Can We Pay People to Act Healthily? Testing the Relative Effectiveness of Incentive Dimensions and Underlying Psychological Mediators

A DISSERTATION
SUBMITTED TO THE FACULTY OF THE
UNIVERSITY OF MINNESOTA
BY

Rachel J. Burns

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

Alexander Rothman

May 2014

Acknowledgements

I am deeply thankful for everyone who has mentored and encouraged me. Special thanks to:
Alex for providing me with a map and compass,
My family and friends for keeping me afloat,
And Zach for being the wind in my sails.

Dedication

This thesis is dedicated to Uncle Joe and Goldie.

Abstract

Offering financial incentives that are contingent upon the performance of a specified health behavior has emerged as a popular intervention strategy. However, the types of incentives that are most effective in changing behavior and the mechanisms through which these effects occur have not been identified. This study tests a theoretical framework that specifies two dimensions along which incentives may vary (reinforcement procedure: positive, negative; schedule: fixed, variable). Negative reinforcement was expected to be more effective than positive reinforcement because people are loss averse. Variable schedules were expected to be more effective than fixed schedules because they buffer against habituation to the incentive. A 5-week randomized controlled trial randomly assigned 153 participants to one of the four conditions that emerge when reinforcement procedure and schedule are crossed or a no-incentive control condition. Incentives were contingent upon meeting a specified walking goal. A host of psychological variables, including the perceived value of the incentive, were measured throughout the study so that mediation could be tested. Rates of walking were greater in the incentive conditions compared to control; the incentives did not differentially affect behavior. The perceived value of the incentive predicted behavior, but was not affected by the type of incentive. Walking rates dropped markedly during a 2-week follow-up. Future work should seek to definitively determine if the incentive categories differ from each other and continue to test mediational models. This study underscores the value of systematically and directly comparing theoretically grounded types of incentives and

testing putative mediators that underlie the effect of specific types of incentives on behavior.

Table of Contents

Acknowledgements..i

Dedication..ii

Abstract...iii

Table of Contents..v

List of Tables...vi

List of Figures...vii

Introduction..1

Methods..42

Results..56

Discussion...72

Tables..97

Figures...111

References...118

Appendices..138

List of Tables

Table 1 Participant characteristics at baseline, end of active treatment, and end of follow-up 97

Table 2 Baseline demographics, perceived barriers and self-efficacy by condition 98

Table 3 Mean manipulation check scores (SD) by reinforcement procedure condition at randomization and at the end of active treatment 99

Table 4 Average number of steps (SD) taken per day amongst participants who did and did not meet the walking goal 100

Table 5 Parameter estimates for model that best fits differences among reinforcement procedure conditions over time 101

Table 6 Parameter estimates for model that best fits differences among schedule conditions over time 102

Table 7 Mean number of weeks that goal was met and percentage of participants meeting goal each week during active treatment by condition 103

Table 8 Parameter estimates for model that best fits differences among all conditions over time 104

Table 9 Mean number of weeks that goal was met and percentage of participants meeting goal each week during follow-up by condition 105

Table 10 Mean (*SD*) perceived barriers, self-efficacy, and satisfaction at the end of active treatment by condition 106

Table 11 Mean (*SD*) of indirect attitudes towards the incentive, indirect attitudes towards the physical benefits of walking, indirect global attitudes towards the walking goal (i.e., indirect attitude incentive + indirect attitude physical benefits), and direct global attitudes during active treatment 107

Table 12 Correlations between direct attitudes towards the walking goal, indirect attitude towards the incentive, and behavior during active treatment 108

Table 13 Correlations between direct attitudes towards the walking goal and indirect attitudes towards the physical benefits of walking during active treatment 109

Table 14 Correlations between direct attitudes towards the walking goal, indirect global attitudes and behavior during active treatment 110

List of Figures

Figure 1 CONSORT diagram illustrating attrition..111

Figure 2 Percentage of participants in each condition meeting the walking goal each week...112

Figure 3 Graph of model that best fits differences among reinforcement procedure conditions over time...113

Figure 4 Effects of reinforcement procedure on the perceived value of the incentive during active treatment..114

Figure 5 Effects of perceived value of the incentive on behavior during active treatment..115

Figure 6 Graph of model that best fits differences amongst schedule conditions over time..116

Figure 7 Effects of schedule on the perceived value of the incentive during active treatment..117

Can We Pay People to Act Healthily? Testing the Relative Effectiveness of Incentive Dimensions and Underlying Psychological Mediators

The behavioral antecedents of many chronic diseases (e.g. Newcomb & Carbone, 1992; Roberts & Barnard, 2005; Warburton, Nicol & Bredin, 2006), coupled with the high prevalence and incidence of these conditions (Roger & Turner, 2011; Shaw, Sicree & Zimmet, 2010; Siegel, Ward, Brawley & Jemal, 2011), has led to the need for interventions that are effective and can be easily disseminated in prompting and sustaining lifestyle changes. Incentivizing the performance of specific health behaviors or the achievement of a specified health outcome is an intervention strategy that was initially explored in the 1970s (e.g. Jeffery, Thompson & Wing, 1978; Jeffrey, 1974) and has recently resurfaced in applied and research settings (e.g. U.S. Department of Health and Human Services, 2011; Volpp et al., 2008). This intervention strategy involves offering participants a monetary incentive, such as a cash reward or reimbursement, that is contingent upon the performance of a specified health behavior, such as exercising, or achieving a particular health outcome, such as losing a specified number of pounds. If shown to be effective, this strategy can be readily disseminated through employer-based or government-run health care plans. In the context of a randomized controlled trial to promote physical activity, this study tests a theoretical framework that specifies (a) the types of incentives that are expected to be most effective in increasing physical activity, and (b) the psychological mechanisms underlying observed changes in behavior.

Overview of Studies Testing the Effects of Incentives on Health Behavior

Empirical tests of the effectiveness of financial incentives to produce and sustain health behavior change have emerged across a host of behavioral domains, including flu vaccination (Moran, Nelson, Wofford, Velez & Case, 1996), abstaining from drug and tobacco use (e.g. Lussier, Heil, Mongeon, Badger & Higgins. 2006; Volpp et al., 2006), eating (e.g. Wall, Mhurchu, Blakely, Rodgers, & Wilton, 2008) and physical activity (e.g. Jeffery, Wing, Thorson & Burton, 1998). Downstream physiological consequences of preventive health behaviors, such as weight loss (e.g. Volpp et al., 2008) and reducing cholesterol levels (Francisco, Paine, Fawcett, Johnston & Banks, 1994), have also been incentivized. The following review of incentive-based studies provides an overview of research in this area by introducing the types of designs used in these studies and demonstrating that this body of literature is comprised of both positive and null results (see Burns et al., 2012; Kane, Johnson, Town & Butler, 2004).

Interventions Testing the Effects of Incentives on Physical Activity

Several randomized control trials have tested the effects of incentives on physical activity. For instance, in an effort to increase walking and jogging among sedentary older adults, Finkelstein, Brown, Brown, and Buchner (2008) randomly assigned sedentary older adults to one of two conditions for four weeks. Participants in the control condition received $75 for attending an orientation session, wearing a pedometer each day, and completing study measures. In contrast, participants in the incentive condition received $50 for performing these three tasks, but could earn additional money each week for walking. Specifically, $10 could be earned by walking an average of 15-25 minutes per day for a week and $25 could be earned by walking an average of 40+ minutes per day for a week. Participants in the incentive condition walked, on average, 1.8 hours per week more than those in the control condition.

Similarly, Jeffery and colleagues (1998) sought to increase the physical activity of obese individuals enrolled in an 18-month weight loss program. Participants were randomly assigned to one of five conditions. Participants in the Standard Behavioral Therapy condition received state of the science behavioral treatment for obesity, which included group meetings, weigh-ins, nutritional planning, exercise goals, and training in behavioral techniques, such as problem-solving and goal setting. Participants in the Supervised Walk condition received treatment similar to that of the Standard Behavioral Therapy condition, but participants were encouraged to attend supervised walking sessions. The Trainer condition was identical to the Supervised Walk condition, except personal trainers walked with participants and made reminder phone calls. The Incentive condition was identical to the Supervised Walk condition with the exception that participants received a cash reward for each walk that was attended (i.e., $1 per walk for their first 25 walks, $1.50 per walk for their next 50 walks, $2 per walk for their next 50 walks, and $3 per walk thereafter). Finally, the Trainer+Incentive condition was a combination of the Trainer and Incentive conditions. The Trainer and Incentive groups were both effective in increasing attendance at supervised walks and the Trainer+Incentive condition was especially effective in promoting attendance.

A more recent randomized controlled trial found that incentivizing gym attendance on an escalating pay scale with a reset contingency (i.e., one returns to the bottom of the scale if attendance is not sufficient) was effective in increasing gym attendance, but not weight loss, among college students over 12 weeks. More participants in the incentive condition met a specified gym attendance goal during the first week of the intervention than in the control condition. Attendance decreased over time in both groups; the rate of decrease over time was comparable across groups (Pope & Harvey-Berino, 2013).

A meta-analysis and systematic review have sought to summarize this literature (Mitchell et al., 2013; Strohacker, Galarrage & Williams, 2013). The search and eligibility criteria for these reviews were similar. Although the numbers of reviewed studies were roughly the same (n=10 and 11), the meta-analyses and systematic review largely examined different studies; only five studies appeared in both reviews. This suggests that these reviews are incomplete. The 95% confidence intervals of many of the mean differences between the incentive and comparison conditions calculated by Mitchell and colleagues (2013) contained 0. However, the authors found that, on average, incentives increased exercise session attendance by 11.55%. The review by Strohacker and colleagues (2013) also concluded that incentives are an effective intervention strategy, though mixed evidence was presented. Both reviews noted a great deal of methodological variability across studies. For instance, the size of the incentive, the type of incentive used, and the duration of the intervention varies across studies.

Interventions Testing the Effects of Incentives on Weight Loss

As with physical activity, researchers have tested the effect of incentives on weight loss. For instance, obese and overweight participants enrolled in a 6-month intervention were offered cash for each percentage point of weight lost from baseline, with payouts at 3 and 6 months (Finkelstein, Linnan, Tate & Birken, 2007). Participants were randomly assigned to a back loaded condition ($14/percentage point lost with reward paid out at 6 months), a frontloaded condition ($14/percentage point lost with reward paid out at 3 months) or the steady condition ($7/percentage point lost with rewards paid out at 3 and 6 months). All participants also received information regarding healthy weight loss strategies. At 3 months, participants in the frontloaded condition lost the most weight, although differences between groups disappeared at 6 months.

Volpp and colleagues (2008) examined the effectiveness of different types of incentives to promote meeting a weekly weight loss goal of 1 lb. per week. Participants enrolled in a 16-week intervention were randomly assigned to either a control condition, which did not receive an incentive, a lottery condition, in which participants earned entry into a daily lottery, or a deposit contract condition, in which participants forfeited their own money (their choice of $.01-$3 per day of the study) to the researchers unless their weight loss goal was met. The researchers also matched each participant's deposit amount and provided an additional $3 per day. Participants in the two incentive conditions lost more weight than those in the control condition.

In an effort to summarize this literature, my colleagues and I (Burns et al., 2012) conducted a systematic review. Definitive conclusions about the effectiveness of incentives on weight loss could not be made because the literature included both positive and null results. Methodological issues also precluded definitive conclusions. Incentives were generally not tested systematically; conditions in which more than one intervention component varied were often compared. Moreover, the type of incentive that was utilized, the size of the incentive, and length of the intervention varied across studies.

Why Are the Results from Incentive-Based Health Behavior Interventions Mixed?

Studies that incentivize health behaviors test a single hypothesis: incentives cause changes in health behavior. However, an immense amount of methodological heterogeneity has emerged amongst studies seeking to test this hypothesis. For instance, the length of the intervention (e.g., 6 weeks vs. 12 months), the outcome that is incentivized (e.g. exercise versus weight loss), the measure of the target behavior or outcome (e.g., physical activity has been operationalized as minutes spent walking, attending supervised walks, and gym attendance), and the additional intervention components that accompany the incentive (e.g. weigh-ins, educational materials, group meetings) vary across studies. In fact, there is considerable variation in the operational definition of the central intervention component—the incentive itself—because researchers face several decisions points when operationally defining the incentive. For example, should the incentive be a cash reward or a refund of one's own money? Should the size of the incentive remain constant or vary during the course of the intervention? As a result, participants in a study designed to incentivize weight loss may earn a $2 cash reward for every pound lost, whereas participants in another study may earn entry into a lottery for every pound lost. Typically, variation amongst these operational definitions is overlooked. However, is it reasonable to assume that these different operational definitions produce interchangeable psychological experiences and produce similar behavioral outcomes? If not, how can researchers navigate the process of operationalizing an incentive?

When navigating the many decision points that arise during the process of operationally defining an incentive, theory can offer guidance by specifying the characteristics of the incentive that are expected to have the greatest influence on behavior and by explaining why these characteristics are consequential (Michie & Abraham, 2004; Michie, Johnston, Francis, Hardeman & Eccles, 2008). However, the majority of interventions that have incentivized health behavior have, at best, given a cursory nod to theoretical frameworks. According to one review, less than 10% of incentive-based studies justify the selection of a particular type of incentive (i.e. few studies explained why a reimbursement, rather than a cash reward or lottery, was chosen; Kane et al., 2004). Moreover, the mechanisms through which incentives affect health behavior are not well specified and have not been tested (Burns et al., 2012; Kane et al., 2004).

The mixed findings in the literature, coupled with heterogeneity in the operational definitions of incentives and the dearth of theoretical guidance suggest that this area of research could benefit from a framework that specifies the conditions under which incentives are expected to be maximally effective and the mechanisms through which incentives affect complex preventive health behaviors. Accordingly, the primary goals of this project are to (a) test a theoretical framework that specifies the types of incentives that are expected to be most effective in changing behavior, and (b) test putative mediators—perceived expectancy and value—of the incentive-preventive health behavior relation. The secondary goals are to explore a potential individual difference moderator (regulatory focus; Higgins, 1997) and to examine the persistence of observed behavioral effects after the incentive has been removed.

Which Incentives Are Most Effective? A Theoretically Grounded Organizational Framework for Incentive Studies

Recently, my colleagues and I proposed an organizational framework that specifies two orthogonal dimensions along which incentives may vary (Burns et al., 2012). The framework can be applied to numerous health-related behavioral domains that require the frequency of a behavior to increase before health benefits are achieved; our initial work was embedded in the weight loss literature because incentive-based interventions are particularly prominent in that area.

Reinforcement Framework for Incentive-Based Health Interventions

The theoretical origins of incentive-based intervention strategies are partially rooted in operant conditioning theory. Unlike some cognitive and economic models, which consider each behavioral decision to be a discrete event, the cornerstone of operant conditioning theory is an attempt to provide an account for how behavioral patterns change over time in response to changes in the consequences of the behavior. This temporal patterning perspective is particularly relevant to the performance of many preventive health behaviors, such as eating behavior and physical activity, which must be enacted repeatedly over time to produce the desired health outcomes. The principles of operant conditioning theory were drawn upon to generate a descriptive, rather than explanatory, framework that delineates two incentive-relevant dimensions because strict operant conditioning theory disregards mediating psychological processes (Skinner, 1938).

During operant conditioning, volitional behaviors are followed systematically by specific consequences. Some consequences lead to an increase in, or *reinforce*, the target behavior (Skinner, 1953). For instance, if an incentive leads to an increase in physical activity, then the incentive is a reinforcer. Operant conditioning theory avers that reinforcement can vary along two critical dimensions--*reinforcement procedure* and *reinforcement schedule*—that affect the rate at which the behavior is repeated and the length of time that the behavior is sustained.

Reinforcement procedure. Reinforcement may be positive or negative. Positive reinforcement refers to the provision of a reward for having engaged in the target behavior (Skinner, 1953). In the incentives for health behavior literature, positive reinforcement strategies typically involve offering cash rewards contingent upon a behavior or outcome. For instance, participants have received cash rewards for attending scheduled walking sessions (Jeffery et al., 1998) and for every kilogram of body weight lost (Luley et al., 2010). In contrast, negative reinforcement aims to increase the frequency of a target behavior by removing an aversive stimulus (Skinner, 1953). For instance, the silencing of a ringing alarm by fastening a seat belt increases seat belt use by eliminating an unpleasant noise. Examples of negative reinforcement strategies that have been employed in the health incentives literature include deposit contracts (e.g. John et al., 2011) and payroll deductions (e.g. Forster, Jeffery, Sullivan & Snell, 1985), in which participants forfeit their own money or a portion of their paycheck to the researchers should they fail to meet a specified behavioral criterion is met. If the criterion is met, then the loss is avoided. For instance, participants in one study deposited $200 with the researchers, which they could earn back at a rate of $20/week by losing at least 2 lbs./week, maintaining a specified daily caloric intake for a week, or attending weekly educational sessions, depending on the condition to which they were assigned (Jeffery, Thompson & Wing, 1978). Deposit contracts and payroll deductions are examples of negative reinforcement because the aversive threat of losing one's own money is removed by performing the target behavior or achieving the target outcome.

People are loss averse; the perceived disadvantage of losing money is greater than is the perceived advantage of gaining the same amount of money (Tversky & Kahneman, 1991). This suggests that the money that stands to be lost with a deposit contract (i.e. negative reinforcement) will be perceived to be more valuable than the same amount of money that could be gained with a cash reward (i.e. positive reinforcement). Therefore, deposit contracts are expected to be more effective in changing behavior than cash rewards because money that one stands to lose is expected to be perceived as more valuable than an equivalent sum of money that one stands to gain. Based on these principles, two hypotheses emerge:

Hypothesis 1a: A main effect of reinforcement procedure is expected, such that a negative reinforcement incentive (i.e., deposit contract) will result in more repetitions of the incentivized behavior than a positive reinforcement incentive (i.e., cash reward).

Hypothesis 1b: Incentives using negative reinforcement are expected to be more effective than those using positive reinforcement because they elicit loss aversion. Loss aversion is expected to manifest as a greater perceived value being placed upon incentives that use negative reinforcement compared to those that use positive reinforcement.

Reinforcement schedules. Reinforcement is seldom administered with each enactment of a behavior. Reinforcement schedules vary the certainty of a consequence. The type of schedule that is used affects how quickly a target behavior is learned and how long the behavior is maintained (Skinner, 1953). If a schedule is *fixed,* then reinforcement is administered after every *n*th behavior (Skinner, 1953). Fixed schedules are common in interventions that incentivize health behavior. For instance, Luley and colleagues (2010) paid participants €5 for every kilogram of body weight lost. In contrast, *variable* schedules deliver consequences unpredictably. The most common example of a variable schedule in incentive-based weight loss interventions is a raffle. Gaining or losing money at an unpredictable rate is absent from this literature (see Burns et al., 2012 for review).

The effects of different reinforcement schedules on behavior have been studied extensively in animal models (see Lee, Sturmey & Fields, 2007). In general, new behaviors are established most quickly using schedules in which reinforcement occurs frequently and predictably, such as a ratio schedule of one, meaning every instance of the desired behavior is reinforced (Ferster & Skinner, 1957). However, behaviors are more consistently maintained over time if reinforcement is administered after an unpredictable number of repetitions of the behavior (Cohen, 1969). Thus, a fixed ratio schedule is most effective during the early initiation of the behavior, but a variable ratio schedule is particularly effective in sustaining the behavior over a longer term (Cohen, 1969; Ferster

& Skinner, 1957).

