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Research Article

Financial Motivation Undermines Maintenance in an Intensive Diet and Activity Intervention

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Financial incentives are widely used in health behavior interventions. However, self-determination theory posits that emphasizing financial incentives can have negative consequences if experienced as controlling. Feeling controlled into performing a behavior tends to reduce enjoyment and undermine maintenance after financial contingencies are removed (the undermining effect). We assessed participants' context-specific *financial motivation* to participate in the Make Better Choices trial—a trial testing four different strategies for improving four health risk behaviors: low fruit and vegetable intake, high saturated fat intake, low physical activity, and high sedentary screen time. The primary outcome was overall healthy lifestyle change; weight loss was a secondary outcome. Financial incentives were contingent upon meeting behavior goals for 3 weeks and became contingent upon merely providing data during the 4.5-month maintenance period. Financial motivation for participation was assessed at baseline using a 7-item scale ($\alpha = .97$). Across conditions, a main effect of financial motivation predicted a steeper rate of weight regained during the maintenance period, $t(165) = 2.15$, $P = .04$. Furthermore, financial motivation and gender interacted significantly in predicting maintenance of healthy diet and activity changes, $t(160) = 2.42$, $P = .016$, such that financial motivation had a more deleterious influence among men. Implications for practice and future research on incentivized lifestyle and weight interventions are discussed.

1. Introduction

The use of financial incentives is a strategy to motivate healthy behavior change that has become routine practice over the past decade. A 2008 survey of major US employers found that over 70% of employee wellness programs were using financial incentives to encourage participation and/or performance [1]. In particular, financial incentives have been increasingly used to help motivate complex healthy behavior changes, such as increasing physical activity, improving diet, and in weight loss interventions more broadly. The use of (nonfood) rewards in obesity treatment has also been recommended by the World Health Organization [2].

Over the past 30 years, health behavior interventionists have identified a number of factors that influence the efficacy of financial incentives for *initiating* weight loss, as well as physical activity and improvements in diet [3–20]. For example, Volpp and colleagues recently published a high impact paper demonstrating that low-intensity intervention paired with small financial incentives can produce impressive initiation of weight loss [18]. However, to date, far less attention has been paid to the issue of weight and health behavior change *maintenance* after financial incentives are removed. A small fraction of the extant studies have assessed maintenance, and those that have typically reported very limited success [14–20]. In the Volpp et al. study [18] at the end of the 16-week incentivized phase, both financial incentive groups lost significantly more weight than did the control group; however, 12 weeks into a maintenance phase the incentive groups had regained much of the weight they had initially lost, and the differences between conditions were no longer significant. A follow-up trial explicitly designed to use financial incentives to achieve extended weight loss lengthened the incentivized phase to 24 weeks and reduced the maintenance phase to 8 weeks. In this case, the difference between incentive and control groups remained significant at 8 weeks but was no longer significant after 12 weeks of maintenance [19]. A 2007 systematic review of financial incentives in treatments for obesity/overweight included nine studies with follow-up of one year or more. Results showed that incentives produced no improvement in weight loss maintenance at 12 or 18 months, after the incentives were removed. In fact, there was a trend toward weight regain *above baseline* at 30-month follow-up [20].

Self-determination theory (SDT) is a theory of motivation that may provide some insight into why weight loss interventions emphasizing financial incentives have struggled to achieve successful maintenance [21, 22]. At the core of SDT is the concept of autonomous motivation, characterized by feeling free and acting for the sake of rewards that are inherent to the activity itself. This inherent reward could be positive emotions, such as interest and enjoyment (i.e., intrinsic motivation), or the satisfaction associated with action that is personally meaningful (i.e., identified extrinsic motivation). Importantly, an emerging body of evidence shows that autonomous motivation is positively related to persistence and maintenance of healthy lifestyle changes. Specifically, self-reported autonomous motivation has been shown to predict greater maintenance of physical activity and weight loss [23, 24]. In a 3-year randomized controlled trial, Silva and colleagues contrasted an intervention designed to promote autonomous motivation for exercise and weight management to a general health education control condition [25–28]. After 3 years, the intervention designed to support autonomous motivation produced significantly better maintenance of both exercise and weight loss, relative to control, and the effects were mediated by autonomous motivation (both intrinsic motivation and identified extrinsic motivation) [29].

