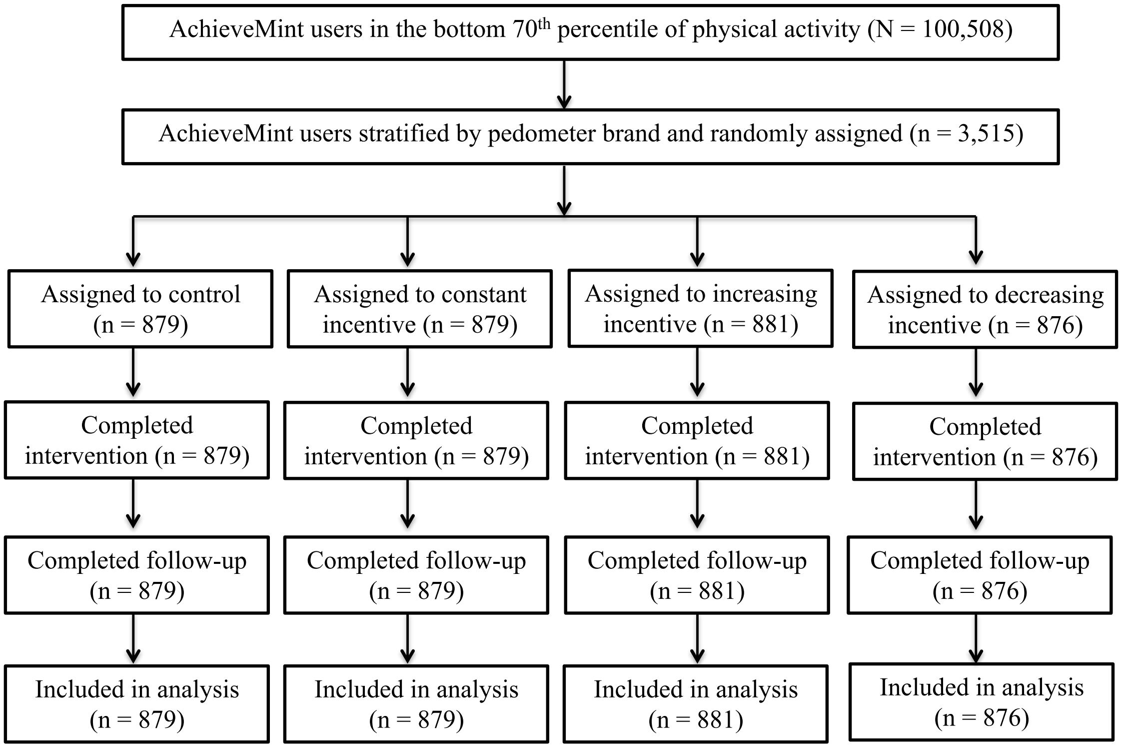


Table 1. Schedule of Incentive Rates Offered per Step on Each of 14 Days of Intervention by Experimental Condition.

Schedule of Incentives	Control	Constant	Increasing	Decreasing
Day 1	$0.00001	$0.00020	$0.00005	$0.00035
Day 2	$0.00001	$0.00020	$0.00005	$0.00035
Day 3	$0.00001	$0.00020	$0.00010	$0.00030
Day 4	$0.00001	$0.00020	$0.00010	$0.00030
Day 5	$0.00001	$0.00020	$0.00015	$0.00025
Day 6	$0.00001	$0.00020	$0.00015	$0.00025
Day 7	$0.00001	$0.00020	$0.00020	$0.00020
Day 8	$0.00001	$0.00020	$0.00020	$0.00020
Day 9	$0.00001	$0.00020	$0.00025	$0.00015
Day 10	$0.00001	$0.00020	$0.00025	$0.00015
Day 11	$0.00001	$0.00020	$0.00030	$0.00010
Day 12	$0.00001	$0.00020	$0.00030	$0.00010
Day 13	$0.00001	$0.00020	$0.00035	$0.00005
Day 14	$0.00001	$0.00020	$0.00035	$0.00005

Figure 2. Relative Incentive Rates Offered per Step on Each of 14 days of Intervention by Experimental Condition Where x = $0.00001 / step