The habituation literature converges on a similar conclusion and provides additional insight into underlying psychological processes. Habituation is a decrease in responsiveness to a stimulus over repeated exposures (McSweeney & Swindell, 1999). Responsiveness has traditionally been operationally defined as the frequency of a conditioned behavior (McSweeney, 2004), but recent research has demonstrated that that people come to value and enjoy objects or experiences less over time if they are encountered repeatedly (Epstein, Temple, Roemmich & Bouton, 2009; Redden & Hawes, in press; Wathieu, 2004). A leading model suggests that habituation occurs when the encountered stimulus ceases to be surprising (Wagner & Brandon, 2001). The diminutions in hedonic and financial value of an object that is repeatedly encountered often leads to variety-seeking behavior, in which one chooses, prefers, and values a novel product more than a product that has recently been consumed or encountered (Kahn, 1995; McAlister & Pessemier, 1982). Similarly, the experimental introduction of variety can reinvigorate behavioral responding to both the novel stimulus and the original stimulus (Epstein, Rodefer, Wisniewski, & Caggiula, 1992; Epstein et al., 2009).

Thus, the repeated presentation of a financial incentive is expected to induce habituation, such that the perceived value of the incentive decreases over time. For instance, a $5 incentive administered on a fixed schedule is expected to have greater subjective value at the beginning of an intervention than at its conclusion. The use of a variable schedule should be relatively more effective in buffering against habituation to the incentive because it introduces variety and is unpredictable. Based on these principles, two hypotheses emerge:

Hypothesis 2a: A main effect of reinforcement schedule is expected, such that an incentive administered on a variable schedule will result in more repetitions of the incentivized behavior than an incentive administered on a fixed schedule.

Hypothesis 2b: A variable schedule is expected to be more effective than a fixed ratio schedule because it will delay habituation to the incentive. Habituation is expected to manifest as a slower decline in perceived value of incentives that use a variable ratio schedule relative to those that use a fixed ratio schedule.

Furthermore, integration of the posited principles regarding reinforcement procedure and schedule produces an additional hypothesis:

Hypothesis 3: A reinforcement procedure x reinforcement schedule interaction is expected. An incentive structure that uses both negative reinforcement and a fixed ratio schedule is expected to be more effective than all other combinations in eliciting and sustaining (i.e. produce the most repetitions of) the incentivized behavior while the incentive is available.

Application of the framework to the existing weight-management literature. In addition to proposing the 2 (reinforcement procedure: positive, negative) x 2 (schedule: fixed, variable) framework, a systematic review was conducted of randomized controlled trials that expressly sought to promote weight loss by offering incentives. The identified 27 studies were categorized into the four incentive categories that result from crossing reinforcement procedure and schedule. Although the review underscored the promise of incentives as an effective strategy in promoting weight loss, it did not permit a complete assessment of the utility of the framework for several reasons. First, the results of the systematic review indicated that studies using a combination of negative reinforcement and a variable schedule were absent from the literature. Although a deposit contract that reimbursed participants at an unpredictable rate is expected to be particular effective in changing behavior and producing weight loss, the effectiveness of this strategy has yet to be tested. Similarly, lotteries were the most common example of positive reinforcement using a variable schedule. The infrequent payoff associated with lotteries may produce low expectancies of obtaining the incentive and produce habituation to *not* receiving an incentive. A system in which the reward is consistently administered, yet varies unpredictably in size, would offer a more suitable test of the effectiveness of positive reinforcement on a variable schedule.

Additionally, the four incentive categories that emerge in our framework have not been directly compared and the immense amount of methodological heterogeneity between studies, such as differences in the size of the incentive, additional support provided to participants, the timing of the incentive, and the outcome/behavior that was reinforced, precluded firm conclusions from being drawn. Therefore, the review indicated that an empirical test of our theoretical framework is necessary to determine the relative effectiveness of the incentive categories.

Regulatory Focus as a Moderator of Reinforcement Procedure

The aforementioned hypotheses describe the effects that are *generally* expected to be caused by different types of incentives. However, the variability often seen in the outcomes of health behavior interventions, especially those targeting lifestyle changes, has led investigators to recognize that a one-size-fits-all approach to behavioral interventions is often not the most advantageous. Thus, it is important to explore the possibility that different types of incentives may work differentially well for specific types of people. That is, the effect of incentives on behavior may be moderated. The potential for gain and loss associated with positive and negative reinforcement, respectively, suggests that regulatory focus may moderate the effect of reinforcement procedure on behavior.

Regulatory focus is an individual difference that describes the extent to which one is oriented towards achieving pleasant experiences or avoiding unpleasant experiences as one works towards a goal or desired end state (Higgins, 1997). Promotion-focused individuals are eager and motivated to pursue opportunities to gain, whereas individuals who are prevention-focused are vigilant and more attuned to avoiding losses (Higgins, 1997). Performance tends to be enhanced when a task matches the individual's regulatory focus. For instance, promotion-focused individuals performed better on an anagram task when an incentive for good performance was framed in terms of gains and non-gains (i.e. "earn a dollar"), whereas those who were prevention-focused performed better when the incentive was framed in terms of losses and non-losses (i.e. "avoid losing a dollar", Shah, Higgins & Friedman, 1998). Given that individuals who are promotion-focused are more responsive to potential gains and those who are prevention-focused are more responsive to potential losses, regulatory focus is expected to moderate the effect of reinforcement type on behavior.

Hypothesis 4: Positive reinforcement incentives are expected to be particularly effective (i.e. produce more repetitions of the target behavior) for individuals who are promotion-focused, whereas negative reinforcement incentives are expected to be relatively more effective for individuals who are prevention-focused.

Does Value Transfer from Regulatory Fit?

Research has demonstrated that evaluations do not occur in isolation; often judgments "spill over" into related areas. For instance, studies have demonstrated halo effects whereby judgments of one of a target person's personality characteristics bleed over into judgments of related, yet distinct, characteristics. For example, a person who is attractive is also perceived to be successful, even when information about success is not presented (Eagly, Ashmore, Makhijani & Longo, 1991). Halo effects are also seen in the evaluation of objects, such as food. Research has demonstrated that a positive health claim pertaining to one aspect of nutrition (e.g., organic) influences judgments about unrelated nutritional properties (e.g., calorie content), such that the food is judged to be healthier in those unrelated properties (Schuldt & Schwarz, 2010).

The aforementioned examples pertain to judgments made about the qualities of a single person or object; however, in some instances, evaluations about one object can spill over into evaluations of second object. For instance, players of a computer game judged a zero-point reward that was previously paired with a high-point reward to be more valuable than a zero-point reward that was previously paired with a low-point reward (London & Zentall, 1999). Halo effects are also readily seen in advertising. The rationale underlying celebrity endorsements is that some qualities of the celebrity (e.g.

fashionable, tough) will transfer to the advertised brand (Erdogan, 1999). Moreover, individuals often purchase particular brands with the hope that the image associated with the brand will be conferred upon them (Aaker, 1999; Tildesley & Coote, 2009).

Similarly, the value derived from the manner in which a task is approached can spill over into related evaluations. Regulatory fit occurs when the nature of a task matches one's regulatory focus orientation (Higgins, 2000). When people experience regulatory fit, it "feels right" and this experience produces value, which in turn motivates behavior (Higgins, 2000). In other words, the relation between regulatory fit and behavior is mediated by an increase in the perceived value of the behavior. Importantly, the value derived from regulatory fit spills over into *subsequent* judgments of value (Higgins, Idson, Freitas, Spiegel & Molden, 2003). For example, if the strategy used to choose between a nice mug and an inexpensive pen (i.e. thinking about what you could gain from choosing each item vs. what you would not lose) matched participants' regulatory focus then participants were willing to pay much more for the mug (Higgins et al., 2003); the value derived from regulatory fit spilled over into a subsequent, related estimation of value. This pattern is also observed if the evaluated object is unrelated to the task from which regulatory fit is derived (Higgins et al., 2003).

In the context of incentivized physical activity, the potential for value from regulatory fit arises because matching the properties of the incentive to regulatory focus can induce regulatory fit. This value, which is directly tied to the incentive, may spill over to evaluations towards physical activity.

Hypothesis 5: A match between regulatory focus and the nature of the incentive will produce more positive evaluations of physical activity than a mismatch between regulatory focus and the nature of the incentive.

Sustaining the Behavior After the Incentive is Discontinued

Any intervention that aims to increase physical activity should determine the extent to which behavioral changes are sustained over time because the accrual of health benefits depends upon sustained physical activity (Blair, LaMonte & Nichaman, 2004; Campbell & Stanley, 1963). In the context of incentivized health behavior, it is particularly important to collect follow-up data because (a) the persistence of observed psychological and behavioral effects can be accurately assessed, (b) psychological or behavioral changes that may emerge after an extended period of time can be detected, (c) recommendations about the length of time that incentives should be offered are informed (i.e. on an indefinite versus finite basis), and (d) concerns pertaining to the incentive "crowding out" intrinsic motivation and causing a decline in the frequency of the behavior can be definitively addressed.

Follow-up data from numerous studies that seek to increase physical activity amongst sedentary individuals consistently converge on one conclusion: it is not common for behavioral changes observed during an intervention to be sustained over time (Müller-Riemenschneider, Reinhold, Nocon & Willich, 2008; Ory, Lee Smith, Mier & Wernicke, 2010). Given that it is unlikely that all participants will continue to be physically active when the incentive is removed, it is more useful to employ a more nuanced approach to questions surrounding the persistence of behavior change. Rather than asking, "Do these effects persist after the incentive is removed?" it is more useful to ask, "For whom do these effects persist?"

Individuals who increase their physical activity during an incentive-based intervention may be motivated by outcomes tied to an extrinsic source of motivation (i.e. the incentive) and/or outcomes that stem from intrinsic sources of motivation (i.e. desire to be healthy). If the extrinsic source of motivation to engage in physical activity is removed, then it is necessary for intrinsic sources of motivation be present for the behavior to continue. Therefore, individuals who experience an increase in intrinsic sources of motivation during the intervention are expected to remain physically active after the incentive is removed. The question thus emerges: Through what means can an incentive-based intervention foster internal sources of motivation?

As a result of participating in the intervention individuals accrue a host of experiences apart from the receipt of the incentive that might foster the development of internal sources of motivation that sustain behavior. Specifically, by engaging in physical activity during the intervention, individuals (a) gain experience performing the behavior and confronting barriers to performing the behavior, (b) experience the consequences of performing a new behavior, and (c) might experience changes in attitudes towards physical activity.

Experience Performing the Behavior and Confronting Behavioral Barriers

In the context of exercise, exercisers and non-exercisers cite the time required to exercise as the most potent barrier (Dishman, Sallis & Orenstein, 1985; Grubbs & Carter, 2002; Myers & Roth, 1997; Sherwood & Jeffery, 2000). Additional perceived barriers include physical barriers, such as sweating or being sore, social barriers, such as missing social events and embarrassment, and specific barriers, such as poor weather conditions (Grubbs & Carter, 2002; Myers & Roth, 1997).

Perceived barriers are powerful predictors of health behavior; one review identified perceived barriers as the *most* powerful predictor of health behavior (Janz & Becker, 1984). Cross-sectional data demonstrate that although active individuals acknowledge barriers to exercise, sedentary individuals perceive greater barriers (Grubbs & Carter, 2002). Specifically, individuals who are thinking about beginning to exercise perceive there to be more time- and effort-related barriers than those who are already exercising (Myers & Roth, 1997). Longitudinal research also shows that changes in perceived barriers predict changes in physical activity (Sallis, Hovell, Hofstetter & Barrington, 1992). Similarly, decreases in the perceived drawbacks to exercise relative to baseline were detected upon completion of a pedometer-based walking intervention, which successfully increased walking (Dinger, Heesch, Cipriani & Qualls, 2007). Although mediation analyses were not performed, it is possible that the increase in walking was mediated by a decrease in perceived drawbacks to exercise. Collectively, these findings suggest that experience with physical activity cause a decrease in one's perceptions of barriers. This may occur because actually confronting a barrier changes one's perceptions of it, such that it is found to be less troublesome or severe than expected. For instance, soreness and fatigue may not be as severe as expected. It is also possible that as individuals confront barriers to exercise, they remove them. For example, competing time commitments may be removed from one's schedule.

Experience engaging in physical activity and confronting barriers may also foster self-efficacy. Self-efficacy is the extent to which one feels confident that one can exercise when confronted with barriers to exercise (McAuley, Peña, & Jerome, 2001). It is typically considered an essential ingredient in behavior change, and predicts the initiation of physical activity, one's level of physical activity, and adherence to exercise programs (McAuley, 1992; McAuley & Jacobson, 1991; Wilbur, Miller, Chandler & McDevitt, 2003). There is a cyclical relation between self-efficacy and the successful performance of a behavior, such that successful performance boosts self-efficacy, which in turn facilitates repetition of the behavior (Lindsley, Brass & Thomas, 1995). Indeed, experts propose that a history of physical activity predicts continued activity via the development of self-efficacy (Sherwood & Jeffery, 2000). However, data do not consistently support this notion. For example, self-efficacy did not differ from baseline at the conclusion of two pedometer-based walking programs, although both interventions successfully increased walking (Dinger et al., 2007; Raedeke, Focht & King, 2010).

In the case of incentivized physical activity, it is likely that individuals are initially motivated, at least in part, by the incentive. However, while exercising to obtain the incentive, individuals gain experience confronting and overcoming perceived barriers. Thus, a decrease in perceived barriers from baseline is expected to emerge at the end of the intervention amongst participants in the incentive conditions and is hypothesized to predict physical activity after the incentive is discontinued. Similarly, as the incentivized behavior is performed, participants may gain self-efficacy. Given that self-efficacy is a key determinant of adherence to exercise programs, an increase in self-efficacy is expected at the conclusion of the intervention relative to baseline amongst participants in the incentive conditions. This increase in self-efficacy is expected to predict sustained behavior after the incentive is discontinued.

Hypothesis 6a: At the end of the intervention, individuals in the incentive conditions will report fewer perceived barriers relative to baseline compared to those in the control condition.

Hypothesis 6b: Perceived barriers will be inversely related to rates of physical activity after the incentive is discontinued.

Hypothesis 7a: At the end of the intervention, individuals in the incentive conditions will report greater self-efficacy relative to baseline compared to those in the control condition.

Hypothesis 7b: Self-efficacy will be positively relative to rates of physical activity after the incentive is discontinued.

Satisfaction as a Predictor of Behavioral Maintenance

As a health behavior is repeatedly performed, its consequences are experienced. Because the general benefits of exercise are commonly known, knowledge of the benefits of exercise does not change as the behavior is performed (Cash, Novy & Grant, 1994; Grubbs & Carter, 2002; Lovell, El Ansari & Parker, 2010; Myers & Roth, 1997; Williams, Benzer, Chesbro & Leavitt, 2006). However, as individuals gain experience with exercise they are able to gauge their *satisfaction* with the benefits that they expect to achieve. For example, most individuals recognize that weight control is a benefit of regular exercise, regardless of their current level of physical activity. Yet, they are only able to judge their satisfaction with the weight control that they expect as they participate in physical activity.

In contrast to decisions pertaining to the initiation of a health behavior, which are governed by expectations about the outcomes of the behavior, decisions to continue engaging in a health behavior are shaped by satisfaction with outcomes and experiences that have resulted from the behavior (Rothman, 2000). For instance, satisfaction with one's weight loss predicted future weight loss amongst individuals enrolled in a weight loss program (Finch et al., 2005) and satisfaction with physical activity predicted exercise maintenance among participants in a physical activity intervention (Williams et al., 2008). Applying this principle to the context of incentivized physical activity suggests that individuals who are satisfied with the non-financial outcomes and experiences (e.g. compliments, increased fitness) afforded by performing the incentivized health behavior will continue to engage in the behavior after the incentive is discontinued.

Hypothesis 8a: At the end of the intervention, individuals in the incentive conditions will report greater satisfaction with the outcomes of physical activity than those in the control group.

Hypothesis 8b: Satisfaction with the outcomes of physical activity at the end of the intervention will be positively related to rates of physical activity after the incentive is discontinued.

Exploratory questions: Although perceived barriers, self-efficacy, and satisfaction are expected to differ between the incentive conditions and the control group at the end of the intervention, the literature does not offer insight into the differential effectiveness of the proposed incentive categories in producing these psychological experiences. Therefore, post-hoc analyses will compare the incentive conditions on these dimensions.

How Do Incentives Produce Behavioral Effects?

To date, interventions employing financial incentives as a strategy for changing health behavior have neglected to expound the mechanism linking financial incentives to behavior change. Nonetheless, this strategy has loose conceptual roots in some rich theoretical traditions, such as classic economic theory (Kane et al., 2004). At the heart of some classic economic theories is the assumption of rationality; individuals are assumed to make rational choices that maximize their self-interest by offsetting objective costs with objective benefits (see Edwards, 1954). The application of this principle to health behavior interventions is straightforward; the costs of performing a health behavior (e.g. discomfort, time) are offset with an attractive benefit (e.g. financial incentive). From this perspective, various types of incentives (e.g. cash rewards, reimbursements) are viewed as functionally and perceptually equivalent if they produce the same objective benefit. However, contemporary work in psychology and behavioral economics has demonstrated numerous violations of the rationality assumption during decision-making, including reliance on heuristics and the stability of cognitive biases (Kahneman, 2003; Kahneman & Tversky, 1979), and has largely established classic economic models as incomplete and oversimplified representations of human decision-making (Camerer & Loewenstein, 2004).

The use of financial incentives to promote health behavior change was also inspired by operant conditioning theory, which identifies the learned association between a behavior and its consequences as the foundation of future behavior (Skinner, 1938). As with classic economic theory, the application of operant conditioning principles to health behavior is straightforward: if the receipt of a pleasant financial incentive is associated with a health behavior, then the frequency of the health behavior will increase over time. However, the psychological processes mediating the association between an incentive and a behavior are not specified because, according to strict operant conditioning theory, these processes are unquantifiable and inappropriate for scientific study (Skinner, 1938). Thus, operant conditioning provides the basis for a descriptive, rather than explanatory, theoretical framework for designing incentives.

Collectively, the original theoretical inspirations for an incentive-based health behavior change strategy are silent on the issue of underlying psychological mechanisms. In endeavoring to gain an understanding of the latent causal pathway, it may thus be beneficial to explore additional literatures that have (a) been alluded to in the incentives and health literature, and (b) not yet been broached in this area of research.

Proffered Mediational Explanations for Incentive-Based Health Behavior Interventions

Despite some loose ties to rich theoretical traditions, such as classic economic theory and operant conditioning theory, it appears that the intuitive appeal of financial incentives as a means of changing health behavior prevails; theory and mediating processes are rarely discussed in justifications for the use of an incentive-based strategy (e.g. Giuffrida & Torgerson, 1997; see Kane et al., 2004). When proffered, theoretical justifications are typically vague and fall into two categories: motivational and behavioral economic explanations.

Motivation-based explanations. Increased motivation, which is a psychological process that stimulates, governs, and maintains goal-directed behavior (Deci & Ryan, 1985), is amongst the most common explanation given for the effect of financial incentives on health behavior (see Sutherland, Christianson & Leatherman, 2008). This type of justification is incomplete and vague because the precise psychological pathways through which motivation is increased are not explicated; *how* a financial incentive arouses a person to action is not specified.

In rare cases, interventions employing a motivational justification further assert that incentives increase extrinsic motivation, which is motivation that originates in external sources and is driven by the attainment of outcomes, such as tangible rewards, rather than interest or enjoyment (Curry, Wagner & Grothaus, 1991; Deci & Ryan, 1985; Sutherland et al., 2008). Indeed, financial incentives are a prototypical source of extrinsic motivation, and self-determination theory, which distinguishes between intrinsic and extrinsic motivation, is germane and will be discussed subsequently (Deci & Ryan, 1985). However, extrinsic motivation is a description of the *type* of motivation that may be generated; asserting that incentives increase extrinsic motivation does not describe *how* a financial incentive affects behavior.