Many studies have demonstrated that extrinsic rewards (including financial incentives) tend to undermine intrinsic motivation, an effect often referred to as "the undermining effect." A meta-analysis of 128 studies on the undermining effect found that performance-contingent rewards increase extrinsic motivation while the contingency is in place, but at the expense of decreasing intrinsic motivation [30]. Moreover, the resulting decrease in intrinsic motivation persists well after the contingency is removed (i.e., poor maintenance). SDT posits that the negative relation between extrinsic rewards and intrinsic motivation can be explained by the fact that contingent rewards have a tendency to feel subtly controlling, thwarting peoples' psychological need for autonomy, and distracting them from potentially enjoyable aspects of the targeted activity.

This led us to wonder—is *undermining* responsible for the pattern of poor maintenance observed in weight loss and lifestyle interventions that have emphasized financial incentives? On the one hand, the general pattern of poor maintenance observed across pay-for-performance weight loss and lifestyle intervention trials has been consistent with the undermining effect. On the other hand there are some noteworthy differences between the ways extrinsic rewards have typically been used in the context of experiments investigating the undermining effect versus how financial incentives have typically been used in weight loss interventions. Few studies of the undermining effect have tested the impact of extrinsic rewards for longer than a few hours or days; by contrast, weight loss interventions are typically interesting in assessing maintenance weeks or months later. Further, the typical laboratory experiment investigating the undermining effect has involved administration of a reward at a single time point, leading Deci et al. [30] to conclude from their meta-analysis that more studies are needed "that examine repeated administration of rewards over time" (p. 650). The pay-for-performance weight loss interventions conducted by Volpp and others have typically involved repeated payments for weight loss achieved incrementally over the course of multiple weeks. Furthermore, studies of undermining effects have typically involved rewarding participants for a *behavior that is intrinsically motivated at baseline*, that is, behaviors that are interesting or enjoyable (e.g., Soma puzzles). In the case of obesity interventions, participants' baseline levels of intrinsic motivation for eating healthy foods and being physically active is likely modest. Collectively, these differences introduce reasonable skepticism about whether the undermining effect is relevant in the context of weight loss and lifestyle interventions and support the need for more research on this topic.

The present research is intended to offer an early contribution toward exploring the question of motivational undermining in the context of the Make Better Choices trial—a study testing intensive lifestyle interventions designed to promote health changes in diet and activity using performance-contingent financial incentives (in addition to coaching and support from mobile technology). Based on the self-determination theory, we hypothesized (H1) that self-reported financial motivation (i.e., motivation derived from performance-contingent financial incentives offered for eating healthy and being physically active) would be *negatively related to maintenance* of both health behavior change and weight loss (after performance-contingent financial incentives were removed). We further predicted (H2) that financial motivation would be *unrelated to initiation* of either health behavior change or weight loss.

We also tested two potential moderators of the predicted undermining of maintenance effects: gender and socioeconomic status (SES). First, several authors have previously reported that males report lower trait levels of autonomy orientation and/or high levels of controlled motivational causality orientation [31–34]. Recently, Hagger and Chatzisarantis [35] demonstrated that motivational causality orientation moderates the undermining effect of rewards on intrinsic motivation. Thus, we predicted (H3) that gender would moderate the undermining of maintenance effects. Second, the economic utility of financial intensives is inversely related to incomes or socioeconomic status, as such, financial incentives may feel more controlling to those low in SES. Thus, we predicted (H4) that SES would moderate the undermining of maintenance effects.