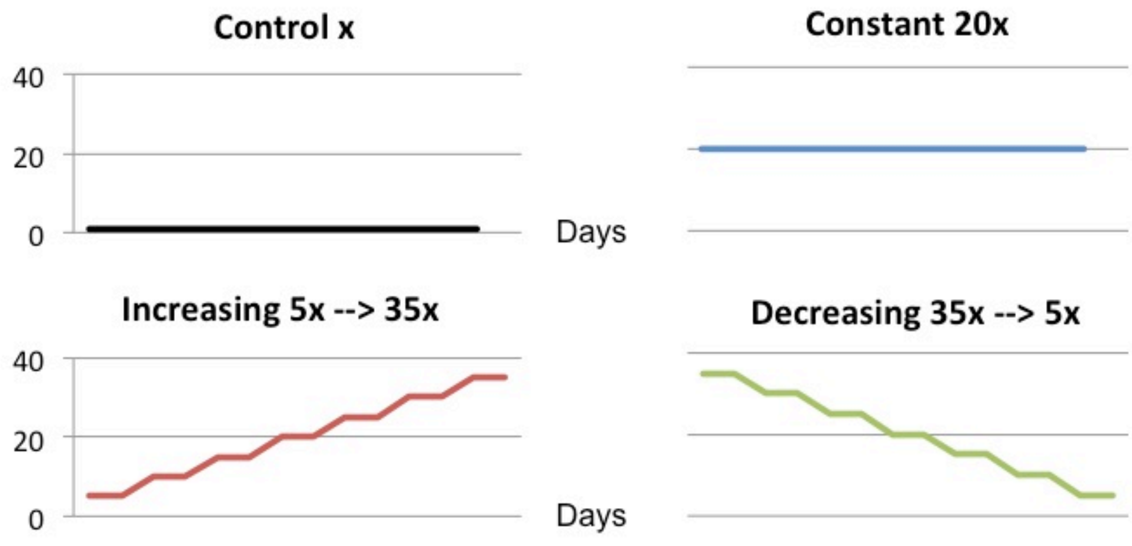


Figure 3. Unadjusted Mean Differences in Step Count Compared to Control by Experimental Condition