In the broad psychological literature, several motivational theories and models have been proposed, though most have not been engaged by the incentives and health literature (Jenkins Jr., Mitra, Gupta & Shaw, 1998). These theories differ in their fundamental perspectives, with some theories placing greater emphasis on psychological mediators than others. Motivational theories further differ in the extent to which motivation is considered to stem from striving to meet basic needs, such as nourishment and safety, versus accomplishing higher order goals, such as achievement goals. Only motivational theories that delineate specific mediating cognitive processes and pertain to the achievement of higher order goals will be considered further.

Expectancy theory. Expectancy theory was originally developed to explain the processes underlying worker motivation and sought to identify the types of incentives and motivators that could be utilized in the workplace to increase worker motivation and productivity (Vroom, 1964). The theory largely explains how personal goals, such as financial gain, may be leveraged as a means of achieving goals that are valued at the organizational or management levels, such as productivity. Although the original theory has been revised over the years (Behling & Starke, 1973; Landy & Becker, 1990; Van Eerde & Thierry, 1996), its fundamental tenets have remained intact.

At the core of this theory is the assumption that when making a decision, individuals are motivated to choose and pursue the behavioral option that is most likely to result in a desired outcome. Each behavioral option is evaluated along three dimensions—expectancy, instrumentality and valence—and the motivational force of each behavioral option is the product of these dimensions. Expectancy is the perceived likelihood that expended effort will proportionally translate into the target behavior or outcome. For instance, will the effort that I exert at the gym result in a 2 lb. weight loss? Tied to expectancy are the psychological concepts of self-efficacy and perceived control because high expectancy requires the perceptions that the target behavior or outcome is changeable and that this change can be caused through effort. Instrumentality is the estimated likelihood that the target behavior or outcome will indeed lead to the achievement of a specified goal, such as earning money or feeling healthier. Thus, instrumentality estimates may involve asking: If I lose 2 lbs. will I receive $2 from the interventionist? Or, if I lose 2 lbs. will I feel healthier? Valence is the subjective value that is placed on the goal and is driven by the satisfaction expected to be derived from achieving the goal. Questions pertaining to valence may include: How much do I value getting $2 from the interventionist? Will I feel satisfied if I feel healthier? Because evaluations of behavioral options are a multiplicative function of expectancy, instrumentality, and valence, motivation to pursue a particular behavioral option is constrained to 0 if expectancy, instrumentality, or valence is estimated to be 0. For instance, if one does not perceive a goal to be valuable, then one will not be motivated to pursue the behavioral option leading to the goal.

In summary, expectancy theory avers that individuals are most motivated to choose a behavioral option if they expect that their efforts will translate into a target behavior, and that this behavior will indeed result in the receipt a valued goal. Although high expectancy is necessary for motivation, strict incentive-based interventions do not target the link between expended effort and performance of the specified behavior, rather these interventions target instrumentality and valence by introducing an attractive goal (i.e. the incentive) that is contingent upon performance of the behavior. Thus, the incentive is most closely tied to instrumentality and valence.

Expectancy-value theory of achievement motivation. Cognitive mediators of motivation are also explicated in the expectancy-value theory of achievement motivation (Wigfield & Eccles, 2000). This educational model posits motivation stems from one's perceived likelihood of success on a task and how much one values the task; motivation is highest when the perceived likelihood of success and value are high (Wigfield & Eccles, 2000). Value is broken into four categories: attainment value (i.e. importance of doing well on the task); intrinsic value (i.e. enjoyment derived from performing the task); utility value (i.e. how well the task fits into one's future plans); and costs (i.e. limitation of other activities, effort, emotional cost, etc.; Wigfield & Eccles, 2000). These four categories, to the extent that they are present, coalesce in an additive fashion to form global value. Intrinsic value and utility value highlight the capacity for internal and external sources of value to additively influence the global subjective perception of value (Wigfield & Eccles, 2000).

Summary of relevant motivational theories. Despite originating in distinct fields of psychology and aiming to explain the cognitive underpinning of motivation in different populations, expectancy theory and expectancy-value theory of achievement motivation overlap conceptually. Both theories recognize that external rewards, such as financial incentives, have the capacity to motivate behavior and specify subjective expectations about an outcome and the desirability of an outcome as chief determinants of motivation.

Behavioral economic theory. Behavioral economics departs from classic economic theories that emphasize rationality by introducing emotional and cognitive factors as legitimate and meaningful influences in the decision making process (Camerer & Loewenstein, 2004). Behavioral economic justifications for the use of incentive-based health intervention strategies center about the hyperbolic discounting principle, which posits that immediate gratification is more greatly valued than distal benefits during decision-making (Finkelstein & Kosa, 2003; Laibson, 1997; Volpp et al., 2008). For example, in the context of health behaviors, the immediate satisfaction derived from a temptation, such as eating unhealthy foods, is weighted more greatly in the decision process than the delayed health benefits derived from performing the polar behavior (i.e., eating healthy foods), such as maintaining a healthy cholesterol level or amount of body fat. A financial incentive that is contingent upon the performance of a health behavior is designed to shift the relative value of proximal and distal outcomes; the health behavior becomes associated with an immediate financial benefit.

Additional Literatures Pertaining to Mediational Explanations for Incentive-Based Health Behavior Interventions

Distinct areas of research have examined the broad processes underlying health behavior change and the effect of incentives on non-health-related behavior. Although neither of these bodies of literature has been explicitly incorporated into the theoretical bases of incentive-based health interventions, their close conceptual ties to these types of interventions render them useful resources in identifying putative mediators of the effect of incentives on health behavior.

Theoretical models of health behavior change. A number of theoretical models detail the conditions and processes that generate health behavior change. These models fall into two broad categories: stage models and continuum models. Stage models stratify people into qualitatively distinct groups that differ along specified dimensions that are germane to behavior change. For instance, the transtheoretical model (Prochaska & Velicer, 1997) categorizes people based on their readiness to change their behavior. Similarly, the precaution adoption process model (Weinstein, 1988) distinguishes between qualitatively distinct stages of engagement with precautionary behaviors. In contrast, continuum models do not stratify individuals into qualitatively distinct categories, but rather specify a number of factors that coalesce to produce behavior. Because continuum models specify the processes that drive behavior change, they hold more promise in looking to this literature for potential mediators of the effect of incentives on health behavior change.

Health Belief Model. The health belief model (Rosenstock, Strecher & Becker, 1988) is amongst the most developed and tested continuum models of health behavior change. It was originally designed to specify the variables to be targeted in health communications and has been applied to a host of health behaviors, including vaccination (Gerend & Shepherd, 2012), weight management (Daddario, 2007), and cancer screening (Yarbrough & Braden, 2008). The model specifies four antecedents of health behavior: perceived susceptibility (i.e., Am I vulnerable to a particular health condition?), perceived severity of harm (i.e., If I did contract the health condition, how bad would it be?), the perceived benefits of engaging in the health behavior (i.e., What may I gain from engaging in this health behavior?), and barriers to engaging in a health behavior (i.e., What factors hinder performing the health behavior?). The health belief model is an expectancy-value model of health behavior because each of the four behavioral determinants can be classified as pertaining to the perceived expectations about the target health outcome (i.e., perceived susceptibility and perceived severity) or the subjective value of the health behavior (i.e., perceived benefits and barriers; Rosenstock, Stretch & Becker, 1994). Benefits and barriers were identified as the best predictors of behavior by a recent meta-analysis of longitudinal studies that tested the health belief model (Carpenter, 2010).

Theory of Planned Behavior. The theory of planned behavior is a continuum model and proposes that behavior is chiefly driven by intentions to perform the behavior, which, in turn, are shaped by perceived behavioral control (i.e. perceived capability to perform the behavior), social norms (i.e. perceived social pressure to engage in or abstain from the behavior), and attitudes (i.e. evaluations of the behavior; Ajzen & Fishbein, 1980). Intentions are predicted to be strongest for behaviors for which perceived behavioral control is high, social norms are high, and attitudes are positive. Intentions are indicative of the amount of effort that one is willing to exert to engage in the behavior, and thus, in some sense, can be conceptualized as motivation (Ajzen, 1991).

The theory of planned behavior has been applied to a number of health behaviors, including smoking (Godin, Valois, Lepage & Descharnais, 1992), sunscreen use (Hillhouse, Adler, Drinnon & Turrist, 1997), and physical activity (Godin, 1993), and several meta-analyses support the theory (Armitage & Conner, 2001; Godin & Kok, 1996). A meta-analysis that compared the relative efficacy of the theory’s constituent elements revealed that attitudes were the strongest predictor of intentions to exercise, even when past behavior was controlled for (Hagger, Chatzisarantis & Biddle, 2002). Moreover, the posited antecedents of intentions appear to differentially impact the intention-behavior relation; intentions based on attitude are more strongly related to behavior than are intentions based on norms (Sheeran, Norman & Orbell, 1999).

Applications to Incentives. The health belief model and the theory of planned behavior point to specific avenues through which incentives may affect the adoption of a health behavior. With regards to the cognitive antecedents specified by the health belief model, it is most likely that an incentive would affect the benefits perceived to be associated with the behavior by introducing the possibility of financial gain. It is unlikely that an incentive would alter the extent to which one feels vulnerable to contracting a health condition or the perceived severity of the condition. The incentive may also directly decrease barriers to the extent that barriers are financial (e.g., offset cost of a gym membership), however, other barriers, such as the time required to perform a health behavior and the potential discomfort associated with the behavior, are unlikely to be directly changed by an incentive.

With regards to the theory of planned behavior, it is most parsimonious to expect incentives to initially produce behavioral effects via attitudes, such that incentives cause the targeted health behavior to be evaluated more positively. With the exception of highly specific and unusual circumstances, it is less clear how the provision of an incentive would change the social norms perceived to surround the behavior or the extent to which one feels capable of performing the behavior. Because incentives are most likely to change attitudes, it is worthwhile to examine the formative components of attitudes. The theory of planned behavior borrows from expectancy-value theory (Fishbein, 1963) in specifying the determinants of attitudes; attitudes are formed via a multiplicative combination of the subjective estimate of the likelihood that a behavior will produce a certain outcome and the subjective value of that outcome (Ajzen, 1991; Fishbein, 1963). Empirical support for this attitudinal model has been garnered from correlational studies demonstrating significant correlations between global attitudinal measures and measures that combine expectancy and value items to calculate global attitude (see Ajzen, 1991).

In conclusion, both the health belief model and the theory of planned behavior converge on perceived value of a health behavior as a behavioral antecedent that is likely to change if a financial incentive is offered. Expectancy of achieving a target outcome is further implicated in the theory of planned behavior, such that expectancy of achieving the target outcome combines with perceived value in a multiplicative fashion. This conclusion is consonant with that reached by examination of relevant motivational theories and behavioral economic theory: incentives produce behavioral effects by influencing the perceived value of a health behavior. Although the perceived likelihood of obtaining the desired outcome is also a necessary behavioral determinant, such that one must perceive the target outcome (i.e. receiving the incentive) as likely to occur, incentive interventions typically do not explicitly target this construct. Rather, incentive-based interventions operate under the reasonable assumption that participants trust that the researcher will provide the incentive if the specified behavioral criterion is met.

Incentives and non-health behaviors. Direct examinations of the psychological processes underlying the effects of incentives on non-health behavior are rare. A small body of literature tested the hypothesis that goal setting mediates the effect of incentives on performance quality, such that incentives cause individuals to set more lofty performance goals, which in turn result in better performance (Wright, 1989, Wright, 1992); however, empirical tests did not support the posited mediation pathway (see Wright, 1991 for further discussion).

In contrast, the behavioral effects of incentives in non-health domains are well documented. The majority of research in this area comes from the industrial/ organizational literature (see Jenkins Jr. et al., 1998) and tests of the overjustification effect (see Deci, Koestner & Ryan, 1999). Within the industrial/organizational literature, empirical studies often test the effectiveness of financial incentives in changing employee behavior, such as work quality or quantity. A meta-analysis of the effect of financial incentives on work and organizational behaviors found that financial incentives are not reliably tied to performance quality (i.e. the caliber of one's work), but are positively associated with performance quantity (i.e. the amount of work produced; Jenkins Jr. et al., 1998).

Overjustification effect. Self-determination theory posits that psychological needs to feel autonomous, competent, and related to others are innate and underpin motivation (Deci & Ryan, 1985). The theory further distinguishes between intrinsic motivation, which originates internally and is driven by interest in or enjoyment of a task, and extrinsic motivation, which comes from external sources and is driven by the attainment of outcomes, such as praise or tangible rewards (Deci & Ryan, 1985). Financial incentives are exemplars of extrinsic motivation.

According to cognitive evaluation theory (Deci, 1975), extrinsic motivation influences intrinsic motivation, such that extrinsic sources of motivation are perceived as coercive and consequently undermine intrinsic motivation by threatening one's sense of autonomy. The overjustification effect is observed in situations in which a previously enjoyed task becomes less interesting because an extrinsic source of motivation was offered and subsequently removed (Deci, 1971, 1972, 1975). For example, children who enjoyed drawing and were offered a reward to draw subsequently displayed less interest in drawing than children who did not receive a reward and children who were given the reward, but did not expect it (Lepper, Greene & Nisbett, 1973).

Meta-analyses have concluded that offering an external reward for performing a task *that is already perceived to be interesting* indeed causes less time to be spent on the task *if the reward is removed* (Deci et al.,1999; Wiersma, 1992). However, the effects of intrinsic and extrinsic motivation appear to be additive if task performance is measured when *both intrinsic and extrinsic motivation are present* (e.g., an incentive is offered and enjoyment is high; Wiersma, 1992). This finding reconciles the overjustification effect with other theories, such as operant conditioning theory and expectancy-value theories, and literatures, such as the industrial/organization literature, that predict additive effects of internal and external sources of motivation, but are primarily concerned with behavioral patterns observed during the provision of an incentive (Hamner & Foster, 1975; Wiersma, 1992).

Summary. Although literatures that examine the effect of incentives on non-health behavior do not offer great insight into the underlying mechanism, these literatures suggest that incentives do indeed cause consistent behavioral changes. Research on the overjustification effect elucidates conditions under which behavior can be expected to increase. Specifically, a given behavior is very likely to occur if it is motivated by both intrinsic and extrinsic sources; however, interest in the behavior is expected to wane if (a) the behavior was initially considered interesting, (b) an external reward contingent on the behavior was offered, and (c) the reward was subsequently removed. If these conditions are translated to the domain of incentivized health behaviors, initial concerns about incentives undermining intrinsic motivation are largely alleviated. Although many individuals indeed take interest in and derive enjoyment from various health behaviors, these individuals are presumably relatively few given that participation in many health behaviors, such as physical activity or fruit and vegetable consumption, is low in the population (Kimmons, Gillespie, Seymour, Serdula & Blanck, 2009; Troiano et al., 2008). Moreover, these few individuals are typically are not targeted by incentive-based interventions; randomized controlled trials using incentives routinely recruit individuals who are not actively engaged in the target health behavior and thus are presumably not intrinsically motivated to engage in the target health behavior (e.g. Jeffery et al., 1998; Volpp et al., 2008).

Integration of Proffered Mediational Explanations

Published randomized controlled trials rarely offer a cursory explanation of underlying psychological mechanisms and have not empirically tested mediators. The few studies that proffer a mediator typically extend a motivational or behavioral economic explanation. Motivational explanations tend to be cursory, but a review of motivational models that specify causal cognitive determinants of motivation revealed that these models conceptually overlap; expectations about the outcome of the behavior and the value of the outcome are paramount determinants of motivation. Similarly, behavioral economic explanations posit that the value of incentives offset the immediate costs of performing a behavior, which are more salient than delayed benefits. Continuum models of health behavior converge on similar processes; value, and to a less extent expectancy, are the most plausible paths through which incentives produce a behavioral effect. Although the literature on incentives and non-health behaviors did not point to a putative mediator, this literature does demonstrate a relation between incentives and behavior, such that incentives increase the frequency of a behavior while the incentive is available.

Expectancy and Value: Putative Mediators

Expectancy-value models have been used to explain a host of motivational and behavioral processes (e.g. Feather, 2011; Fishbein, 1963; Shah & Higgins, 1997). Broadly, these models specify a multiplicative combination of the subjective expectation of the outcomes of a behavior and the subjective value of the outcome as key motivational determinants. Generally, this multiplicative combination is referred to as attitude. Attitude is expected to mediate the effect of incentives on behavior, such that incentives increase the frequency of the target health behavior by increasing one’s global evaluation of the target health behavior.

Attitudes are presumed to capture the expectancy and value evaluations of all relevant outcomes. In most situations, the number of relevant outcomes is limited.

However, in the context of incentive-based health behavior interventions, there are several outcomes that are potentially valuable, such as improved health, improved appearance, and financial gain. The question thus emerges: which outcome is being subjected to expectancy and value estimates?

In the domain of health behavior, correlational designs are typically used to explore the utility of expectancy and value as predictors (e.g. Gao, Lee, Kosma & Solmon, 2010; Grube, Morgan & McGree, 2011). The few intervention studies that draw on expectancy-value models typically contain intervention components (e.g., specialized physical education classes, Lytle et al., 2009; helpful websites, Wadsworth & Hallam, 2010) that exclusively facilitate the achievement of outcomes *typically associated with physical activity* (i.e., health- or appearance-related outcomes); most interventions that draw on expectancy-value theory restrict the object of expectancy and value evaluations to outcomes typically associated with physical activity. However, incentive-based interventions are unique in that the intervention component (i.e., the incentive) may facilitate the achievement of outcomes typically associated with physical activity *and/or* a desirable non-health outcome (i.e., earning money). The implicit assumption of incentive-based strategies is that incentives change the perceived *benefits* associated with a behavior, but it is not well specified if this effect is driven by one's attitude towards distal health- and appearance-related benefits, one's attitude towards the possible financial benefit, or a combination of both. Thus, in measuring expectancy and value, it is important to consider the type(s) of benefit that is being subjected to expectancy and value evaluations.

The literature does not offer guidance on this topic; most models of goal pursuit fail to acknowledge that people hold multiple goals when making a behavioral choice (Fishbach & Dhar, 2007). One of the few exceptions is the multiple goal pursuit model, which suggests that if several goals are held simultaneously, then one searches for and prefers actions that maximize the number of goals that are achieved (Fishbach & Dhar, 2007). However, this model does not address subjective estimates of expectancy and value. The achievement motivation theory (Wigfield & Eccles, 2000) recognizes value as an important determinant of motivation and proposes that the global perception of value can come from several different sources, such enjoyment and feeling competent, which combine in an additive manner. Similarly, the behavioral effects of intrinsic and extrinsic motivation are additive if measured when both sources of motivation are present (Wiersma, 1992). Application of this principle to the issue at hand suggests that the expectancy and perceived value of health benefits (i.e. attitude towards typical physical activity outcomes) and the expectancy and perceived value of the incentive (i.e. attitude towards the incentive) should be added to generate an estimate of one's global attitude towards the target health behavior.

Exploratory questions: The relation between directly measured, global attitude towards physical activity, and (a) attitude towards the incentive, (b) attitude towards the outcomes typically associated with physical activity, and (c) their combination will be explored. Relations between these various conceptualizations of attitude and behavior will also be explored. These analyses will be restricted to active treatment because this is the only time that the incentive was offered.

Review of Hypotheses and Project Overview

The primary goals of the proposed project were to (a) identify the types of incentives that are most effective, and (b) identify mediators of the incentive-behavior relationship. Secondary goals were to (c) to test regulatory focus as a moderator of incentive type, (d) test the transfer of value derived from regulatory fit to attitudes towards physical activity, and (e) examine the persistence of observed effects after the incentive is discontinued.