2. Materials and Methods

The study design and methods are described in detail in an open source study protocol paper published in BMC Public Health [36] and will be described briefly.

2.1. Study Sample. Chicago area adults of ages between 21 and 60 years were recruited through community advertisements. To be eligible, individuals were required to report all of the following: (a) <5 fruits and vegetables (FV)/day; (b) >8% caloric intake from saturated fat (Fat), (c) <60 min/day moderate/vigorous physical activity (PA), and (d) >90 min/day targeted sedentary screen time (Sed; television, movies, recreational internet use, and videogames). All procedures were approved by the Institutional Review Boards of the University of Illinois at Chicago and Northwestern University.

2.2. Two-Week Baseline Phase (and Final Eligibility Screening). Candidates who self-reported all four risk behaviors were screened by a Bachelor level research assistant (coach). The coach trained participants to accurately estimate and use a handheld device to record and upload dietary intake, moderate-vigorous-intensity physical activity, and targeted recreational sedentary screen time. During the two-week baseline (run-in) phase, participants wore an accelerometer, recorded diet and activity on the handheld device, and submitted data daily to the coach.

2.3. Randomization. Candidates who displayed all four risk behaviors throughout baseline, as evidenced by handheld and accelerometer data, were randomized (stratified by gender) using a computer-generated sequence of randomly permuted blocks. The four behavioral intervention groups differed based on the behaviors that were targeted/incentivized. Each group was assigned to target a different combination of two behavior goals, one related to diet (FV or Fat) and one related to activity (PA or Sed): (1) increase FV and PA (FV↑PA↑), (2) decrease Fat and increase PA (Fat↓PA↑), (3) increase FV and decrease Sed (FV↑Sed↓), or (4) decrease Fat and Sed (Fat↓Sed↓).

2.4. Intervention Phase (Initiation). Coaches tailored behavioral strategies based on participants' baseline data. For example, those who asked to decrease Fat were shown the ten foods that supplied their greatest saturated fat grams and coached to reduce portion size or number for those foods. For the first week of treatment ($T \times 1$), daily diet and activity goals were set midway between baseline behavior and the ultimate daily goal. From the second treatment week onward, full goals were set for the two targeted behaviors to which the participant was randomized: 5 fruit and vegetable servings, saturated fat intake $< 8\%$ of calories, physical activity $\geq$ 60 minutes, or sedentary recreational activity $\leq$ 90 minutes per day. Participants were expected to reach their behavioral targets during treatment week 2 and to maintain them during week 3. During the three treatment weeks, they uploaded data daily and communicated as needed with their coaches via telephone or e-mail, per preference, to problem-solve around adherence barriers.

2.5. Performance-Contingent Financial Incentives. During the 3-week intervention phase, participants could earn a $175 incentive for fully meeting goals for both targeted behaviors. Thus, participants could earn just over $50/week ($175/3) for meeting their health behavior goals; a relatively small financial incentive in comparison to the amount of time and effort required for success.

2.6. Follow-Up Phase (Maintenance). To explore the potential for maintenance of healthy behavior changes, the study included a 17-week follow-up phase. Immediately after the intervention phase, participants were informed that attainment of diet and activity targets was no longer required; payment was now contingent solely upon recording and transmitting handheld data on a predetermined schedule. This follow-up phase in this study is analogous to the "free choice periods" included in many experiments on rewards and undermining, wherein activity is considered an indicator of intrinsic or autonomous motivation (i.e., "free-choice behavior"). Recording was required daily for the first week following treatment, for three consecutive days in post-treatment weeks two and three, biweekly for the next six weeks, then monthly until the final follow-up. Participants could earn incrementally larger financial incentives (from $30 to $80) for uploading data during consecutive follow-ups. All recording-contingent incentives were received at the end of follow-up.