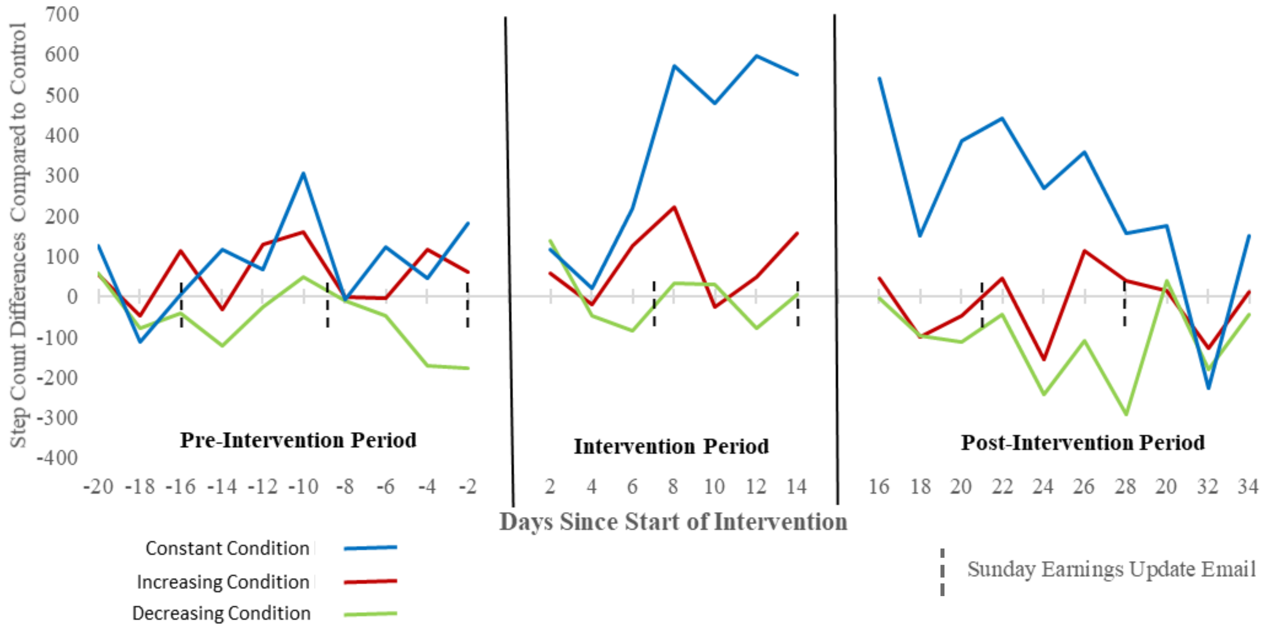


Table 2. Adjusted Mean Daily Step Counts by Experimental Condition During the 14-Day Intervention Period

	Main Model				***Sensitivity Analysis***			
	Control	Constant	Increasing	Decreasing	Control	Constant	Increasing	Decreasing
Daily Step Count	6,968.9	7,275.5	6,970.4	7,065.8	7,386.1	7,803.5	7,389.4	7,466.6
95% CI	[6912.4 , 7025.4]	[7075.5 , 7475.6]	[6910.6 , 7030.2]	[7008.1 , 7123.4]	[7301.7 , 7470.6]	[7498.8 , 8108.1]	[7303.7 , 7475.2]	[7384.3 , 7548.9]
Difference in Daily Step Count								
Relative to Control	-	306.7**	1.5	96.9*	-	417.3*	3.3	80.5
95% CI		[91.5 , 521.9]	[-81.6 , 84.7]	[15.3 , 178.5]		[91.7 , 742.9]	[-118.1 , 124.7]	[-38.5 , 199.4]
Relative to Increasing	-	305.1**	-	-	-	414.0*	-	-
95% CI		[89 , 521.2]				[88.4 , 739.6]		
Relative to Decreasing	-	-	-95.3*	-	-	-	-77.1	-
95% CI			[-179.3 , -11.3]				[-197 , 42.8]	
Relative to Constant	-	-	-	-209.8+	-	-	-	-336.9*
95% CI				[-425.3 , 5.7]				[-661.6 , -12.2]
Sample	*Imputed Steps, Full Sample*				*Only Steps ≥ 2,000*			
N	815,480				509,275			
R^2	0.38				0.26			

+ p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001
Ordinary least square regression models used to generate these estimated step counts include fixed effects for person-by-day-of-week, day-of-year, and pedometer brand. Robust standard errors are clustered by participant-day-of-week. Between intervention arm differences were calculated using Wald Tests. The main model utilizes an ITT strategy and replaces missing data based on an average of pre-intervention step counts greater than 2000 steps, stratified by day of week – this would bias slightly towards a null effect. The sensitivity analysis only includes step count data > 2000 steps – this would bias more heavily towards a null effect.

Table 3. Adjusted Mean Daily Step Counts by Experimental Condition During the 21-Day Post-Intervention Period