It was hypothesized that incentives that use negative reinforcement would be more effective than those that use positive reinforcement, in that they would result in more physical activity, and that a variable schedule would be more effective than a fixed schedule. Incentives that use both negative reinforcement and a variable schedule were expected to be the most effective (Hypotheses 1-3).

Regulatory focus was expected to moderate the effect of incentives on behavior, such that a “match” between one’s regulatory focus and reinforcement procedure would be most effective in producing physical activity. Moreover, the value derived from regulatory fit was expected to transfer to physical activity (Hypotheses 4 and 5).

Experience participating in physical activity was expected to decrease perceptions of barriers and boost self-efficacy, which, in turn, were expected to predict the continuation of physical activity when the incentive was discontinued. Satisfaction with experienced outcomes and attitudes towards physical activity were also expected to predict sustained physical activity (Hypotheses 6-8).

Furthermore, the relations between global attitudes and combinations of perceptions of expectancy and value of the incentive and the physical benefits typically associated physical activity were explored, and the relations between attitude and behavior were tested. To test these hypotheses, a randomized controlled trial that incentivized walking was implemented.

Method

Design and Overview

A 2 (reinforcement procedure: positive, negative) x 2 (schedule: fixed, variable), plus a hanging no-incentive control condition, between-subjects design was used. Walking, as measured by a pedometer smart phone application, was incentivized. Walking was selected because it is relatively easy, convenient, low intensity and amongst the most common form of physical activity (Sherwood & Jeffery, 2000). There was one-week of baseline data collection, followed by the 5-week intervention, and 2 weeks of follow-up. Participants were block randomized to condition at Lab Session 2. An abbreviated version of the procedure was pilot tested prior to the onset of the study.

Power calculations determined that 18 participants are needed per cell to detect an effect size of 0.50 with 80% power. An effect size of 0.50 represents a small-medium effect in social science studies (Cohen, 1988) and was chosen because prior studies have found small (Volpp et al., 2008) to large (Finkelstein et al., 2008; Volpp et al., 2008) effect sizes, depending on the experimental conditions that are compared. The length of the intervention is conducive to attrition, thus an additional 7 participants per cell were recruited to ensure sufficient power.

Participants

Participants were 153 relatively inactive undergraduate students. All individuals expressing interest in the study were screened for eligibility. To be eligible, participants had to: be enrolled in a course at the University of Minnesota that was participating in the Research Experience Program (REP); own a smartphone with a iOS (iPhone) or Android operating system; be willing to download and use the pedometer app on their smartphone for 8 weeks; and report walking less than 1.5 hours per day. Participants who walked more than 1.5 hours were screened out to circumvent ceiling effects in attitudes towards exercise and levels of physical activity and because incentives are typically used to attract individuals who are not otherwise sufficiently motivated to exercise.

Procedure

The procedure involved a screening questionnaire, three lab sessions, and weekly online assessments. All data was collected between October and December of 2013 at the University of Minnesota.

Screening questionnaire. Individuals expressing interest in the study completed an online screening questionnaire to assess their eligibility (see Appendix 2). The questionnaire queried if the individual was enrolled in a REP course, had a smartphone with an iOS or android operating system, and was willing to download and use a smartphone pedometer app for 8 weeks. Activity level was also measured with the short form International Physical Activity Questionnaire (IPAQ; Craig et al., 2003). An item on the IPAQ asks respondents on how many of the past 7 days they walked at least 10 minutes at a time. Respondents indicating that they walked on least 1 day of the past week were then asked how much time, in total, they usually spent walking on one of those days. Individuals who reported walking less than 1.5 hours per day were eligible, provided additional eligibility criteria were met. Responses were reviewed, and eligible participants were invited to attend Lab Session 1.

Lab Session 1. After providing consent, participants viewed a short presentation by the researcher. The presentation described the three components of the study (attending lab sessions, using the pedometer app, and completing online assessments) and the allocation of REP points for each component of the study. Participants were informed that they should use the app to track all of their walking over the next 8 weeks (i.e., use the app every day), and that they could not continue with the study if they did not attend Lab Session 2. The incentive and walking goal were not mentioned during this session; if participants asked if they should increase their walking, they were instructed to walk as much as they normally do.

Participants then completed a computer tutorial that briefly reviewed the presentation, demonstrated how to download and use the app, and illustrated how to share their pedometer data with the researcher. The researcher and trained research assistants verified that the app was properly downloaded.

A survey measuring (a) demographics and background information, (b) direct global attitudes towards the experience of walking 10,000 steps/day on most days of the week, (c) direct global attitudes towards the goal of walking 10,000 steps/day on most days of the week, (d) perceived expectancy and value of improved physical appearance and fitness derived from physical activity, (e) self-efficacy, (f) perceived barriers to exercise, and (g) regulatory focus was administered (see Appendix 3). Additional measures that are not relevant to the analyses discussed in this paper were also collected (see Appendix 3). Lab Session 2 was also scheduled.

Lab Session 2. One week after Lab Session 1, participants reported for Lab Session 2. First, the walking goal was described to all participants. Federal guidelines recommending that individuals walk 10,000 steps per day to acquire the health benefits of walking (CDC, 2011) were briefly described. Next, all participants were told that their goal was to walk 10,000 steps per day on most days of the week (i.e., at least 4 of 7 days). Consistent with the lifestyle approach to increasing physical activity advocated by experts (e.g. Sherwood & Jeffery, 2000) and federal guidelines (CDC, 2011), the weekly walking goal may be achieved by combining numerous walking sessions within a day. Walking may be done on a treadmill. Each participant's week began the day after Lab Session 2.

Next, the incentive category to which participants were block randomized was described. The recruitment flyer stated that all participants could make up to $50. Thus, participants in the control condition were told that they would earn an entry into a draw for $50 for each week that they uploaded pedometer data, regardless of having met the walking goal (i.e., participants who uploaded data showing that they walked 500 steps would receive an entry). Therefore, the incentive was not contingent upon the performance of the specified health behavior.

Participants assigned to one of the four incentive conditions were told that they could receive a cash incentive each week if the walking goal was met and that their balance could be collected at Lab Session 3. Piloting testing revealed that $10/week was an attractive incentive for the population.

Positive reinforcement was administered in the form of a cash reward. Participants were informed that cash would be earned for each week that the walking goal was achieved. To highlight the experience of gaining money, participants were told that they had a bank account in the study, and that although they currently had $0 in their account, they could gain some of the researcher's money on a weekly basis, up to a maximum cumulative total of $50, for meeting the walking goal. This description was accompanied by a cartoon of a fundraising thermometer that began with $0 and had funds added to it. A deposit contract, in which individuals entrust their own money to the researcher and earn it back as a specified criterion is met, is the most common type of negative reinforcement used in research. However, the limited income typical of undergraduates makes this option unattractive. Thus, framing, which has been successfully used in an incentive-based smoking cessation program (Romanowich & Lamb, 2013), was used to create the psychological experience of losing one's own money. Participants were told that they had a bank account with $50 in it, and that they would lose some of their money each week that the walking goal was not met. In this condition, the fundraising thermometer cartoon began at $50 and had funds deducted from it. A manipulation check was administered at the end of Lab Session 2 and at Lab Session 3 (i.e., the end of active treatment) to verify that this manipulation was indeed inducing the experience of losing one's own money.

In the fixed ratio condition, the size of the incentive remained constant. Participants were told that they would gain [*lose*] $10/week for each week that the walking goal was [*was not*] met. Conversely, in the variable ratio condition, the size of the incentive varied unpredictably each week. Participants were told that the amount that they stood to gain [*lose*] would be revealed in their weekly email *after the week was complete*. Unbeknownst to participants, the incentive size for each week was preselected and constant across participants; participants in this condition stood to gain [*lose*] the following amounts during weeks 2-6, respectively: $3, $14, $10, $18, and $5.

All participants were told to expect a weekly email containing a link to the weekly assessment questionnaire. Participants in the incentive condition were told that the weekly email would also state (a) whether the walking goal was met in the previous week, (b) the amount of money gained [*lost*] that week, and (c) their total account balance.

Next, participants completed several measures. Specifically, intention to walk 10,000 steps/day on at least 4 days of the week, direct global attitudes towards the experience and goal of walking 10,000 steps/day on at least 4 days of the week, and expectancy and value of improved physical fitness, improved physical appearance, and making money in the study were measured (see Appendix 4).

Weekly Assessments. The day after participants' weeks ended, they received an email containing a link to a brief online survey. Participants were instructed to complete the survey within 24 hours of receiving it. The survey measured (a) intention to walk 10,000 steps/day on at least 4 days of the week, (b) direct global attitudes towards the experience and goal of walking 10,000 steps/day on at least 4 days of the week, (c) expectancy and value of improved physical fitness, improved physical appearance, and the incentive, (d) effort put into walking 10,000 steps/day on most days of the week, and (e) satisfaction with monetary benefits and benefits typically associated with physical activity (see Appendix 5). Satisfaction with monetary benefits was not measured during follow-up (see Appendix 6).

During active treatment, emails sent to participants in the incentive conditions also stated (a) whether the walking goal was met in the previous week, (b) the amount of money gained [*lost*] that week, and (c) their total account balance (see Appendix 7).

Lab Session 3. Five weeks after Lab Session 2, participants returned to the lab to collect the money owed to them. Measures from the weekly assessment were administered. Self-efficacy, perceived barriers, and activity level were also measured (see Appendix 8).

Measures and Materials. A schedule indicating when each measure was administered is presented in Appendix 1.

Activity level. Activity level was measured with the short form IPAQ (Craig et al., 2003), which measures the amount of time participants have spent engaged in moderate physical activity, vigorous physical activity, walking, and sitting during the past 7 days. Participants are asked to indicate the number of days that they engaged in each activity in the last week, and if applicable, the average amount of time spent engaged in the activity each day. Adequate validity has been demonstrated for this measure (Craig et al., 2003).

Direct global attitudes towards the experience and goal of walking. Attitudes towards the goal of walking 10,000 steps/day on most days of the week and attitudes towards the experience of walking were both measured because these attitudes may be orthogonal. As recommended by Ajzen (2006), the items "For me, the goal of walking 10 000 steps (approximately 4.5 miles) per day on most days of the week is:" and "For me, the experience of walking 10 000 steps (approximately 4.5 miles) per day on most days of the week is:" were rated on four 7-point scales anchored with bipolar adjectives (*good-bad*; *pleasant-unpleasant*; *important- unimportant*; *desirable-undesirable*). Items were scored on a scale of -3 to +3. All items were reverse coded prior to aggregation so that higher scores represent more positive attitudes. These scales demonstrated adequate internal reliability (α goal end of week 1-end of week 8=.52, .53, .68, .77, .64, .66, .73, .63; α experience baseline-end of week 8 =.79, .80, .77, .82, .83, .83, .86, .85, .85). When measured concurrently with perceived expectancy and value, direct measures of global attitudes were measured first because responses to global attitude items can be strongly, and perhaps unduly, influenced by preceding items that measure component aspects of the attitude (see Schwarz, 1999).

Perceived expectancy and value. Expectancy and value were assessed for health-related outcomes and financial outcomes. The health-related outcomes that were assessed were improved physical fitness and improved physical appearance. These outcomes were chosen because they are the benefits most commonly associated with physical activity amongst young adults (Grubbs & Carter, 2002; Lovell et al., 2010). Making money in the study was the financial outcome that was assessed.

Perceived expectancy items had the following stem: For me, walking 10 000 steps (approximately 4.5 miles) per day on most days of the week will [improve my physical fitness/improve my physical appearance/make me money]. Ratings were made on a 7-point scale (1=*Very unlikely*, 7= *Very likely*). Perceived value items had the stem, "My [improved physical fitness/improved physical appearance/making money in this study] is…" Each outcome was evaluated on three 7-point bipolar adjective scales (*bad-good*; *unimportant-important*; *desirable-undesirable*). Items were scored on a scale of -3 to +3. The latter item was reverse coded and items were aggregated. This measure demonstrated adequate reliability (α fitness baseline-end week 8=.76, .73, .77, .75, .83, .76, .86, .77, .70; α appearance baseline-end week 8=.73, .84, .78, .72, .81, .78, .80, .71, .75; α money end of week 1-end of week 6=.64, .60, .52, .65, .73, .66). Expectancy and value items for each outcome were multiplied to generate attitudes towards financial outcomes and health-related outcomes.

Perceived barriers to physical activity. Perceived barriers to physical activity were assessed with the barriers scale of the Exercise Benefits/Barriers Scale (EBBS; Sechrist, Walker & Pender, 1987). The EBBS has demonstrated adequate psychometric properties (Sechrist et al., 1987), and the barriers subscale asks participants to rate their agreement with 14 items that pertain to barriers to exercise (e.g. I am fatigued by exercise) on a 4-point scale (*Strongly agree, Agree, Disagree, Strongly disagree*). Composite scores are generated by reverse scoring and summing all items.

Self-efficacy. The Barrier Self-Efficacy Scale (BARSE; McAuley, 1992) was adapted to reflect walking, rather than physical activity, self-efficacy. The scale measures how confident respondents were that they could meet the walking goal when confronted with 13 specific barriers. Confidence was rated on a scale that ranges from 0% (*Not at all confident*) to 100% (*Highly confident*) in 10% increments. Items were aggregated. Adequate validity and reliability have been established (McAuley, 1992; Wilbur, Miller, Chandler & McDevitt, 2003; α= .93 and .93 baseline and end of intervention, respectively).

Satisfaction. Given that participants may be motivated by making money and/or the benefits typically associated with physical activity, satisfaction with both of these outcomes were measured with two items, which were adapted from Baldwin et al. [2006; *Given the amount of effort that you have put into your walking, how satisfied are you with your progress in terms of making money (the benefits typically associated with physical activity)? When it comes to making money (the benefits typically associated with physical activity), as of today, how satisfied are you with what you have experienced as a result of walking 10,000 steps/day on most days of the week?*]. Responses were made on 9-point scales (-4=*Very dissatisfied*, 0=*Neither satisfied nor dissatisfied*, 4=*Very satisfied*). Reliability was adequate (α physical activity end of week 2-end of week 8=.84, .88, .87, .92, .95, .95, .90; (α money end of week 2-end of week 6=.94, .90, .92, .94, .93).

Regulatory focus. Regulatory focus was measured with the Regulatory Focus Questionnaire (RFQ; Higgins et al., 2001). The RFQ contains prevention and promotion subscales and asks participants to rate how frequently various events have occurred in their lives (e.g. Not being careful enough has gotten me into trouble at times) on a 5-point scale (0=*Never or seldom*, 5=*Very often;* α= .77 and .71 prevention and promotion, respectively).

Manipulation Check. To determine if participants in the deposit contract condition more strongly felt that they stood to lose money compared to participants in all other conditions, all participants were asked to indicate how strongly they agreed with the statement “I am losing money each week that I do not walk 10,000 steps on most days of the week” (1=*Strongly disagree*, 7=*Strongly agree*).

Smartphone application and pedometer data. The Runtastic Step Counter is a publically available downloadable app for iPhone and Android smart phones. The app uses GPS and accelerometry to count the number of steps walked, distance travelled, and duration. The application also tracks walking done on a treadmill and allows participants to pause the pedometer. This app was selected over several other apps during piloting because participants found it to be the easiest to use and the most accurate.

Initially, all participants downloaded the free, basic version of the app. However, during Lab Session 2, participants were upgraded to the PRO version of the app, which contains fewer advertisements.

Data collected by the app is automatically uploaded to participants’ Runtastic.com webpages. This removed the opportunity for participants to inaccurately self-report their data. During Lab Session 2, participants created their pages and granted the researcher access to them.

Demographics and background information. Demographic information, such as gender, age, race, relationship status, socioeconomic status, and living arrangements (i.e., dormitory, off-campus, at home) was collected during Lab Session 1. Self-reported height, weight, and basic exercise and weight history were also measured.

Compensation. Participants were compensated with REP points (extra credit in psychology courses) for attending lab sessions and completing weekly assessments. Compensation was independent of the incentive to encourage the submission of pedometer data by participant who did and did not meet the walking goal. To earn a REP point for completing the weekly assessment, participants had to (a) complete the online survey, and (b) upload pedometer data on at least 6 days of the week, *regardless of how many steps were walked* (i.e., it did not matter if the daily step count was more or less than 10,000). The distinction between REP points and the incentive was explicated during Lab Session 2.

Analysis Plan

Data treatment. Intent to treat was applied to behavioral data; participants who did not provide data during a given week were assumed to have not met the walking goal and were analyzed accordingly.

Analyzing behavior change. Unless specifically pertaining to follow-up, analyses pertaining to behavioral changes consider only data collected during active treatment because (a) as seen in the Figure 2, a large increase in the number of participants reaching the walking goal was seen after randomization; including baseline data would have negated my ability to detect a quadratic change in behavior over time during active treatment (i.e., if the quadratic term was significant, then it would be unclear if it indicated a change in slope during active treatment *as well as* a change in slope between baseline and active treatment), (b) all participants had the same experience prior to randomization, (c) the purpose of random assignment is to distribute extant individual differences evenly across conditions, and (d) the walking goal was not explicated prior to randomization.

In analyses pertaining to behavior change, the outcome of interest was if the walking goal was met. This outcome can be conceptualized in two ways: examining patterns of behavior over time, and counting the number of times the goal was met without considering the point in time at which the behavior occurred. To address the latter case, traditional statistical techniques were used (e.g., ANOVA). In these analyses, the outcome variable was the number of times that the walking goal was met during active treatment (possible range 0-5). To investigate changes in behavior over time, generalized linear mixed effects regression (GLMER) was used. GLMER was selected because it accounts for repeated measurements and provides individual- and group-level information (Bates, 2005). The outcome variable in these models was meeting the walking goal (*no*=0, *yes*=1).

GLMER models were run using the lme4 package in R (Bates, 2005). Parameter estimates are generated via maximum likelihood methods. The log link function was used and a binomial distribution was specified because the outcome variable was dichotomous (*no*=0, *yes*=1). In GLMER analyses, time (i.e., week in the study) is included as a predictor variable. A significant effect of time indicates a slope effect. Significant interactions with time indicate differences in slope between the indicated group and the referent group. Tests of terms that do not interact with time are tests of intercept differences between the indicated group and the referent group.

One random effect was included in all models; experts recommend using a single random effect with GLMER models predicting binary outcomes to avoid estimation problems (Long, 2011). The single random effect represented participant-specific intercepts. This parameter estimate represents a participant with no random effect. That is, each participant's intercept is a deviation from this estimate.

GLMER model selection used a multimodel approach. In this approach, the fit of increasingly complex models are compared and models that improve fit are retained (Anderson, 2008). Model fit was evaluated with a chi square test and the Akaike information criterion (AIC; Akaike, 1985). A significant chi-square indicates an improvement in model fit and, thus, that the more complex model should be retained. The AIC estimates the difference between the model and "full reality" (Anderson, 2008). AICs can only be interpreted against each other with lower values indicating better fit (i.e., smaller distance between the model and reality). The AIC does not have a conventional cut-off that indicates an improvement in fit. However, differences of 1 or 2 between AICs are typically not considered meaningful differences in fit.

The design was not perfectly crossed; a hanging control group was utilized. Because all participants assigned to the control condition in the reinforcement procedure variable were, by definition, also assigned to the control condition in the schedule variable, multicollinearity issues would emerge if the interaction between reinforcement procedure and schedule were modeled. Accordingly, before modeling the reinforcement procedure x schedule interaction, the five conditions would directly be compared. If differences between incentive conditions were detected, then the control condition would be dropped and the interaction would be modeled.