2.7. Handheld Tool. Participants used a personal digital assistant to record and self-regulate their targeted behaviors. They were instructed to carry the device and record immediately after executing a behavior. During treatment and follow-up, the handheld device displayed two decision support feedback "thermometers"—one for diet (F/V or Fat) and one for activity (PA or Sed). Once activated, goal thermometers were continually updated in response to data entry. The goal thermometers also enabled participants to observe the potential impact of a food or activity choice.

2.8. Measures. Demographic information, anthropometric data, and motivation for health behavior change were assessed during screening. Demographic data gathered include gender, age, ethnicity, marital status, education, income, and household size. Participants estimated their annual household income on the following 11-point scale: $0–15 k, $15–20 k, $20–25 k, $25–30 k, $30–35 k, $35–40 k, $40–45 k, $45–50 k, $50–60 k, $60–75 k, and > $75 k.

2.8.1. Financial Motivation. Context-specific financial motivation for participating in the study was measured using modified items from the Motives for Physical Activities Measure [37]. Before answering these questions, the nature of the study was explained to participants and, specifically, the potential for earning performance-contingent financial incentives in exchange for making healthy behavior changes.

Seven items were altered to ask about eating as well as activity changes and the degree to which financial incentives were a motive for participating in the study (e.g., "Because I want to earn extra money"; $\alpha = .97$). Participants responded on a 7-point Likert scale (1: not at all true for me; 7: very true for me).

2.8.2. Assessment of Individual Behaviors. Saturated fat and FV consumption were measured from daily intake recordings. To prevent superfluous calories (e.g., in sweetened beverages) from inflating the fat gram allowance, the saturated fat goal for those randomized to decrease Fat was determined using the Harris-Benedict equation [38] to estimate calories needed to maintain weight. Minutes of physical and sedentary activity were measured cumulatively by an end-of-day 24-hour activity log in which participants accounted for every 15-minute block of each day.

2.8.3. Composite Diet-Activity Improvement Score. In order to quantify overall change across four behaviors (FV, Fat, PA, and Sed), we developed a composite healthy diet and activity improvement score, weighting each behavior equally. All variables were transformed to better approximate normality, using square root transformation for the count outcomes (FV, PA, and Sed) and arc sine transformation for the percentage outcome, Fat [39]. To allow direct comparisons between interventions on these disparately measured variables, each individual health behavior was standardized to provide a common metric using a modified z-score (where 1 unit represents a 1-standard deviation change), with higher values representing greater healthy lifestyle improvement. Z-scores for time points after baseline were standardized relative to the overall baseline distribution to reflect improvement relative to baseline. To reflect the effect of treatment across multiple health behaviors, the mean of all four individual z-scores at each time point was calculated, as recommended [40], to derive a composite index that expressed each participant's overall healthy behavior change. We refer to this as a "composite diet-activity improvement score."

2.8.4. Weight. Weight was measured at three times: at baseline, the end of prescription, and at the end of the follow-up phase. A trained staff member weighed participants (to the nearest 1 lb) on a calibrated beam balance scale without shoes and wearing light clothing. Two measures were recorded at each visit.

3. Results and Discussion

3.1. Study Sample. The final sample of 204 adults included 48 males, 46.6% minorities, 25% with no more than a high school education, and mean age 33.3 years (s.d. = 11.01). Except for one individual, all participants attained behavioral targets during the 3-week initiation period (thus earning the $175 performance-contingent incentive); the majority did so promptly. The median time taken to achieve consumption of five FV was nine days (i.e., two days after the full five FV goal was set). The median time taken to attain each of the Sed, Fat, and PA targets was eight days (i.e., one day after the targeted amount was set as a goal).

3.2. Group Effects. Group effects have been reported previously [41]. The primary finding was that the group assigned to FV↑Sed↓ produced significantly greater change in composite diet-activity improvement score after the 3-week intervention phase, relative to the other three groups (FV↑PA↑, Fat↓PA↑, Fat↓Sed↓). Further, the FV↑Sed↓ group maintained this advantage through the end of the 17-week Follow up Phase.