	Main Model				*Sensitivity Analysis*			
	Control	Constant	Increasing	Decreasing	Control	Constant	Increasing	Decreasing
1-Week Post-Intervention (Days 1 - 7)								
Daily Step Count	6,985.8	7,315.4	6,917.6	7,006.8	7,426.6	7,912.0	7,304.6	7,396.6
95% CI	[6910.7 , 7061]	[7023.4 , 7607.3]	[6843.4 , 6991.8]	[6933.3 , 7080.4]	[7304.5 , 7548.8]	[7434 , 8390]	[7189.4 , 7419.8]	[7282.6 , 7510.7]
Difference in Daily Step Count								
Relative to Control	-	329.5*	-68.3	21.0	-	485.4+	-122.0	-30.0
95% CI		[20.6 , 638.4]	[-174.6 , 38.1]	[-84.9 , 126.8]		[-20.1 , 990.9]	[-290.2 , 46.2]	[-197.4 , 137.5]
Relative to Increasing	-	397.8*	-	-	-	607.4*	-	-
95% CI		[89.2 , 706.4]				[103.7 , 1111.1]		
Relative to Decreasing	-	-	-89.2+	-	-	-	-92.0	-
95% CI			[-194.4 , 16]				[-254.5 , 70.5]	
Relative to Constant	-	-	-	-308.6*	-	-	-	-515.4*
95% CI				[-617.1 , -0.1]				[-1018.8 , -12]
2-Week Post-Intervention (Days 8 - 14)								
Daily Step Count	7,025.9	7,239.4	6,924.2	6,942.3	7,472.3	7,791.4	7,288.9	7,259.5
95% CI	[6952.3 , 7099.6]	[6947.7 , 7531.2]	[6846.9 , 7001.6]	[6869.6 , 7015.1]	[7354.6 , 7590.1]	[7319.1 , 8263.7]	[7169.4 , 7408.4]	[7147 , 7372]
Difference in Daily Step Count								
Relative to Control	-	213.5	-101.7+	-83.6	-	319.1	-183.4*	-212.9*
95% CI		[-94.8 , 521.8]	[-209.2 , 5.8]	[-187.7 , 20.6]		[-179.7 , 817.9]	[-351.5 , -15.3]	[-376.2 , -49.6]
Relative to Increasing	-	315.2*	-	-	-	502.5*	-	-
95% CI		[6 , 624.4]				[3.5 , 1001.5]		
Relative to Decreasing	-	-	-18.1	-	-	-	29.4	-
95% CI			[-125 , 88.8]				[-135.1 , 193.9]	
Relative to Constant	-	-	-	-297.1+	-	-	-	-532.0*
95% CI				[-605.1 , 10.9]				[-1029.4 , -34.6]
3-Week Post-Intervention (Days 15 - 21)								
Daily Step Count	6,981.7	6,959.0	6,905.4	7,041.7	7,423.0	7,350.7	7,268.6	7,406.8
95% CI	[6903.3 , 7060.1]	[6829 , 7088.9]	[6828 , 6982.8]	[6970.1 , 7113.2]	[7291.8 , 7554.3]	[7131.2 , 7570.3]	[7143.1 , 7394]	[7290.8 , 7522.8]
Difference in Daily Step Count								
Relative to Control	-	-22.8	-76.3	59.9	-	-72.3	-154.5+	-16.2
95% CI		[-177.3 , 131.8]	[-187.1 , 34.5]	[-46.8 , 166.7]		[-333.6 , 188.9]	[-336.4 , 27.4]	[-191.7 , 159.2]
Relative to Increasing	-	53.6	-	-	-	82.1	-	-
95% CI		[-100.5 , 207.7]				[-176.4 , 340.6]		
Relative to Decreasing		-	-136.3*	-	-	-	-138.2	-