Mediational tests. The central mediational hypotheses seek to explain the mechanism underlying expected differences between positive and negative reinforcement, and between fixed and variable schedules. Thus tests for mediation will only proceed if such differences are observed (i.e., an effect to mediate must be present). In such cases, latent growth curve modeling will be used in MPlus. Latent growth curve modeling uses maximum likelihood to (a) estimate the intercept and growth factor (i.e., slope) for the mediator and the outcome, and (b) test for the indirect effect of the intervention on the growth factor of the outcome through the intercept or growth factor of the mediator (MacKinnon, 2008; Selig & Preacher, 2009). However, if the expected differences between conditions are not observed, then the posited causal pathway will be dissected and examined to identify the ways in which the observed pathway differs from the posited pathway. Specifically, structural equation modeling will be used to determine (a) whether the manipulations produced differential effects on the putative mediator, and (b) whether the putative mediator affected behavior.

Results

Results are presented in four sections. The first section describes participant characteristics, analyzes the manipulation check, and contextualizes the walking goal. Hypotheses describing the effects of incentives on behavior during active treatment (i.e., during the intervention) are presented in the second section. Because active treatment was

5 weeks, participants had 5 opportunities to meet the walking goal. Within this section, a test of the main effect of reinforcement procedure on behavior is followed by a test of the main effect of schedule and tests for differences between the five conditions. The moderating effect of regulatory focus on reinforcement procedure is also presented here. In the third section, hypotheses pertaining to follow-up (i.e., after incentive is discontinued) are tested. Follow-up was 2 weeks, so participants had 2 opportunities to meet the walking goal. Within this section, differences between control and the incentive conditions in perceived barriers, self-efficacy, and satisfaction at the end of active treatment are tested. The ability of perceived barriers, self-efficacy, and satisfaction at the end of active treatment to predict behavior during follow-up is also presented here. The final section explores associations between directly measured, global attitudes towards physical activity, and (a) indirect attitudes towards the incentive, (b) indirect attitudes towards the outcomes typically associated with physical activity, and (c) their combination. Relations between these conceptualizations of attitude and behavior are also explored. These analyses are restricted to active treatment because this is the only time that the incentive was offered.

Section I: Participant Characteristics, Attrition, Manipulation Check, and Contextualizing the Walking Goal

Participant characteristics and attrition. At baseline, participants had an average age of 19.0 years (*SD*=1.94). The majority of participants were women (67%) and Caucasian (71%). Most participants reported walking for 1.0 hour on a typical day (median and mode=1.0 hour). Complete demographic information for participants at baseline, the end of active treatment, and the end of follow-up is presented in Table 1. Table 2 presents demographic information, perceived barriers, and self-efficacy at baseline across conditions. Trends of participant characteristics within each condition reflected trends in the larger sample; in all conditions, the majority of participants were women and Caucasian with a mean age of approximately 19 years. The positive-variable and negative-variable conditions had slightly more women than the other conditions. Across conditions, participants perceived a moderate amount of barriers to exercise and reported feeling fairly efficacious.

Attrition is displayed in Figure 1. Retention was quite good during the intervention. However, attrition increased during follow-up; nineteen participants dropped out during the intervention, and 31 dropped out during follow-up. As seen in Table 1, the demographic composition of the sample was largely unaffected by attrition.

Do participants in the negative reinforcement condition perceive themselves as standing to lose money? To ensure that the negative reinforcement manipulation was indeed effective in creating an experience of loss, scores on the manipulation check (*I am losing money each week that I do not walk 10,000 steps on most days of the week*; 1=*Strongly disagree*, 7=*Strongly agree*) were compared across reinforcement procedure conditions. There were differences across conditions in the extent to which participants felt they were losing money by not walking 10,000 steps on most days of the week at randomization (i.e., start of week 2) and at the end of active treatment (i.e., end of week 6), $F(2,110)=19.3$, $p<.001$, and $F(2,109)=12.77$, $p<.001$, respectively. At both time points, participants assigned to the negative reinforcement condition more strongly agreed with the statement than those in the control and positive reinforcement conditions (both $p<.003$). Moreover, participants in the positive reinforcement condition marginally agreed with the statement more than participants in the control condition at randomization and the end of active treatment ($p=.12$ and .15, respectively). Mean values are presented in Table 3.

Contextualizing the walking goal. The focal dependent measure is whether the goal of walking 10,000 steps per day on most days of the week was met during a given week. However, because meeting the walking goal can cover a vast range of behavior (e.g., walking 10,000 steps vs. 20,000 steps), Table 4 shows the average number of steps per day that were walked by participants who did and did not meet the goal each week. On average, participants who met the goal exceeded 10,000 steps by several thousand steps per day, whereas participants who did not meet the goal were several thousand steps short of 10,000. However, amongst those who did and did not meet the goal, there was a considerable amount of variability in the number of steps walked per day.

The percentage of participants in each condition meeting in the walking goal over time is shown in Figure 2. Generally, the number of participants meeting the walking goal increased when active treatment began and decreased during follow-up. Relative to the incentive conditions, fewer participants in the control condition meet the walking goal each week.

Section II: The Effects of Incentives on Walking Behavior During Active Treatment

Does negative reinforcement produce more repetitions of the incentivized behavior than a positive reinforcement incentive (Hypothesis 1a)? The number of weeks that the goal was met differed across reinforcement procedure conditions (i.e., negative, positive, and control), $F(2,150)=8.02$, $p<.001$. Specifically, participants in the incentive conditions met the goal more frequently than participants in the control condition $t(150)=-4.00$, $p<.001$. The number of weeks that the goal was met did not differ between the positive and negative reinforcement conditions, $t(150)=-.03$, $p=.99$. On average, participants in the positive and negative reinforcement conditions met the goal 2.89 (*SD*=2.07) and 2.90 (*SD*=1.99) weeks, respectively. Participants in the control condition met the goal less frequently (*M*=1.24, *SD*=1.90).

Examining behavioral changes over time. To determine if the likelihood of meeting the walking goal changed in a linear or quadratic manner across time, a model containing only a linear time term (i.e., week) was compared to a model containing both linear and quadratic time terms. The addition of the quadratic term did not significantly improve model fit (omnibus $\chi^2(1)=.33$, $p=.57$; AIC 726 vs. 728) so the quadratic term was not retained.

Next, intercept and slope differences between reinforcement procedure conditions were tested. Because there are three conditions, two dummy coded variables were created. The control condition was the referent. The dummy variables "positive reinforcement" and "negative reinforcement" represent differences between the control condition and the positive and negative reinforcement conditions, respectively.

The best fitting model contained time, positive reinforcement, and negative reinforcement; the model did not contain interactions with time. All terms in the model significantly predicted the likelihood of meeting the goal; parameter estimates are displayed in Table 5. The intercepts of positive reinforcement and negative reinforcement did not significantly differ from each other (z=.13, p=.89). This model had significantly better fit than a model containing a linear time term only (omnibus $\chi^2(2)$=16.7, p<.001; AIC 726 vs. 714). Adding interactions between time and the dummy variables did not improve model fit (omnibus $\chi^2(2)$=.4, p=.82; AIC 717 vs. 714). Thus, the intercepts of the positive reinforcement and control conditions significantly differed, as did the intercepts of the negative reinforcement and control conditions. The natures of these differences are displayed in Figure 3. In both cases, participants in the incentive condition were more likely to begin active treatment by meeting the goal than participants in the control condition. The rate of change in behavior across time (i.e., slope) did not differ across reinforcement procedure conditions.

Does the perceived value of the incentive mediate the effect of reinforcement procedure on behavior (Hypothesis 1b)? The preceding analyses demonstrate that behavior did not differ between the positive and negative reinforcement conditions. Because the hypothesized mediation pathway (i.e., negative reinforcement increases the likelihood of meeting the walking goal relative to positive reinforcement by increasing the perceived value of the incentive) required a difference in behavior between negative and positive reinforcement, formal tests of mediation were not performed. However, it is important to determine (a) whether reinforcement procedure conditions differentially affected the perceived value of the incentive, and (b) whether the perceive value of the incentive predicted behavior. Because they did not receive an incentive, participants in the control condition were omitted from the following analyses.

Figure 4 shows the effects of positive and negative reinforcement on the perceived value of the incentive during active treatment, as well as the mean perceived value in each condition. Unsurprisingly, the autoregressive effects were significant; perceived value of the incentive positively predicted perceived value at the next time point. In general, reinforcement procedure did not affect the perceived value of the incentive; the average perceived value of the incentive did not differ between positive and negative reinforcement. However, the effect of reinforcement procedure on value at the end of the intervention was marginally significant (p=.10), but in the opposite direction of what was expected; participants in the positive reinforcement condition perceived the incentive to be more valuable than those in the negative reinforcement condition.

Figure 5 shows the effects of perceived value of the incentive on behavior during active treatment. The paths modeled in the figure include autoregressive effects for value and behavior, as well as the cross-lagged effects of value on behavior. This analysis was chiefly concerned with the effect of perceived value on behavior, so the cross-lagged effects of behavior on value were not modeled. However, these effects could be modeled in the future. It was not surprising that behavior predicted subsequent behavior and perceptions of value predicted subsequent perceptions of value. Perceived value positively predicted subsequent behavior, with the exception of perceived value at week 2 predicting behavior at week 3.

Does a variable schedule produce more repetitions of the incentivized behavior than a fixed schedule during active treatment (Hypothesis 2a)? The number of weeks the goal was met differed across schedule conditions (i.e., fixed, variable, and control), $F(2,150)=8.41$, $p<.001$. Specifically, participants in the control condition met the goal less frequently than participants in the incentive conditions, $t(150)=-3.97$, $p<.001$. The number of weeks that the goal was met did not differ between the fixed and variable conditions, $t(150)=.84$, $p=.41$. On average, participants in the fixed and variable conditions met the goal 3.03 (SD=1.86) and 2.73 (SD=2.20) weeks, respectively. Participants in the control condition met the goal less frequently (M=1.24, SD=1.90).

Examining behavioral changes over time. Recall that analyses for hypothesis 1a indicated that a quadratic time term was not necessary. Intercept and slope differences between schedule conditions were tested. Because there are three conditions, two dummy coded variables were created. The control condition was the referent. The dummy variables "fixed schedule" and "variable schedule" represent differences between the control condition and the fixed and variable schedule conditions, respectively.

The best fitting model contained a linear time term, fixed schedule, and variable schedule; the model did not contain interactions with time. All variables in the model significantly predicted if the goal was met; parameter estimates are displayed in Table 6. The intercepts of fixed schedule and variable schedule did not significantly differ from each other ($z=-.53$, $p=.47$). This model had significantly better fit than a model containing only time (omnibus $\chi^2(2)=16.7$, $p<.001$; AIC 726 vs. 713). Adding interactions between time and fixed schedule and variable schedule did not improve model fit (omnibus $\chi^2(2)=.4$, $p=.82$; AIC 717 vs. 713). Thus, the intercepts of the fixed schedule and control conditions significantly differed, as did the intercepts of the variable schedule and control conditions. In both cases, participants in the incentive conditions were more likely to begin active treatment by meeting the goal than participants in the control condition (see Figure 6). The rate of change in behavior across time (i.e., slope) did not differ across schedule conditions.

Does the perceived value of the incentive mediate the effect of schedule on behavior (Hypothesis 2b)? The preceding analyses demonstrate that behavior did not differ between the fixed and variable schedule conditions. Because the hypothesized mediation pathway (i.e., a variable schedule increases the likelihood of meeting the walking goal relative to a fixed schedule by preventing habituation to the perceived value of the incentive) requires a difference in behavior between fixed and variable schedules, formal tests of mediation were not performed. However, it is important to determine (a) whether schedule conditions differentially affect the perceived value of the incentive, and (b) whether the perceive value of the incentive predicts behavior. Recall that the latter question was examined in Figure 5. Because they did not receive an incentive, participants in the control condition were omitted from the following analyses.

Figure 7 shows the effects of fixed and variable schedule on the perceived value of the incentive during active treatment, as well as the mean perceived value in each condition at all time points. The autoregressive effects were significant; perceived value of the incentive strongly predicted perceived value at the next time point. In general, schedule did not affect the perceived value of the incentive; the average perceived value of the incentive did not differ between fixed and variable schedule conditions. However, the effect of schedule on value at the end of the intervention was significant (p=.04), but in the direct opposite of what was expected; participants in the fixed schedule condition perceived the incentive to be more valuable than those in variable schedule condition.

Is negative reinforcement on a variable schedule the most effective combination of reinforcement type and schedule (Hypothesis 3)? The number of weeks the goal was met differed across the five conditions, $F(4,148)=4.97$, $p=.001$. Specifically, participants in the incentive conditions met the goal more frequently than participants in the control condition ($p<.001$). The number of weeks that the goal was met did not differ between across the four incentive conditions (all $p\leq.56$). The mean number of weeks the goal was met in each condition is presented in Table 7. Because the four incentive conditions did not differ from each other, the interaction was not modeled, as per the analysis plan.

Examining behavioral changes over time. The design was not perfectly crossed; a hanging control group was utilized. Because all participants assigned to the control condition in the reinforcement procedure variable were, by definition, also assigned to the control condition in the schedule variable, multicollinearity issues would emerge if the interaction between reinforcement procedure and schedule were modeled. Accordingly, as specified in the analysis plan, the five conditions would initially be compared. If differences between incentive conditions were detected, then the control condition would be dropped and the interaction would be modeled.

Four dummy coded variables were created: positive-fixed, positive-variable, negative-fixed, and negative-variable. The control condition was the referent. Thus, the dummy variables represented differences between the control condition and the specified condition. Recall that prior analyses indicated that a quadratic time term was not necessary.

The best fitting model contained time and the four dummy variables; the model did not contain interactions with time. All variables in the model significantly predicted if the goal was met; parameter estimates are displayed in Table 8. The intercepts of the four incentive conditions did not differ from each other (all $p \geq .52$). This model had significantly better fit than a model containing a time only (omnibus $\chi^2(4)=17.1$, $p=.002$; AIC 726 vs. 717). Adding interactions between time and fixed schedule and variable schedule to the model did not improve model fit (omnibus $\chi^2(4)=.60$, $p=.96$; AIC 724 vs. 717). Thus, the intercept of each incentive condition significantly differed from control. In all cases, participants in the incentive conditions were more likely to begin active treatment by meeting the goal than participants in the control condition. The rate of change in behavior across time (i.e., slope) did not differ across conditions.

Does regulatory focus moderate the effect of reinforcement procedure on behavior (Hypothesis 4)? Participants had a mean promotion score of 19.31 (*SD*=2.26) and a mean prevention score of 18.49 (*SD*=5.67). To determine if regulatory focus moderated the effect of reinforcement procedure on behavior, prevention, promotion, and reinforcement procedure were entered into an analysis of covariance. Neither prevention, $F(2,128)=.79$, $p=.46$, nor promotion, $F(2,128)=.22$, $p=.80$, interacted with reinforcement procedure. However, there was a main effect of promotion, $F(1,128)=3.95$, $p=.049$. Follow-up analyses revealed that participants low in promotion (i.e., scoring one standard deviation below the mean) met the walking goal more frequently (*M*=2.44 weeks, *SD*=2.10) than participants high in promotion focus (i.e., one standard deviation above the mean; *M*=1.70 week, *SD*=2.01). Main effects of prevention and reinforcement procedure were not significant.

Is the walking goal evaluated more positively when there is a match between reinforcement procedure and participants' regulatory focus (Hypothesis 5)? To determine if the positive feeling of "rightness" assumed to emerge when regulatory focus matched the reinforcement procedure spilled over into attitudes towards the walking goal, promotion, prevention, and reinforcement procedure were entered into an analysis of covariance. Neither promotion, $F(2,102)=.22$, $p=.81$, nor prevention, $F(2,102)=.75$, $p=.48$, interacted with reinforcement procedure to predicted attitudes towards the walking goal at the end of active treatment. However, the main effect of promotion was marginal, $F(1,102)=2.62$, $p=.11$. Follow-up analyses revealed that participants high in promotion (i.e., scoring one standard deviation above the mean) evaluated the goal less positively (*M*=1.21 *SD*=.65) than participants low in promotion focus (i.e., one standard deviation below the mean; *M*=1.47, *SD*=.70). Main effects of prevention and reinforcement procedure were not significant.

Section III: The Effects of Incentives on Walking Behavior, Perceived Barriers, Self-Efficacy, and Satisfaction During Follow-Up

Does walking behavior during follow-up differ across conditions? An exploratory aim of this study was to compare follow-up behavior across the five conditions. Thus, the frequency of meeting the walking goal during follow-up was compared across the five conditions. The five conditions not differ in the number of weeks that the goal was met, $F(4,148)=1.16$, $p=.33$. On average, participants met the goal 0.31 weeks ($SD=.60$; possible range 0-2). The means of each condition are presented in Table 9.

Examining behavioral changes over time. The best fitting model contained only a linear time term ($B=-1.71$, $p<.001$). This model had significantly better fit than models containing reinforcement procedure intercepts (omnibus $\chi^2(2)=4.34$, $p=.11$; AIC 242 vs. 243), and schedule condition intercepts (omnibus $\chi^2(2)=2.88$, $p=.24$; AIC 244 vs. 243).

Do incentives affect perceived barriers at the end of active treatment (Hypothesis 6a)? After controlling for perceived barriers at baseline, perceived barriers at the end of active treatment marginally differed across the five conditions, $F(4, 105)=2.21$, $p=.07$. Specifically, there was a trend towards participants in the negative-variable condition perceiving more barriers ($M=33.71$) than participants in the positive-fixed condition ($M=31.50$). No other differences in perceived barriers emerged between conditions. Average perceived barriers in each condition are presented in Table 10.

Do perceived barriers predict behavior during follow-up (Hypothesis 6b)? Condition, perceived barriers at baseline, and perceived barriers at the end of active treatment were entered into an analysis of covariance to test for differences in the frequency of meeting the walking goal during follow-up. None of these variables predicted the number of weeks that the walking goal was met during follow-up (all $p\geq.37$).

Do incentives affect self-efficacy at the end of active treatment (Hypothesis 7a)? After controlling for self-efficacy at baseline, self-efficacy at the end of active treatment did not differ across the five conditions, *F*(4, 106)=.241, *p*=.92. Mean self-efficacy scores in each condition are presented in Table 10.

Does self-efficacy predict behavior during follow-up (Hypothesis 7b)? Condition, self-efficacy at baseline, and self-efficacy at the end of active treatment were entered into an analysis of covariance to test for differences in the frequency of meeting the walking goal during follow-up. Self-efficacy at the end of active treatment significantly predicted the number of weeks the walking goal was met during follow-up, *F*(1, 104)=8.81, *p*=.004; self-efficacy at baseline (*p*=.66) and condition (*p*=.60) did not. Follow-up analyses revealed that participants high self-efficacy (i.e., one standard deviation above the mean) met the walking goal more frequently (*M*=.77 weeks, *SD*=.75) than participants with low self-efficacy (i.e., scoring one standard deviation below the mean; *M*=.05 weeks, *SD*=.23).

Do incentives affect satisfaction with the physical benefits of walking at the end of active treatment (Hypothesis 8a)? Satisfaction with the physical benefits of walking differed across the five conditions at the end of active treatment, *F*(4, 107)=2.89, *p*=.026. Specifically, there was a marginal tendency for participants in the negative-variable condition (*M*=0.34) to be less satisfied than participants in the positive-fixed condition (*M*=1.68) and negative-fixed (*M*=1.51) conditions. Mean satisfaction scores in each condition are presented in Table 10.

Does satisfaction with the physical benefits of walking predict behavior during follow-up (Hypothesis 8b)? Condition and satisfaction with physical activity at the end of active treatment were entered into an analysis of covariance to test for differences in the frequency of meeting the walking goal during follow-up. Neither satisfaction, $F(1, 106)=1.92$, $p=.17$ nor condition, $F(4, 106)=1.37$, $p=.25$, predicted the frequency of meeting the walking goal during follow-up.