The effects reported herein related to financial motivation were independent of group assignment. None of the financial motivation x group interactions were significant; thus, all secondary analyses reported in this paper were conducted collapsing across Groups.

3.3. Financial Motivation → Initiation of Healthy Changes. Two linear regression models were run regressing initiation of healthy changes from the baseline phase to the end of the (incentivized) intervention phase onto financial motivation. Healthy change outcomes were (1) initiation of composite diet-activity improvement score change and (2) initiation of weight change (loss). As predicted, financial motivation was unrelated to initiation of healthy change during the incentivized intervention phase, unrelated to healthy lifestyle improvement initiation ($\beta = -.10$; $P = .12$), and unrelated to weight loss initiation ($\beta = .014$; $P = .19$).

3.4. Financial Motivation → Maintenance of Healthy Changes. Next, two linear regression models were run regressing maintenance of healthy changes from the baseline phase to the end of the follow-up phase onto financial motivation. Maintenance of healthy change outcomes was (1) maintenance of composite diet-activity improvement score change and (2) maintenance of weight change (loss). Financial motivation was unrelated to maintenance of composite diet-activity improvement score, $\beta = -.08$, $P = .23$. However, Financial motivation was negatively related to maintenance of weight change, $\beta = .034$, $P = .03$; that is, those who were higher in Financial motivation weighed more on average at the end of the follow-up phase, after controlling for weight during the baseline phase (see Table 1 & Figure 1).

3.5. Financial Motivation x Gender → Maintenance of Healthy Changes. We ran two linear regression models that tested the interaction between financial motivation and gender predicting change from the baseline phase to the end of the follow-up phase in terms of (1) maintenance of composite diet-activity improvement score change and (2) maintenance of weight change (loss). Gender interacted with financial motivation to predict maintenance of composite diet-activity improvement score change ($\beta = .17$, $P = .02$), such that financial motivation undermined maintenance of composite diet-activity improvement score more among men (see Table 2). The gender by financial motivation interaction did not predict maintenance of weight loss

Table 1: Regression model predicting weight at the end of follow-up (maintenance).

	B	SE	β	t	P-value
Constant	5.40	2.779		1.94	<.05
Financial motivation	1.51	0.705	.034	2.15	<.05
Baseline weight	0.97	0.015	.986	62.44	<.001

Note. The positive β and t statistics associated with financial motivation imply a positive relation with total body weight at the end of follow-up and thus a negative relation with weight loss from baseline to the end of follow-up.

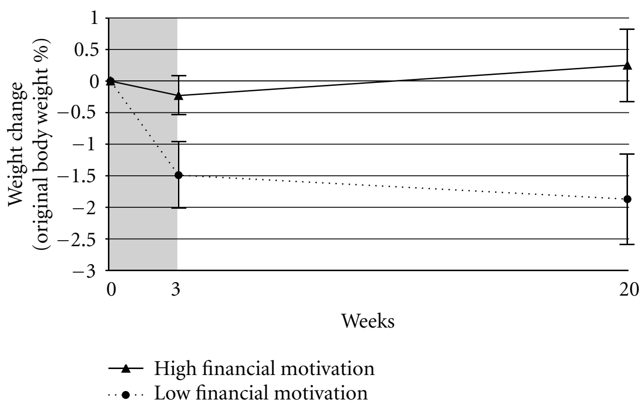

Figure 1: Financial motivation predicting weight change (% of original body weight). high: top quartile; low: bottom quartile.

Table 2: Regression model predicting composite diet-activity score (diet-activity) at the end of follow-up (maintenance).

	B	SE	β	t	P-value
Constant	.635	0.069		9.19	<.001
Financial motivation	.086	0.071	−.084	−1.21	.23
Gender	−.012	0.068	−.012	−0.17	.86
Baseline diet-activity	.654	0.115	.404	5.69	<.001
Financial motivation					
x Gender	.172	0.071	.169	2.42	.016

($\beta = -.022$, $P = .139$), though the main effect of financial motivation remained significant even controlling for this interaction term.