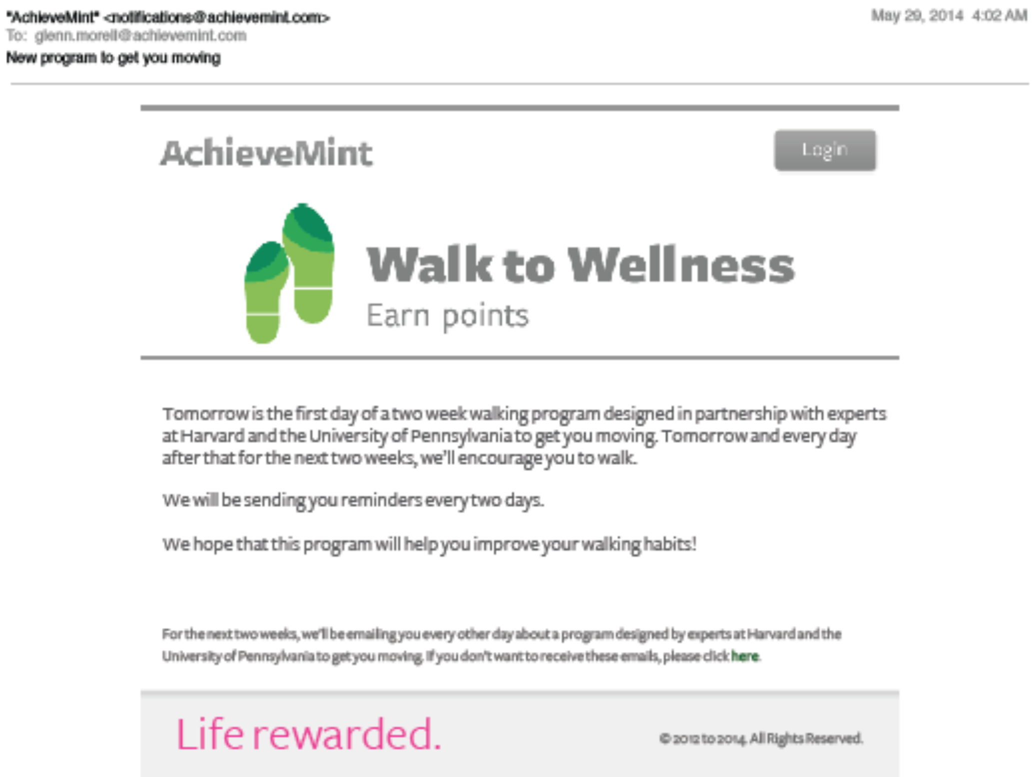
95% CI			[-242.3 , -30.3]				[-309.3 , 32.9]	
Relative to Constant	-	-	-	82.7	-	-	-	56.1
95% CI				[-68.4 , 233.8]				[-197.5 , 309.7]
Sample	*Imputed Steps, Full Sample*				*Only Steps ≥ 2,000*			
N	815,480				509,275			
R^2	0.38				0.26			

+ $p < 0.10$;   * $p < 0.05$;   ** $p < 0.01$;   *** $p < 0.001$

Ordinary least square regression models used to generate these estimated step counts include fixed effects for person-by-day-of-week, day-of-year, and pedometer brand. Robust standard errors are clustered by participant-day-of-week. Between intervention arm differences were calculated using Wald Tests. The main model utilizes an ITT strategy and replaces missing data based on an average of pre-intervention step counts greater than 2000 steps, stratified by day of week – this approach would bias slightly towards a null effect. The sensitivity analysis only includes step count data > 2000 steps – this would bias more heavily towards a null effect.

Online Supplement Table of Contents

eFigure 1. Program Announcement Email for the Control Condition



eFigure 2. Program Announcement Email for the Constant Incentive Condition

"AchieveMint" <notifications@achievemint.com>

May 29, 2014 4:02 AM

To: glenn.morell@achievemint.com

New program to get you moving (with bonus points)

AchieveMint

Login

Walk to Wellness

Earn points

Tomorrow is the first day of a two week walking program designed in partnership with experts at Harvard and the University of Pennsylvania to get you moving. Tomorrow and every day after that for the next two weeks, we'll encourage you to walk by multiplying the points you earn for walking by 20.

Specifically, your bonuses from AchieveMint over the next two weeks will follow this schedule:

June 2014

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2 20x	3 20x	4 20x	5 20x	6 20x	7 20x
8 20x	9 20x	10 20x	11 20x	12 20x	13 20x	14 20x
15 20x	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

We will be sending you reminders every two days about upcoming bonuses.

We hope that this program will help you improve your walking habits!

For the next two weeks, we'll be emailing you every other day about a program designed by experts at Harvard and the University of Pennsylvania to get you moving. If you don't want to receive these emails, please click **here**.

eFigure 3. Program Announcement Email for the Increasing Incentive Condition

"AchieveMint" <notifications@achievemint.com>　　May 29, 2014 4:02 AM
To: glenn.morell@achievemint.com
New program to get you moving (with bonus points)

AchieveMint　　Login

Walk to Wellness
Earn points

Tomorrow is the first day of a two week walking program designed in partnership with experts at Harvard and the University of Pennsylvania to get you moving. Tomorrow and the day after that, we'll encourage you to walk by multiplying the points you earn for walking by 5. After that (i.e., in 3 days' time), we'll multiply the points you earn for walking by 10, and then two days later, your bonus multiplier will increase again. Specifically, your multiplier will increase by 5 every two days, up to a multiplier of 35 on the last two days of this program.