Section IV: What are attitudes towards the walking goal comprised of? Exploring associations between expectancy and value of the incentive, expectancy and value of physical benefits of walking, global attitudes towards the walking goal, and behavior.

It is unclear if expectancy and value of the incentive, physical benefits of walking (i.e., improved appearance and fitness), and/or their combination underlie global evaluations of the walking goal. Accordingly, correlations between these attitudes were computed. Direct attitudes refer to those attitudes that were measured directly (e.g., the walking goal is…), whereas indirect attitudes will refer to attitudes that are calculated by multiplying expectancy and value items. Direct attitudes towards the walking goal were calculated by aggregating the four bipolar scales (i.e., *good-bad*; *pleasant-unpleasant*) among which the goal of walking 10,000 steps per day was evaluated. Indirect attitudes towards the incentive were calculated by multiplying perceived expectancy by the aggregate of the perceived value items (e.g., *good-bad*; *desirable-undesirable*). Indirect attitudes towards the physical benefits of walking were calculated by summing the expectancy-value product terms for the improved fitness and improved appearance items. Indirect global attitudes towards the walking goal were calculated by summing indirect attitudes towards the incentive and the physical benefits of walking.

Expectancy scores can be scaled in a number of ways (e.g., -3 to +3 vs. 0 to 6), and scaling can have a profound effect on the expectancy-value product term (see Ajzen & Fishbein, 2008). A priori guidance for scaling is lacking (Ajzen & Fishbein, 2008), so it is important to understand the assumptions that accompany each type of scaling. For example, unipolar scaling anchored at 0 more closely reflects objective probability than bipolar scaling (Ajzen & Fishbein, 2008). The incentive used in this study lends itself to the estimation of objective probabilities very well; the circumstances under which an incentive would and would not be awarded were clear and concrete. Thus, unipolar scaling was used. Means for direct global attitudes towards the walking goal, indirect global attitudes, indirect attitudes towards the incentive, and indirect attitudes towards the physical benefits of walking are presented in Table 11,

Which indirect attitudes correlate with direct attitudes towards the walking goal? In an effort to determine which indirect attitudes shape direct attitudes towards the walking goal, correlations between direct attitudes towards the walking goal and (a) indirect attitudes towards the incentive, (b) indirect attitudes towards physical benefits of walking, and (c) indirect global attitudes were calculated. These correlations are presented in Tables 12, 13, and 14, respectively. Because the goal of this analysis is to get a sense of which indirect attitudes comprise global attitudes towards the walking goal, particular attention will be paid to concurrently measured attitudes. Table 13 shows that direct global attitudes towards the walking goal are generally positively correlated with concurrent indirect attitudes towards the physical benefits of walking (i.e., improved appearance and fitness). However, neither indirect attitudes towards the incentive nor indirect global attitudes towards the walking goal correlate with indirect global attitudes (see Tables 12 and 14).

Which attitudes are associated with behavior? To begin to understand which attitudes are meaningfully related to behavior (i.e., meeting the walking goal), the four types of attitude were correlated with behavior during active treatment. Indirect attitudes towards the incentive tended to be positively correlated with concurrent behavior (see Table 12). However, indirect global attitudes towards the walking goal, global attitudes towards the walking goal and indirect attitudes towards the physical benefits of walking were not correlated with behavior (Tables 13 and 14).

Discussion

Offering financial incentives that are contingent upon the performance of a health behavior is a behavior change strategy that is commonly used in applied settings (Florida Agency for Health Care Administration, n.d.; Idaho Department of Health and Welfare, n.d.; U.S. Department of Health and Human Services, 2011; Volpp et al., 2008). However, despite the intuitive appeal of this strategy, randomized controlled trials testing its effectiveness in promoting healthy behaviors, such as physical activity, and outcomes, such as weight loss, have generated mixed results (e.g., Burns et al., 2012; Kane et al., 2004; Mitchell et al., 2013). These mixed results may be due, in part, to variability in the operational definition of the incentive. For example, studies have used cash rewards (e.g., Jeffery et al., 1998; Luley et al., 2010), deposit contracts (e.g., John et al., 2011), payroll deductions (e.g., Forster et al., 1985), and lotteries (Volpp et a., 2008). The present study tested a theoretical framework that specifies the types of incentives that are expected to be most effective in changing behavior. Specifically, incentives based on negative reinforcement (e.g., deposit contracts) were expected to be more effective in promoting walking behavior than incentives based on positive reinforcement (e.g., cash rewards) because people are loss averse. Moreover, incentives offered on a variable schedule were expected to be more effective than incentives offered on a fixed schedule because they buffer against habituation to the incentive.

This framework was tested in a 5-week randomized controlled trial. Participants were randomly assigned to one of the four incentive categories that emerge when reinforcement procedure and schedule are crossed, or a no-incentive hanging control group. The incentive was contingent upon walking at least 10,000 steps per day on most days of the week. The focal outcome was whether the walking goal was met each week because it is the behavior to which the incentive was most closely tied. Behavior was measured for 2 weeks after the incentive was discontinued and a host of psychological variables were measured throughout the study, including attitudes towards the walking goal, the perceived value of the incentive and physical benefits of walking, self-efficacy, perceived barriers, and satisfaction.

Effects of Incentives on Walking Behavior During the Intervention

Participants in the incentive conditions were more likely to meet the walking goal during active treatment than participants in the control condition. These findings are consistent with prior research that has compared the behavior of participants who receive an incentive to those who do not. For instance, older adults who were assigned to receive a cash reward for walking at least 15 minutes per day for a week walked more than those in the no-incentive control condition (Finkelstein et al., 2008). College students who received a cash reward for checking into the campus health club were also more likely to meet a prescribed health club attendance goal than those in the no-incentive control group (Pope & Harvey-Berino, 2013). Moreover, a recent meta-analysis of the effects of incentives on physical activity found that incentives increased physical activity by about 11% relative to comparison conditions that did not include an incentive (Mitchell et al., 2013). However, not all work in this area has observed differences in behavior between participants who did and did not receive an incentive. For example, offering lottery entries for attending a jogging class did not increase class attendance (Dubbert et al., 1984).

The number of participants in the incentive conditions who met the walking goal during the early weeks of the intervention was around 60%, though this number decreased as the weeks went on. In contrast, the percentage of participants in the control condition meeting the walking goal remained fairly constant, but was much lower (approximately 25%). These values appear reasonable in light of past research. Without intervention, most adults do not walk 10,000 steps per day (Bohannon, 2007). Though college students tend to walk more than other age groups, on average, college students still do not walk 10,000 steps per day (Mestek, Plaisance & Grandjean, 2008). Moreover, the walking goal appears to have been appropriate for this population; ceiling and floor effects were not observed, indicating that the goal was neither too easy nor too challenging.

This study advances the literature by seeking to determine *which types* of incentives are most effective in changing behavior; prior literature has focused almost exclusively on determining *if* incentives are effective in changing walking behavior. Systematic and direct comparisons of different types of incentives allow the most effective type of incentive to be identified. This type of information contributes to our basic understanding of incentives and informs the design of incentives in applied settings. However, direct comparisons of incentives are rare; only one other study has directly compared the effects of different types of incentives on physical activity. Esptein, Wing, Thompson, and Griffith (1980) found that exercise session attendance did not differ across lottery and deposit contract conditions. Consistent with this finding, rates of walking did not differ across the four incentive conditions in this study.

The predicted difference in behavior between incentives based on positive and negative reinforcement was not observed, nor was the expected difference between fixed and variable schedules. This is inconsistent with work in the smoking cessation literature which demonstrated that incentives framed as losses were more effective at increasing quit rates than incentives framed as gains (Romanowich & Lamb, 2013). The inconsistencies between the present findings and those of Romanowich and Lamb (2013) may be due to different behaviors being incentivized or the marked difference in the size of the incentive ($375 vs. $50). Although the negative reinforcement manipulation did indeed elicit the intended feeling of standing to lose money, the relatively modest incentive used in this study may not have elicited as much loss aversion as the large incentive used by Romanowich and Lamb (2013).

This study is further distinguished from other studies in this area by its use of a theoretical framework to determine which types of incentives to compare. The lack of theoretical guidance on this topic is evidenced by the large proportion of studies that fail to justify the selection of a specific type of incentive (Kane et al., 2004). The theoretical framework used here (Burns et al., 2012) directly informed the design of incentives by specifying the properties of incentives that likely affect behavior (i.e., reinforcement procedure and schedule).

Testing the Mediating Effect of the Perceived Value of the Incentive

This study further contributes to the literature by (a) explicating mediational pathways through which incentives are expected to affect walking behavior, and (b) collecting data that permit these hypotheses to be tested. Complete mediational models have not been specified in this area of research, and the few mediational explanations that have been proffered tend to be vague. For instance, increased motivation is the most commonly proffered explanation for the effect of incentives on behavior (Kane et al., 2004).

Given that specific mediating pathways through which incentives affect health behavior have not been hypothesized, it is not surprising that tests of mediation have never been conducted in this context. However, numerous benefits are derived from testing the mechanism(s) through which an intervention produces an outcome. First, testing for mediation verifies that the intervention is indeed changing the targeted psychological mechanisms (MacKinnon, 2011). Second, intervention components that are critical and those that are unnecessary or inhibitory can be identified, thus improving the efficiency of future iterations of the intervention (MacKinnon & Luecken, 2008; Rothman, 2004). Third, by knowing exactly why an intervention was effective researchers may thoughtfully modify the strategy so that it can be applied to other populations (Michie & Abraham, 2004).

Because negative reinforcement was not more effective than positive reinforcement, and the variable schedule was not more effective than the fixed schedule, it was not logical to test hypotheses pertaining to loss aversion and habituation (i.e., there was not an effect to mediate). However, in an effort to understand why these hypothesized differences did not emerge, the putative mediational pathways were broken down; the effects of (a) reinforcement procedure and schedule on perceived value of the incentive, and (b) perceived value of the incentive on behavior were explored separately. The former effect determines if the manipulations did indeed produce the expected changes in the perceived value of the incentive. If the manipulations did not differentially affect perceived value, then they may need to be strengthened or modified. In contrast, if the effects of the perceived value of the incentive on behavior were not significant, then perceived value may not be a useful construct to target; alternate candidate mediators may need to be identified and targeted.

In general, the positive and negative reinforcement conditions did not differentially affect the perceived value of the incentive, nor did the fixed and variable schedule conditions. However, perceived value of the incentive generally predicted the likelihood of meeting the walking goal; greater perceived value was associated with a greater likelihood of meeting the goal. Taken together, these results suggest that perceived value of the incentive is a suitable candidate for mediation, but that it was not differentially affected by the reinforcement procedure and schedule manipulations. More data is needed to determine if (a) individuals do not differentiate between various types of incentives when perceiving value, or (b) the manipulations used in this study were not strong enough to elicit differences in the perceived value of the incentive. The latter issue can be addressed by generating and testing strategies for exaggerating the perceived value of the incentive across conditions, such as increasing the objective value of the incentive or utilizing a true deposit contract. The manipulation check verified that the framing manipulation used in the negative reinforcement condition was indeed effective, however, loss aversion is likely magnified when one stands to lose one's own money.

The associations between perceived value of the incentive and behavior suggest that it is a good mediational candidate. However, this is the first study in this area to measure and test a putative mediator. Accordingly, this literature will benefit from the generation, testing, and refinement of additional theoretically grounded mediational models. For example, loss aversion may not be best captured by the perceived value of the incentive. Rather, it may manifest as worry or concern about the incentive or as a desire to retain the incentive. Plausible mediational hypotheses can also be derived from self-determination theory (Deci & Ryan, 1985). Such hypotheses will likely focus on feelings associated with extrinsic motivation (e.g., desire to obtain the incentive, feeling like one ought to obtain the incentive). Similarly, there is much room for the development of measures of mediators in this area. During this initial foray into this area, a widely used measure of perceived value was used (Ajzen, 2006). However, measures that are specific to incentives will likely become increasingly necessary.

Regulatory Focus as a Moderator of Reinforcement Procedure

Because promotion-focused individuals are sensitive to gains, they were expected to be more responsive to an incentive that was based on positive reinforcement. In contrast, prevention-focused individuals were expected to be more responsive to incentives based on negative reinforcement because they are sensitive to losses. However, regulatory focus did not moderate the effect of reinforcement procedure on perceptions of physical activity or behavior. Because a match between reinforcement procedure and regulatory focus did not affect evaluations of physical activity, presumed positive evaluations of the incentive resulting from fit did not “spill over” into evaluations of physical activity. This is inconsistent with a lab study that demonstrated that the value derived from regulatory fit spills over into judgments of objects (Higgins et al., 2003). Perhaps, in the present study, regulatory fit did not produce sufficient feelings of “rightness” (Higgins, 2000) or feelings of rightness originating in the incentive did not affect evaluations of physical activity.

Though the behavioral benefits of matching regulatory focus to the framing of an incentive have been demonstrated (Shah et al., 1998), the study examined performance on an anagram task during a laboratory session. The meaningful ways in which performance on an anagram task and walking 10,000 steps per day on most days of the week differ could explain the discrepancies between these findings. For instance, meeting the walking goal required repeated action and involved lifestyle changes that may have been uncomfortable or inconvenient. It is possible that the costs associated with the walking goal blunted feelings of "rightness" derived from fit with regulatory focus.

A slight positive relationship emerged between promotion and the number of weeks that the walking goal was met. This is consistent with a sizable body of literature, which demonstrates that individuals high in promotion focus are eager to obtain pleasant experiences, such as an incentive (Higgins, 1997, Shah et al., 1998).

Although the hypothesized moderating effects of regulatory focus on reinforcement procedure were not observed, they should continue to be explored in the future because the motivational orientations of promotion- and prevention-focused individuals (i.e., gains and losses, respectively) map squarely onto the essential difference between positive and negative reinforcement. The benefits of matching the incentive to regulatory focus may emerge when a true deposit contract is used because true deposit contracts will likely elicit stronger feelings of loss than were observed in this study. Similarly, increasing the monetary value of the incentive may also increase the intensity of feelings of gain or loss and should also be explored in the future. If regulatory focus does indeed moderate the effect of reinforcement procedure on behavior, then tailored interventions can be designed. Such interventions would seek to optimize behavior change by purposefully matching the type of incentive that a participant receives to her regulatory focus.

Behavior During Follow-Up

In the context of incentivized health behavior, it is particularly important to collect follow-up data because (a) the accrual of health benefits depends upon sustained physical activity (Blair et al., 2004), (b) the persistence of observed psychological and behavioral effects can be accurately assessed, (c) recommendations about the length of time that incentives should be offered are informed (i.e. on an indefinite versus finite basis), and (d) concerns pertaining to the incentive "crowding out" intrinsic motivation and causing a decline in the frequency of the behavior can be addressed.

Persistence of behavioral effects observed during the intervention. As is the case with many physical activity interventions (e.g., Müller-Riemenschneider et al., 2008; Ory et al., 2010), physical activity declined markedly during follow-up. Moreover, behavior during follow-up did not differ between the control condition and the incentive conditions.

Individuals who increase their physical activity during an incentive-based intervention may be motivated by outcomes tied to an extrinsic source of motivation (i.e. the incentive) and/or outcomes that stem from intrinsic sources of motivation (i.e. desire to be healthy). Self-determination theory (Deci & Ryan, 1985) posits that if the extrinsic source of motivation to engage in physical activity is removed, then it is necessary for intrinsic sources of motivation be present for the behavior to continue. From this perspective, the question thus emerges: through what means can an incentive-based intervention foster internal sources of motivation?

Satisfaction is a source of intrinsic motivation that has been shown to predict the maintenance of health behaviors (e.g., Finch et al., 2005; Williams et al., 2008). In thinking about the basic conditions that must be present for satisfaction with the outcomes of a behavior to develop, it becomes apparent that performance of the behavior is a necessary condition. By increasing rates of the target behavior, incentives thus create an opportunity for satisfaction to develop. For example, in the present study, incentives increased the amount that participants walked, which created the opportunity for participants to become satisfied with the outcomes of increased walking (e.g., improved appearance).

This notion can also be applied to the development of other beneficial psychological experiences, such as increased self-efficacy and reduced perceived barriers. For instance, by increasing their walking, individuals have the opportunity to manage and overcome barriers. This logic rests on the two key hypotheses that were tested in this study: (a) by the end of the intervention, incentives affect satisfaction, self-efficacy and perceived barriers, and (b) these variables predict behavior after the incentive is discontinued.

Do incentives affect satisfaction, self-efficacy, and perceived barriers at the end of the intervention*?* Although incentives were successful in changing behavior during the intervention, participants in the incentive and control conditions did not differ in self-efficacy, perceived barriers, and satisfaction at the end of active treatment. This is inconsistent with a small literature, which demonstrates that self-efficacy is increased by successfully performing a health behavior (Ashford, Edmunds & French, 2010; Lindsley et al., 1995; Sherwood & Jeffery, 2002). In the present study, participants were moderately active prior to enrollment; most reported walking for an hour on most days. Moreover, at baseline, participants perceived a moderate number of barriers to physical activity and reported feeling quite efficacious. Accordingly, the amount of self-efficacy and perceived barrier reduction that could be fostered by participating in this study was likely limited. The predicted patterns of self-efficacy and perceived barriers may emerge in a more sedentary sample, especially if initial levels of self-efficacy are low and perceived barriers are great.

Alternatively, these findings suggest that performing the behavior is not a sufficient condition for the development of self-efficacy and satisfaction and the reduction of perceived barriers. This is consistent with theory and research demonstrating that these constructs are influenced by a variety of factors (e.g., Ashford et al., 2010; Rothman, 2000). For instance, satisfaction is influenced by the magnitude of the perceived difference between one's current state and an undesired alternative state (Jeffery, Linde, Finch, Rothman & King, 2006; Rothman, 2000). Thus, future interventions may wish to capitalize on the opportunities to increase self-efficacy and satisfaction afforded by incentive-based interventions by incorporating additional intervention components that explicitly target these constructs. For example, an intervention similar to the one implemented by Jeffery and colleagues (2006), which increased satisfaction by highlighting positive changes that have occurred as a result of increased walking, may be incorporated into incentive-based interventions that seek to increase walking.

These null findings also suggest that a more nuanced approach to this question may be useful. The presented analyses used the incentive condition as a proxy for the experience of increasing walking behavior, but it may be useful to model this experience directly. However, this type of analysis would raise an important question: how should the experience of increasing one's walking be operationalized? At baseline, all participants in this study walked to some extent, and the amount of walking that can be expected to meaningfully affect perceived barriers, self-efficacy, and satisfaction is not easily specified. For example, how many times does the weekly walking have to be met before self-efficacy, satisfaction and perceived barriers can be affected? Perhaps, operationalizing the experience of increasing one's walking in terms of the number of weeks that the goal was met is not a sufficiently sensitive operationalization. For example, it is possible that individuals who did not meet the walking goal over the course of active treatment still increased their walking (e.g., walking 4,000 steps/day at baseline and 8,000 steps/day during active treatment) and, as a result, experienced increased self-efficacy, greater satisfaction, and fewer barriers. If this is plausible, then the difference between the number of steps walked at baseline and at the end of active treatment may be a more beneficial way of conceptualizing the experience of increasing walking. These possibilities can be explored in subsequent analyses.

Unexpected differences emerged between the negative-variable and positive-fixed conditions, such that the negative-variable condition reported more barriers and less satisfaction; neither condition differed from control. It is likely that these effects are related. For example, it possible participants who perceived a greater number of barriers had to exert more effort to meet the walking goal. Recall that satisfaction items queried how satisfied participants were given the amount of effort they had put into meeting the walking goal. Thus, satisfaction may have been undermined because a great deal of effort was required to overcome a large number of perceived barriers. However, because barriers and satisfaction were measured concurrently, it is unclear if they are causally related (e.g., perceiving more barriers produces less satisfaction).