The gender x financial motivation interaction predicting maintenance of composite diet-activity improvement score is illustrated in Figure 2. Participants in the top and bottom quartiles with respect to financial motivation were categorized as "high" or "low," respectively, yielding four groups. Simple slopes were calculated for each group: (i) high financial motivation males; $t(70) = -4.15$, $P < .001$; (ii) low financial motivation males; $t(70) = -2.17$, $P < .05$; (iii) high financial motivation females; $t(70) = -2.70$, $P < .01$; (iv) low financial motivation females; $t(70) = -3.51$, $P = .001$.

3.6. Financial Motivation x SES → Maintenance of Healthy Changes. We ran two linear regression models that tested the

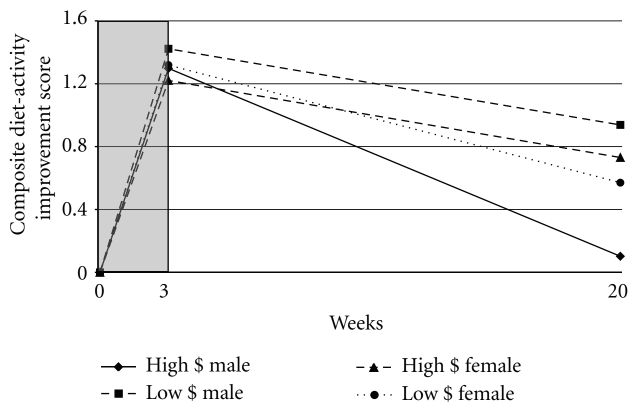

Figure 2: Financial motivation x gender predicting composite diet-activity improvement score. $: financial motivation. high: top quartile; low: bottom quartile.

interaction between financial motivation and SES predicting change from the baseline phase to the end of the follow-up phase in terms of (1) maintenance of composite diet-activity improvement score change and (2) maintenance of weight change (loss). Participants' estimates of annual income were negatively skewed; the modal response (28%) reported an annual household income greater than $75,000. The interactions between financial motivation and income were not significant.

4. Conclusions

In the Make Better Choices Trial, participants were offered performance-contingent financial incentives for making healthy behavior changes (related to diet and activity) over the course of three weeks. While financial motivation was unrelated to healthy behavior or weight change during this 3-week initiation or intervention phase, after performance-contingent financial incentives were removed (and after a 17-week follow-up phase), financial motivation was negatively related to weight loss maintenance. Financial motivation was also negatively associated with maintenance of healthy behavior changes among men, more so than for women. This research represents, to the best of our knowledge, the first evidence for the undermining effect within the context of an intensive healthy lifestyle intervention. Furthermore, past research on the undermining effect has typically involved lab experiments with relatively small samples, rewards administered at a single time point, short follow-up periods, and behaviors with high levels of baseline intrinsic motivation. This research is among the first to provide evidence for the undermining effect in a study with a relatively large sample ($n = 204$), an extended incentivization period (3 week), an extended follow-up period (17 weeks), and behaviors for which there was only modest levels of intrinsic or autonomous motivation at baseline.