Specifically, your bonuses from AchieveMint over the next two weeks will follow this schedule:

June 2014

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2 5x	3 5x	4 10x	5 10x	6 15x	7 15x
8 20x	9 20x	10 25x	11 25x	12 30x	13 30x	14 35x
15 35x	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

We will be sending you reminders every two days about upcoming bonuses.

We hope that this program will help you improve your walking habits!

For the next two weeks, we'll be emailing you every other day about a program designed by experts at Harvard and the University of Pennsylvania to get you moving. If you don't want to receive these emails, please click here.

eFigure 4. Program Announcement Email for the Decreasing Incentive Condition

"AchieveMint" <notifications@achievemint.com>
To: glenn.morell@achievemint.com
New program to get you moving (with bonus points)

May 29, 2014 4:03 AM

AchieveMint

Login

Walk to Wellness

Earn points

Tomorrow is the first day of a two week walking program designed in partnership with experts at Harvard and the University of Pennsylvania to get you moving. Tomorrow and the day after that, we'll encourage you to walk by multiplying the points you earn for walking by 35. After that (i.e., in 3 days' time), we'll multiply the points you earn for walking by 30, and then two days later, your bonus multiplier will decline again. Specifically, your multiplier will decrease by 5 every two days, down to a multiplier of 5 on the last two days of this program.

Specifically, your bonuses from AchieveMint over the next two weeks will follow this schedule:

June 2014

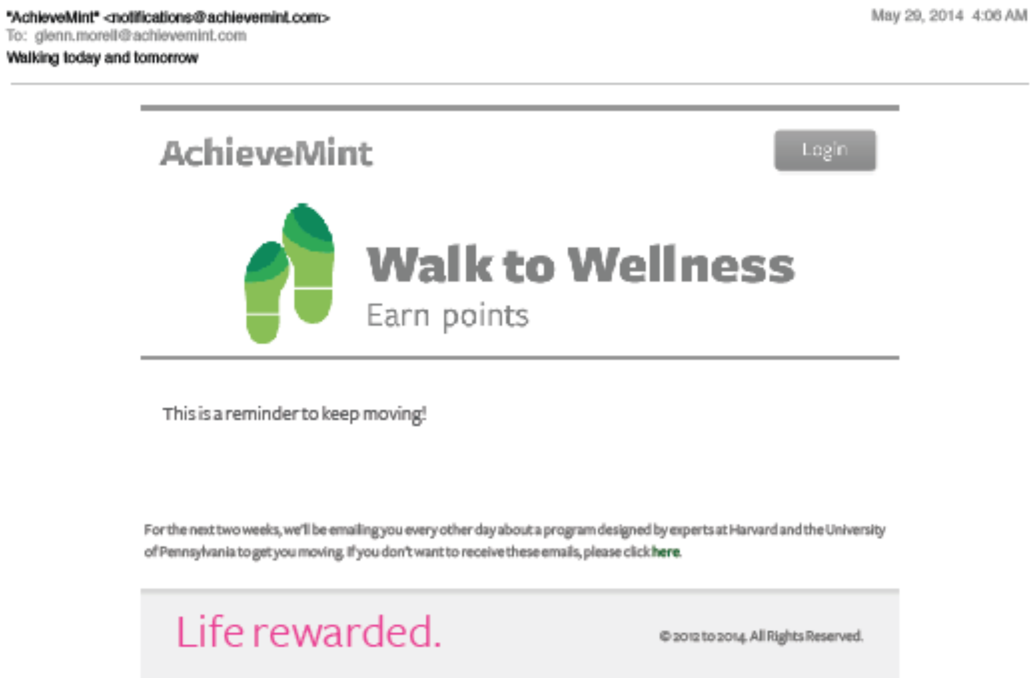
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2 35x	3 35x	4 30x	5 30x	6 25x	7 25x
8 20x	9 20x	10 15x	11 15x	12 10x	13 10x	14 5x
15 5x	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

We will be sending you reminders every two days about upcoming bonuses.