Many possible explanations for these unexpected data are undermined by other findings from this study. For example, it is unlikely that participants inferred satisfaction and perceived barriers from past behavior because behavior did not differ across these conditions during the intervention. Similarly, the notion that, perhaps, participants in the negative-variable condition put forth the most effort because they were most motivated to obtain the incentive, which, in turn, rendered them more sensitive to barriers is undermined by data showing that the value of the incentive did not differ across conditions.

Do satisfaction, self-efficacy, and perceived barriers at the end of the intervention predict behavior during follow-up? Self-efficacy, at the end of the intervention, but not perceived barriers and satisfaction, predicted behavior during follow-up. Research and theory suggest that self-efficacy is most important during the initiation of a behavior, whereas satisfaction is most important during the maintenance of the behavior (Finch et al., 2005; Rothman, 2000; William et al., 2008). Thus, this pattern of results suggests that at the end of the 5-week intervention participants may have been in the initiation phase of behavior change. In longer interventions, the transition into behavioral maintenance may be seen and the predictive ability of satisfaction may emerge.

However, transitioning into maintenance may not be the ultimate goal of incentive-based programs. The initiation and maintenance of complex behaviors like physical activity are usually reflective and effortful; behavior is not automatic (Rothman, Sheeran & Wood, 2009). In contrast, habits are behaviors that occur automatically in response to environmental cues, such as time of day, location or specific persons (Rothman et al., 2008). Thus, perhaps the goal of incentive-based programs should be to have individuals repeat the target behavior within a particular environment until the response is habitual. Targeting the development of habits may be particularly useful because habits are not dependent upon effortful self-control, which can be difficult to exert when faced with stress or repeated temptation (Betsch, Haberstroh, Molter & Glöckner, 2004; Muraven, Tice & Baumeister, 1998). Future research may wish to trace reflective (e.g., self-efficacy, perceived barriers and benefits) and automatic processes (e.g., automatic responses to cues, extent to which behavior is habitual) throughout a lengthy intervention to determine if transitions between initiation, maintenance, and habit are indeed possible and when these transitions occur.

Recommendations about the length of the intervention. Although the incentives increased walking during this 5-week intervention, walking decreased markedly during follow-up. This pattern mirrored a 3-month incentive-based study that measured physical activity during follow-up (Dubbert et al., 1984). It is possible that lengthier interventions may be more successful in sustaining behavior change during follow-up because participants are able to accrue more experience overcoming barriers to exercise while exercising to obtain the incentive. Moreover, many of the desirable benefits of exercise (e.g., improved muscle tone, weight loss) that contribute to satisfaction are not experienced immediately. Thus, only lengthy interventions afford participants the opportunity to experience these outcomes and become satisfied with them. The likelihood of physical activity becoming habitual is also greater in longer interventions because they allow for a greater number of repetitions of the behavior.

Unfortunately, the literature does not offer insight into the effects of intervention length on follow-up behavior. Most interventions in this area are quite short; only a few exceed 6 months (e.g., Wing, 1996; Jeffery et al., 1998). Moreover, follow-up data is often not collected. Future research should thus seek to determine the optimal length of incentive-based interventions with a focus on sustaining behavior change after the incentive is discontinued. In addressing this issue, it will be important to be mindful of the possibility of continuing to offer the incentive indefinitely because many employer-sponsored incentive programs (e.g., health club reimbursements) are set up in this manner.

Addressing concerns that the incentive "crowds out" intrinsic motivation.

Self-determination theory distinguishes between intrinsic motivation, which originates internally and is driven by interest in or enjoyment of a task, and extrinsic motivation, which comes from external sources and is driven by the attainment of outcomes, such as praise or financial incentives (Deci & Ryan, 1985). The theory also posits that extrinsic motivation influences intrinsic motivation, such that extrinsic sources of motivation are perceived as coercive and consequently undermine intrinsic motivation by threatening one's sense of autonomy. The overjustification effect is observed in situations in which a previously enjoyed task becomes less interesting because an extrinsic source of motivation was offered and subsequently removed (Deci, 1971, 1972, 1975; Deci et al.,1999; Wiersma, 1992).

The decrease in behavior observed during follow-up suggests that the extrinsic motivation of the incentive did not translate into intrinsic motivation and supports the overjustification effect. However, follow-up data must be interpreted with caution because decreased rates of walking behavior were also seen in the control condition. This suggests that factors beyond the discontinuation of the incentive contribute to the decline in behavior seen in the incentive conditions. For instance, the marked decline in behavior may be partially attributable to the use of an intent-to-treat approach. As seen in Figure 1, attrition increased dramatically during follow-up. Because an intent-to-treat approach was used, the 20% of participants who dropped out during follow-up were assumed to not be meeting the walking goal. The increased attrition during follow-up may have been caused by the discontinuation of the incentive. Alternatively, increased attrition may be attributable to the point in the semester at which these data were collected. For all participants, follow-up occurred during the last few weeks of the semester, which is a notoriously busy and stressful time for students.

Addressing the Multiple Outcomes of Incentive-Based Interventions: Do Evaluations of Incentive and Physical Benefits of Walking Both Contribute to Global Evaluations of Walking, and How Do These Evaluations Relate to Behavior?

Expectancy-value models have been used to explain a host of motivational and behavioral processes (e.g. Feather, 2011; Fishbein, 1963; Shah & Higgins, 1997). Broadly, these models specify a multiplicative combination of the subjective expectation of the outcomes of a behavior and the subjective value of the outcome as key motivational determinants. This multiplicative combination is referred to as indirect attitude, and is contrasted with direct attitudes, which query evaluations directly and do not require expectancy-value computations.

Attitudes are presumed to capture the expectancy and value of all relevant outcomes. In most situations, the number of relevant outcomes is limited. However, in the context of incentive-based health interventions, there are several outcomes that are potentially valuable, such as improved fitness, improved appearance, and financial gain. The implicit assumption of incentive-based strategies is that incentives change the perceived *benefits* associated with a behavior, but it is not well specified if this effect is driven by one's attitude towards distal fitness- and appearance-related benefits, one's attitude towards the incentive, or a combination of both. Thus, in measuring expectancy and value, it is important to consider the type(s) of benefit that is being subjected to expectancy and value evaluations. The literature does not offer much guidance on this topic. In fact, some experts recommend examining the correlations between a pool of potentially important outcomes and behavior and global attitudes as a means of identifying important outcomes (Ajzen, 2006). Unfortunately, this strategy is data-driven and does not permit the a priori specification of important outcomes. This study began to address some of these issues by exploring associations amongst these various types of attitudes.

Directly measured global attitudes towards the goal of walking 10,000 steps per day on most days of the week tended to correlate with indirect attitudes towards the physical benefits of walking (i.e., sum of expectancy-value product terms for improved appearance and fitness), but not with indirect global attitudes (i.e., sum of expectancy-value product terms for improved appearance, fitness, and the incentive) or indirect attitudes towards the incentive. This pattern suggests that global attitudes towards the walking goal are not the sum of attitudes towards the incentive and the physical benefits of walking, but are shaped by attitudes towards the physical benefits of walking. Moreover, these results suggest that attitudes towards the incentive are not incorporated into global attitudes towards the goal.

To begin to understand the relative importance of these different types of attitudes, their correlations with behavior were explored. Only attitudes towards the incentive consistently correlated with behavior. Though one must be mindful of the inferences that can be made from correlations, these results suggest that attitude towards the incentive may be a better candidate mediator for the effect of incentives on behavior than global attitude towards the walking goal or attitude towards the physical benefits of walking. Mediational tests were not conducted in this paper because the expected differences between reinforcement procedure and schedule did not emerge (i.e., there was not an effect to mediate). Moreover, it did not seem useful to determine if the differences in behavior between the control and incentive conditions were mediated by attitude towards the incentive because (a) the control condition did not receive an incentive, and thus (b) comparing the expectancy and value of the incentive across these conditions was more akin to a manipulation check than an exploration of mediating psychological processes.

The limited theory and research on this issue tend to suggest that goals are additive

(Wigfield & Eccles, 2000; Wiersma, 1992) and that individuals tend to prefer behaviors that meet multiple goals (Fishbach & Dhar, 2007). However, an additive effect of attitudes towards the incentive and the physical benefits of walking was not observed. Because models of multiple goal pursuit are not well developed, it is unclear why attitudes towards the incentives and the physical benefits of walking were not additive, and why attitudes towards the incentive were most closely tied to behavior. However, given that limited past work has found goals to be additive, some specific features of the present study must have contributed to the unique pattern of results that was observed. For instance, perhaps the novelty or salience of the incentive eclipsed the physical benefits of walking. These features are difficult to identify in the absence of models that specify how multiple goals are simultaneously managed.

Implications for Theory Development

Given that the framework tested here is the first theoretical framework to specify the effects of specific types of incentives on health behavior change, there are ample opportunities for theoretical development. With the exception of this work, the processes that mediate the effect of different types of incentives on a health-relevant behavior have not been tested, and the few mediational pathways that have been posited specify vague mediational constructs, such as motivation. Thus, a priority in theoretical development should be the specification and testing of mediational pathways. Once mediators are identified, we can modify incentives so that they more strongly affect the mediator (Michie et al., 2008). For example, if the perceived value of the incentive emerges as an important mediator, then we design incentives that increase perceived value (e.g., increase the objective value of the incentive). Theoretical development should also explore the possibility that mediators will change over time. For example, reflective processes may guide behavior change early on and habits may mediate more distal behavioral effects.

Theory in this area must also address how multiple goals present in incentive-based interventions (e.g., financial gain, health benefits) are managed and affect behavior. Doing so will create a more realistic, complete picture of the factors that motivate behavior change and provide specific mediators to target. Early steps of theory development in this area will involve identifying the types of goals that are held, specifying how these goals are simultaneously managed, and determining which combination of goals best predicts behavior. Theory development in this area may have implications beyond incentive-based interventions because multiple goals are not specific to incentive-based interventions and theories of multiple goal pursuit are rare in the psychological literature (Fishbach & Dhar, 2007).

Implications for Interventions

The results of this study suggest that incentives are an effective means of changing behavior, and that the incentive dimensions specified in the theoretical framework do not produce differential effects. However, before recommendations are made about how incentive should be implemented in applied interventions, it is important to test the generalizability of these results in different populations. At baseline, the college student population used in this study tended to walk for an hour per day, felt quite efficacious, and perceived a moderate amount of barriers to physical activity. Moreover, walking is very likely incorporated into the daily lives of these participants; some degree of walking is required to reach most of the classrooms on campus. Incentives may not be as effective for groups that feel less efficacious or perceive more barriers to exercise; these individuals may require intervention components, such as support and guidance, which are not built into basic incentive-based programs. Similarly, the effects of a true deposit contract on physical activity must be examined and systematically compared to the other types of incentives before recommendations for interventions can be made because (a) a true deposit contract may elicit a stronger sense of loss aversion than was created in this study, which may in turn translate into increased physical activity, and (b) a deposit contract may have unintended, undesirable effects, such as low enrollment or high rates of drop-out.

This study underscores the benefits of systematically comparing theoretically meaningful classes of incentives to spur recommendations for interventions. Making meaningful distinctions between types of incentives and carefully comparing them will allow definitive recommendations about the most effective type of incentive to emerge more quickly. Investigators are encouraged to use the theoretical model described in this paper, or to develop new ones that are better suited to the unique challenges associated with specific health behaviors (e.g., smoking, screening) by thinking about the psychological processes through which the incentive may be operating.

If future research converges on the conclusion that the four types of incentives do not differentially affect behavior, then the selection of an incentive in applied settings may be driven by the goals of increasing enrollment and minimizing attrition. Thus, research may examine the types of incentives that increase enrollment (e.g., are particular types of incentives especially appealing or unattractive to individuals who are considering enrolling?) or minimize attrition (e.g., do some incentives encourage sustained participation in an on-going intervention?).

Limitations and Future Directions

This study has several limitations that must be considered when interpreting results and addressed in future research. For instance, in order to receive the incentive, participants were required to (a) walk 10,000 steps per day on most days of the week, and (b) record their walking of 10,000 steps per day on most days of the week. Thus, participants were paid to engage in two behaviors. This issue is common in incentive-based interventions, and strategies for circumventing this issue have their own drawbacks. For instance, incentivizing attendance at supervised walking sessions (Jeffery et al., 1998) requires many resources and may be experienced as restrictive or burdensome to participants. Similarly, if incentives are contingent upon checking in at a health club, participants may leave the facility without exercising or after exercising minimally. This underscores the difficulty of operationalizing the behavioral outcome. In the present study, the outcome could have been defined as it was, or as the average number of steps walked per day, or average distance walked per day. Ultimately, whether the goal was met was selected because it was the behavior most closely tied to the incentive and because, as discussed below, the nature of the smartphone app introduced a lot of noise in the number of steps counted.

Although the Runtastic Step Counter PRO smartphone app used in this study had many attractive qualities (e.g., convenience), it shortened the battery life of participants' phones. Thus, when the incentive was discontinued, it is unclear if participants did indeed walk less or walked the same amount but opted not record their walking. This issue can be addressed in the future by using different measures of behavior and incentivizing different behaviors. Because it is unlikely that a perfect measurement strategy or behavioral criterion can be created or identified, it will be important to examine triangulating evidence derived from several studies. Moreover, smartphone pedometer apps are much less accurate than traditional pedometers (Boyce, Padmasekara & Blum, 2012). Although pedometer apps that use GPS, like Runtastic Step Counter PRO, improve accuracy, they still have a tendency to over count steps (Boyce, Padmasekara & Blum, 2012).

One must also be mindful of the sample used in this study when interpreting results. The University of Minnesota Twin Cities has a sprawling campus that spans several miles. Moreover, classes within a major are spread across campus, requiring students to walk at least a moderate amount. Although participants who reported walking a great deal were not eligible to participate, a different pattern of results may emerge in a sample comprised of individuals who work in sedentary jobs. Moreover, the limited income typical of undergraduate students precluded the use of a true deposit contract. Although the manipulation check indicated that the manipulation was effective, a true deposit contract may produce stronger feelings of loss, which, in turn, may elicit more pronounced behavioral differences between positive and negative reinforcement procedures.

Conclusion

The purpose of this study was to test a theoretical framework that specifies which types of incentives are most effective in changing health behavior and the mechanisms underlying these effects. Incentives increased walking rates relative to the control condition, but incentive conditions did not differ from each other. Behavior was not sustained after the incentive was discontinued. The perceived value of the incentive appears to be a good mediational candidate, though this fledgling area of research will benefit from the generation, testing, and refinement of other theoretically grounded mediation models. This study underscores the utility of systematically comparing types of incentives and testing for mediation. Future work in this area should focus definitively establishing if there are conditions under which differences among the specified types of incentives emerge, and on identifying the mechanism through which incentives affect health-relevant behavior.

Table 1

Participant characteristics at baseline, end of active treatment, and end of follow-up

Time	*N*	Age (*SD*)	Ethnicity (%)	Women (%)	Median, Mode Hours Spent Walking/Day at Baseline
Baseline	153	19.0 (1.94)	66.0 Caucasian 10.5 Asian 3.3 African-American 0.7 Hispanic 2.0 Middle Eastern 3.3 Multiracial 3.9 Other 10.5 Declined	61.4 (10.5 Declined)	1.0, 1.0
End of Active Treatment	138	19.0 (2.02)	65.4 Caucasian 11.8 Asian 2.9 African-American 0.7 Hispanic 1.5 Middle Eastern 2.2 Multiracial 4.4 Other 11.0 Declined	61.8 (11 Declined)	1.0, 1.0
End of Follow-Up	107	19.1 (2.24)	66.3 Caucasian 11.5 Asian 1.0 Hispanic 3.3 African-American 2.9 Multiracial 3.8 Other 11.5 Declined	58.7 (11.5 Declined)	1.0, 1.0

Table 2

Baseline demographics, perceived barriers, and self-efficacy by condition

Condition	*N*	Age (*SD*)	Ethnicity (%)	Women (%)	Median, Mode Hours Spent Walking/ Day at Baseline	Mean Perceived Barriers at Baseline (*SD*)	Mean Self-Efficacy at Baseline (*SD*)
Control	29	18.9 (.86)	65.5 Caucasian 10.3 Asian 6.9 African-American 6.9 Multiracial 3.4 Other	55.2 (7 Declined)	1.0, 1.0	31.7 (4.0)	6.75 (1.6)
Positive Variable	26	18.8 (.83)	69.2 Caucasian 3.8 Asian 3.8 African-American 3.8 Other	73.1 (19 Declined)	1.0, 1.0	31.8 (3.3)	7.91 (1.9)
Negative Fixed	41	19.3 (2.04)	56.1 Caucasian 14.6 Asian 2.4 Middle Eastern 2.4 African-American 2.4 Multiracial 4.8 Other	53.7 (14 Declined)	1.0, 1.0	31.8 (3.1)	6.78 (1.8)
Positive Fixed	28	19.1 (3.03)	78.6 Caucasian 3.5 Asian 3.5 African-American 3.5 Multiracial 7.0 Other	57.1 (3 Declined)	1.0, 1.0	32.2 (2.9)	7.20 (2.2)
Negative Variable	29	18.9 (2.05)	65.5 Caucasian 17.2 Asian 3.4 Hispanic 6.8 Middle Eastern 3.4 Multiracial	72.4 (3 Declined)	1.0, 1.0	31.7 (2.7)	7.18 (2.6)

Table 3

Mean manipulation check scores (SD) by reinforcement procedure condition at randomization and at the end of active treatment

	Control	Positive Reinforcement	Negative Reinforcement
At Randomization	2.61 (1.7) *n*=23	3.64 (2.0) *n*=42	5.54 (2.2) *n*=48
End of Active Treatment	2.95 (1.8) *n*=20	4.02 (2.0) *n*=43	5.45 (2.1) *n*=49

Table 4

Average number of steps (SD) taken per day amongst participants who did and did not meet the walking goal during active treatment

	Week 1	Week 2	Week 3	Week 4	Week 5
Did Not Meet Goal	7062.4 (2599.5)	6949.7 (3033.8)	6669.9 (2888.0)	6410.5 (3059.1)	6111.1 (29.37.9)
Met Goal	12431.5 (2766.8)	12739.7 (2476.3)	12541.7 (2566.2)	12374.2 (2423.9)	12920.9 (6260.1)

Table 5

Parameter estimates for model that best fits differences among reinforcement procedure conditions over time

	B	Standard Error	*p*
Intercept	-2.41	.86	.005
Week	-.18	.08	.025
Positive Reinforcement	3.67	1.00	<.001
Negative Reinforcement	3.77	.96	<.001

Table 6

Parameter estimates for model that best fits differences among schedule conditions over time

	B	Standard Error	*p*
Intercept	-2.40	.86	.005
Week	-.18	.08	.025
Fixed schedule	3.94	.96	<.001
Variable schedule	3.41	1.00	<.001

Table 7

Mean number of weeks that goal was met and percentage of participants meeting goal each week during active treatment by condition

	Control	Positive Fixed	Positive Variable	Negative Fixed	Negative Variable
Mean (*SD*)	1.24 (1.9)	3.04 (2.0)	2.73 (2.3)	3.02 (1.9)	2.72 (2.2)
% Met Goal Week 1	24.1	65.8	61.5	67.9	62.1
% Met Goal Week 2	27.6	56.1	53.8	57.1	55.2
% Met Goal Week 3	24.1	65.8	50.0	64.3	51.7
% Met Goal Week 4	24.1	58.5	53.8	60.7	51.7
% Met Goal Week 5	24.1	56.1	53.8	53.6	51.7
n	29	28	26	41	29

Note: Possible range for number of weeks goal was met: 0-5.