Based on the self-determination theory (SDT), the reason that financial incentives have the potential to undermine autonomous motivation, and thus maintenance after being removed, is that incentives are often experienced as subtly controlling. A meta-analysis of studies related to the undermining effect found that this is especially true of tangible, performance-contingent incentives [30], as were used in this study. As noted earlier, a number of studies have found that men tend to have a more controlling (and less autonomous) orientation to the world, in general [31–34]. Recently, Hagger and Chatzisarantis [35] demonstrated that these same causality orientations can moderate the undermining effect of rewards on intrinsic motivation. Specifically, in the context of a lab experiment, the authors found that control-oriented participants assigned to a reward condition exhibited significantly lower levels of intrinsic motivation (less time spent on a puzzle activity during a free choice period) compared to those assigned to a no reward condition: a replication of the classic undermining effect. In contrast, there was no significant difference in intrinsic motivation levels between reward conditions for autonomy-oriented participants. Hagger and Chatzisarantis interpret their findings as indication that autonomy-oriented causality orientation protects individuals from the undermining effect of rewards on intrinsic motivation. We offer a similar, speculative interpretation for the financial motivation by gender interaction observed in the present study. That is, we suspect that females in our sample tended towards a more autonomy-oriented causality orientation, which protected them from the undermined maintenance of healthy behavior changes that males in our sample exhibited. Because the present study involved secondary analysis of data, measures of motivational orientation were not included. A future study might test this interpretation by measuring global causality orientation and investigating whether the financial motivation by gender interaction remains significant after controlling for a financial incentive by causality orientation interaction term (i.e., mediated moderation [42, 43]). Related follow-up research might investigate further individual differences and contextual factors relating to the *interpretation* or experience of financial incentives in an intensive lifestyle intervention.

Another useful direction for future research would be more studies of intensive lifestyle interventions that experimentally vary the way financial incentives are framed. Prior work has already demonstrated in lab settings that different reward contingencies and interpersonal contexts each influence intrinsic motivation by virtue of influencing the interpretation of rewards [30, 44]. One might argue that a limitation of this study pertains to the correlational (versus experimental) nature of the data. Correlational data, and cross-sectional designs in particular, make it difficult to draw causal inferences. It is important to consider, however, that using experimental designs to investigate the potential for undermining in the context of healthy behavior change intervention may pose ethical challenges. In the case of behaviors typically studied in the lab (e.g., Soma puzzles), the cost of undermining intrinsic motivation into the future is relatively low. The benefit to science gained from conducting such experiments typically outweighs the cost of potentially reducing participants' enjoyment of Soma puzzles. The ethical ramifications of turning a participant off to healthy eating and/or physical activity in the future are far more serious; thus, more consideration must be exercised on the part of researchers, and Institutional Review Boards (IRBs) are more likely to raise concerns.

Despite these challenges, it is our position that more research on the issue of financial incentives and potential undermining in health behavior interventions is sorely needed. At their best, financial incentives may be a useful tool in helping people initiate healthy habits, or even grow to enjoy healthy behaviors. A number of studies have recently demonstrated that offering small financial incentives increase enrollment and reduce disparities by encouraging otherwise underrepresented groups to enroll in both physical activity and weight loss interventions, thereby enhancing intervention reach [45–47]. Furthermore, the high potential value of research in this area can also be explained by the fact that financial incentives are already being widely used in health behavior interventions. As noted earlier, one survey of large US employers found that over 70% of employee wellness programs were using financial incentives to encourage participation and/or performance in 2008; this represented an increase from 62% in 2007 [1], and the World Health Organization has recommended using rewards in obesity treatment, specifically [2]. Popular consumer websites, such as stickk.com, have also contributed to making financial incentives for healthy behavior changes an increasingly routine practice. As a result of this existing infrastructure, research that illuminates the use of financial incentives can have a swift, significant, and positive impact on public health.

In conclusion, the findings from this study demonstrate that financial incentives have the potential to undermine successful maintenance in an intensive lifestyle intervention. Specifically, participants who reported being more motivated by the MBC intervention's financial incentives were worse off in terms of their diet and activity (among men), and their body weight (men and women) at the end of a 17-week follow up period. Our interpretation of these findings is that financial incentives, when overemphasized, have the potential to be interpreted as controlling, thereby undermining autonomous motivation and subsequent maintenance of targeted health behaviors. Researchers and practitioners who are planning to use financial incentives in health behavior interventions may do well to consider framing those incentives in ways that are autonomy supportive and investing resources in the collection of follow-up data to investigate behavioral maintenance after incentives have been removed.

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