We hope that this program will help you improve your walking habits!

For the next two weeks, we'll be emailing you every other day about a program designed by experts at Harvard and the University of Pennsylvania to get you moving. If you don't want to receive these emails, please click here.

eFigure 5. Reminder Email for the Control Condition



"AchieveMint" <notifications@achievemint.com>
To: glenn.morell@achievemint.com
Walking today and tomorrow

May 29, 2014 4:06 AM

AchieveMint

Login

Walk to Wellness

Earn points

This is a reminder to keep moving!

For the next two weeks, we'll be emailing you every other day about a program designed by experts at Harvard and the University of Pennsylvania to get you moving. If you don't want to receive these emails, please click **here**.

Life rewarded.

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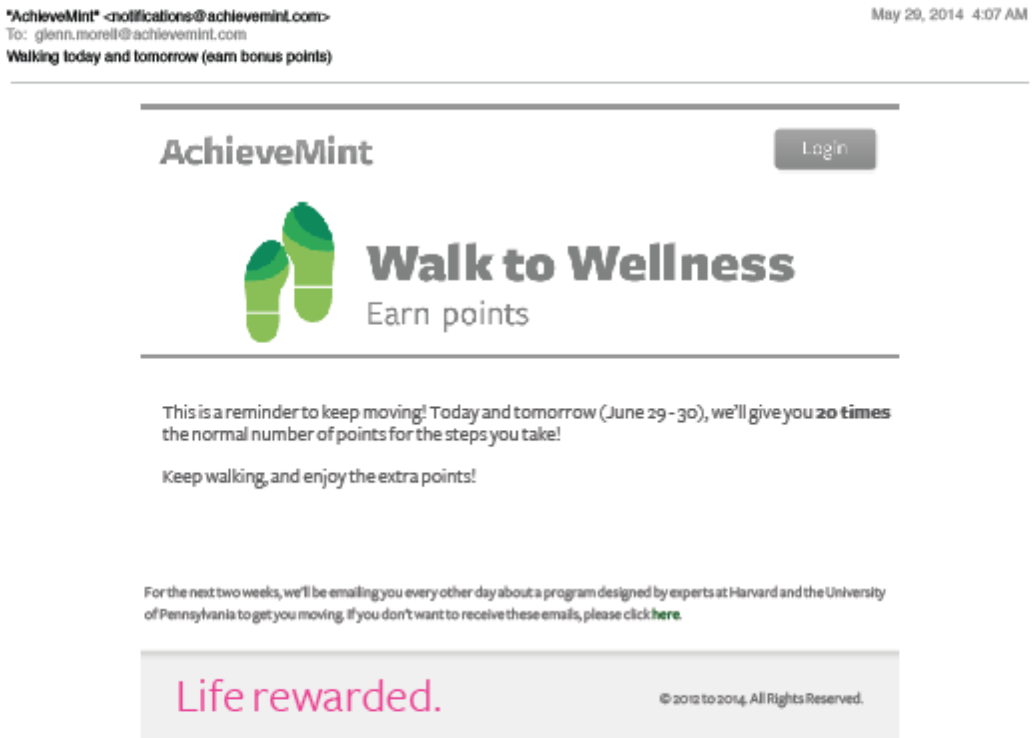
eFigure 6. Reminder Email for the Treatment Conditions (information about the extra points promised varied by treatment condition and day of intervention)



"AchieveMint" <notifications@achievemint.com>

To: glenn.morell@achievemint.com

Walking today and tomorrow (earn bonus points)

May 29, 2014 4:07 AM

AchieveMint

Login

Walk to Wellness

Earn points

This is a reminder to keep moving! Today and tomorrow (June 29 - 30), we'll give you **20 times** the normal number of points for the steps you take!

Keep walking, and enjoy the extra points!

For the next two weeks, we'll be emailing you every other day about a program designed by experts at Harvard and the University of Pennsylvania to get you moving. If you don't want to receive these emails, please click **here**.

Life rewarded.

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