Table 8

Parameter estimates for model that best fits differences among all conditions over time

	B	Standard Error	*p*
Intercept	-2.20	.93	.017
Week	-.18	.09	.032
Positive-variable	3.42	1.22	.005
Negative-fixed	3.99	1.11	<.001
Positive-fixed	3.83	1.18	.001
Negative-variable	3.37	1.18	.004

Table 9

Mean number of weeks that goal was met and percentage of participants meeting goal during follow-up by condition

	Control	Positive Fixed	Positive Variable	Negative Fixed	Negative Variable
Mean (*SD*)	.17 (.47)	.32 (.61)	.19 (.49)	.42 (.63)	.41 (.73)
% Met Goal Week 1	10.3	29.2	15.4	21.4	27.6
% Met Goal Week 2	6.9	12.2	3.8	10.7	13.8
n	29	28	26	41	29

Note: Possible range for number of weeks goal was met: 0-2.

Table 10

Mean (SD) perceived barriers, self-efficacy, and satisfaction at the end of active treatment by condition

	Control	Positive Fixed	Positive Variable	Negative Fixed	Negative Variable
Perceived barriers	32.34 (3.7)	31.46[a] (3.2)	31.59 (3.0)	33.52 (3.6)	33.71[a](4.5)
Self-efficacy	7.24 (2.0)	6.74 (2.0)	7.20 (2.1)	6.85 (1.6)	7.52 (2.3)
Satisfaction	.68 (1.4)	1.68 (1.6)[b]	1.22 (1.3)	1.52 (1.6)[c]	.34 (1.9)[b, c]

Note: *p*-value for difference between values sharing superscript: [a]p=.14; [b]p=.057; [c]p=.12

Table 11

Mean (SD) of indirect attitudes towards the incentive, indirect attitudes towards the physical benefits of walking, indirect global attitudes towards the walking goal (i.e., indirect attitude incentive + indirect attitude physical benefits), and direct global attitudes during active treatment

	Start week 1	End week 1	End week 2	End week 3	End week 4	End week 5
Indirect incentive	9.26 (6.38)	9.47 (6.55)	9.50 (6.12)	9.61 (6.45)	9.50 (6.99)	8.60 (6.70)
Indirect physical benefits	-10.11 (4.61)	-10.09 (5.12)	-9.42 (4.87)	-8.66 (5.07)	-8.61 (4.99)	-7.97 (5.22)
Indirect global	-.76 (7.66)	-.62 (8.61)	.08 (7.89)	.95 (7.88)	.90 (8.19)	.63 (8.56)
Direct global	-1.52 (.51)	-1.52 (.49)	-1.44 (.62)	-1.51 (.67)	-1.40 (.61)	-1.35 (.61)

Table 12

Correlations between direct attitudes towards the walking goal, indirect attitude towards the incentive, and behavior during active treatment.

		Direct Attitudes Towards Walking Goal						Behavior: Was Goal Met?				
		Start Week 1	End Week 1	End Week 2	End Week 3	End Week 4	End Week 5	Week 1	Week 2	Week 3	Week 4	Week 5
Indirect attitudes towards incentive	Start week 1	.09	.10	.01	.07	.04	.01	.38*	.33*	.36*	.26*	.26*
	End week 1	.16	.08	-.001	-.06	-.10	-.11	.41*	.27*	.29*	.30*	.25*
	End week 2	.19	.15	.01	-.05	-.06	-.09	.40*	.36*	.39*	.36*	.32*
	End week 3	.23*	.17	.07	.03	-.11	-.07	.43*	.33*	.49*	.42*	.33*
	End week 4	.18	.31*	.01	.09	-.18	-.19	.41*	.43*	.47*	.44*	.43*
	End week 5	.22*	.17	.11	.08	-.12	-.11	.49*	.40*	.51*	.50*	.41*
Behavior	Week 1	.07	.07	.08	.04	-.11	-.08	.				
	Week 2	.16	.14	.14	.07	-.09	-.09					
	Week 3	.07	.02	.11	.02	-.14	-.16					
	Week 4	.07	-.05	.01	-.06	-.26*	-.15					
	Week 5	-.004	-.003	-.001	.15	-.27*	-.27*					

Notes: *$p<.05$; behavior coded as 0=goal not met, 1=goal met; correlations with behavior are point-biserial correlations

Table 13

Correlations between direct attitudes towards the walking goal and indirect attitudes towards the physical benefits of walking during active treatment.

Indirect attitudes towards physical benefit	Direct Attitudes Towards Walking Goal						Behavior: Was Goal Met?				
	Start week 1	End week 1	End Week 2	End Week 3	End Week 4	End Week 5	Week 1	Week 2	Week 3	Week 4	Week 5
Start week 1	.29*	.14	.01	-.01	.15	.05	.03	.18	.06	.11	.01
End week 1	.26*	.25*	.22	.11	.03	.01	.17	.17	.12	.09	.14
End week 2	.37*	.27*	.01	.22*	.16	.10	.09	.25*	.16	.11	.13
End week 3	.46*	.27*	.07	.26*	.05	.15	.07	.16	.19	.13	.04
End week 4	.34*	.25*	.01	.20	.45*	.34*	.01	.08	-.003	-.06	-.10
End week 5	.30*	.10	.11	.21*	.23*	.24*	.05	.17	.09	-.04	-.04

Note: *p<.05; correlations with behavior are point-biserial correlations

Table 14

Correlations between direct attitudes towards the walking goal, indirect global attitudes and behavior during active treatment.

		Direct Attitudes Towards Walking Goal						Behavior: Was Goal Met?				
		Start week 1	End Week 1	End Week 2	End Week 3	End Week 4	End Week 5	Week 1	Week 2	Week 3	Week 4	Week 5
Indirect Global Attitudes	Start week 1	-.08	-.02	.12	.16	.06	.16	.06	-.03	.01	-.04	.05
	End week 1	-.13	-.06	.02	.03	.01	.11	.11	-.03	.13	.03	-.08
	End week 2	-.15	.02	.03	.11	.05	.08	.10	-.04	.07	.03	-.01
	End week 3	-.21*	-.05	-.04	.06	.06	.10	.12	.01	.09	.07	.10
	End week 4	-.22*	-.09	-.05	.03	-.02	.07	.15	-.01	.15	.10	.21*
	End week 5	-.11	-.09	.02	-.02	.04	.11	.18	-.001	.21*	.20*	.17

Note: *$p<.05$; correlations with behavior are point-biserial correlations

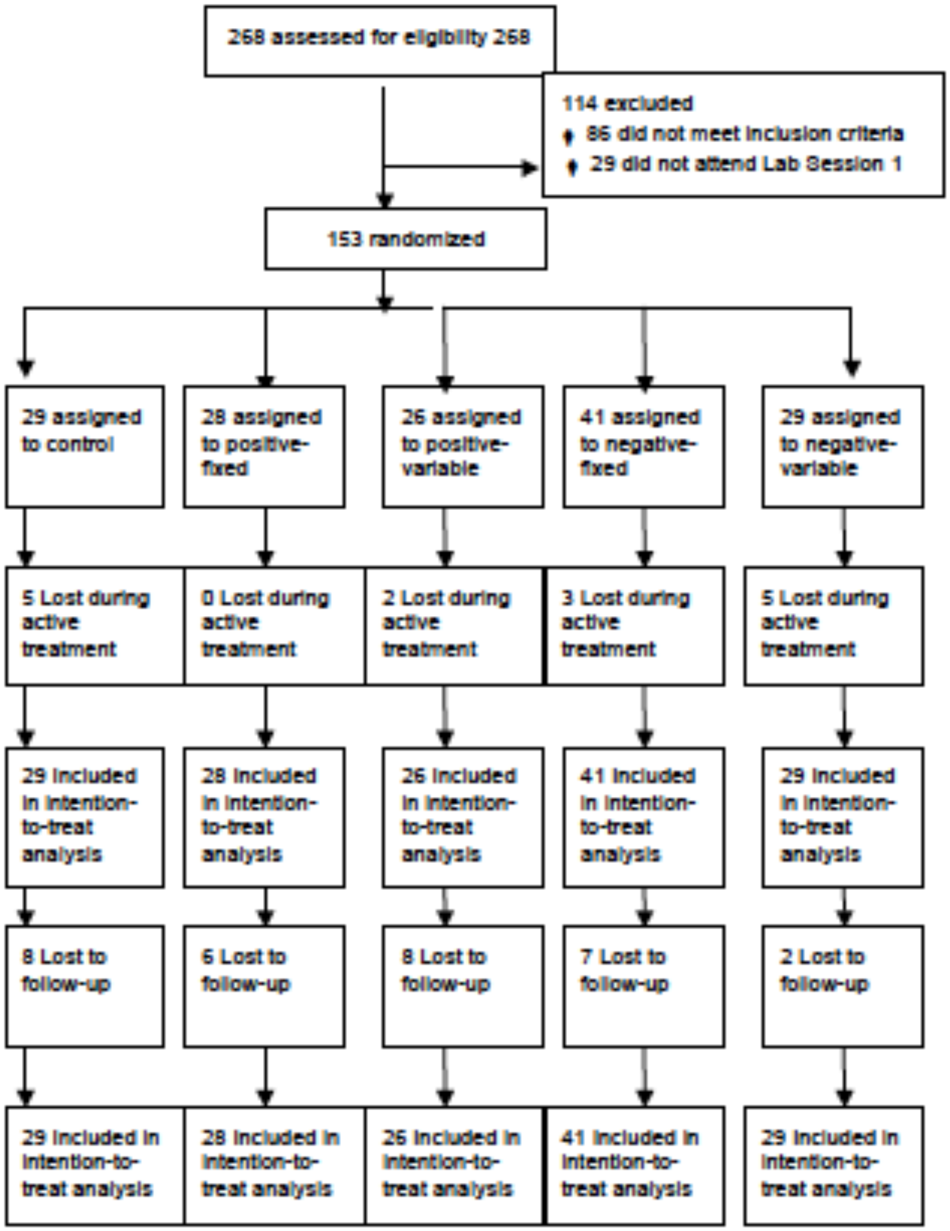


Figure 1. CONSORT diagram illustrating attrition.

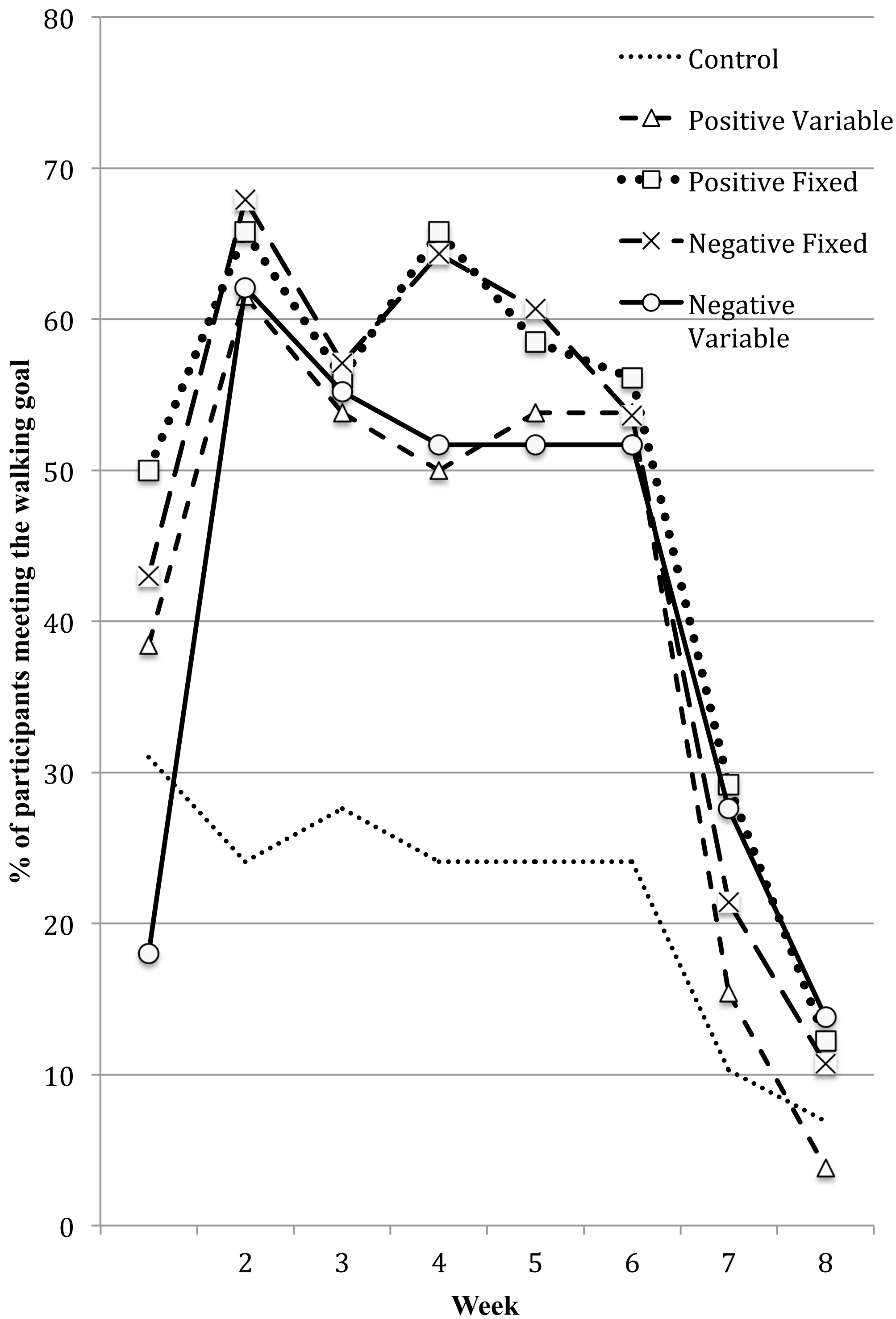


Figure 2. Percentage of participants in each condition meeting the walking goal each week.

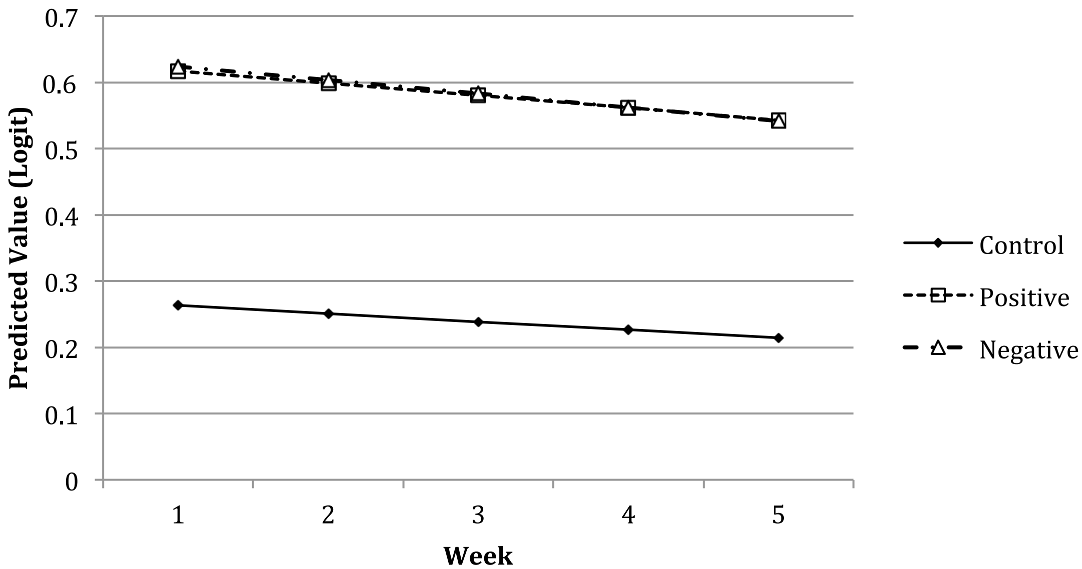
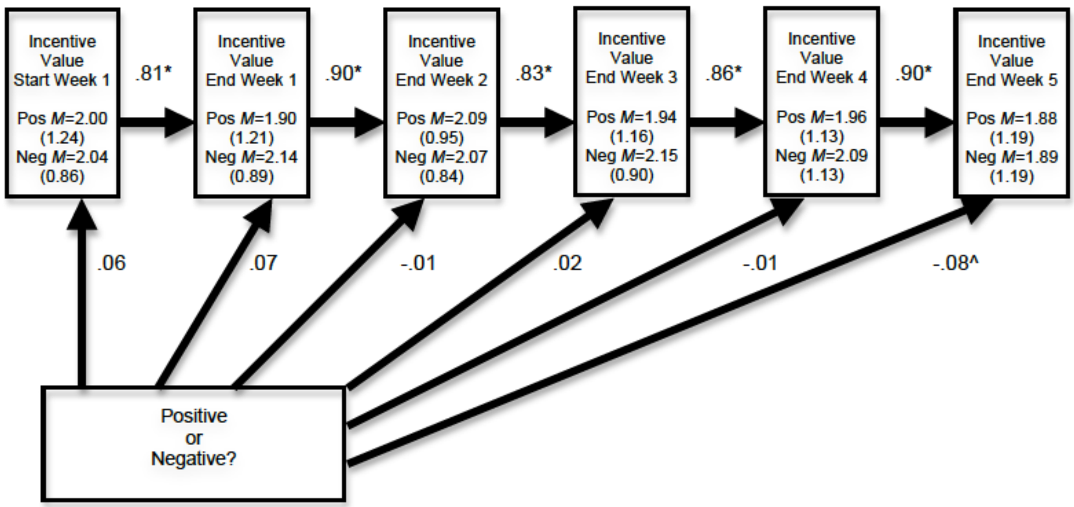
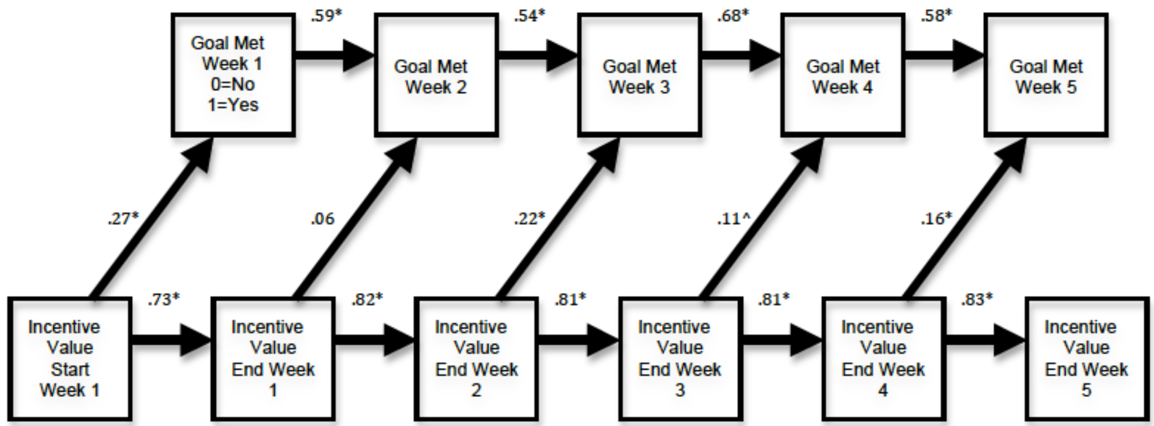


Figure 3. Graph of model that best fits differences among reinforcement procedure conditions over time.



Notes: Estimates are standardized regression weights; *p<.05, ^p<.10.

Figure 4. Effects of reinforcement procedure on the perceived value of the incentive during active treatment



Notes: Estimates are standardized regression weights; *p<.05, ^p≤.10.

Figure 5. Effects of perceived value of the incentive on behavior during active treatment

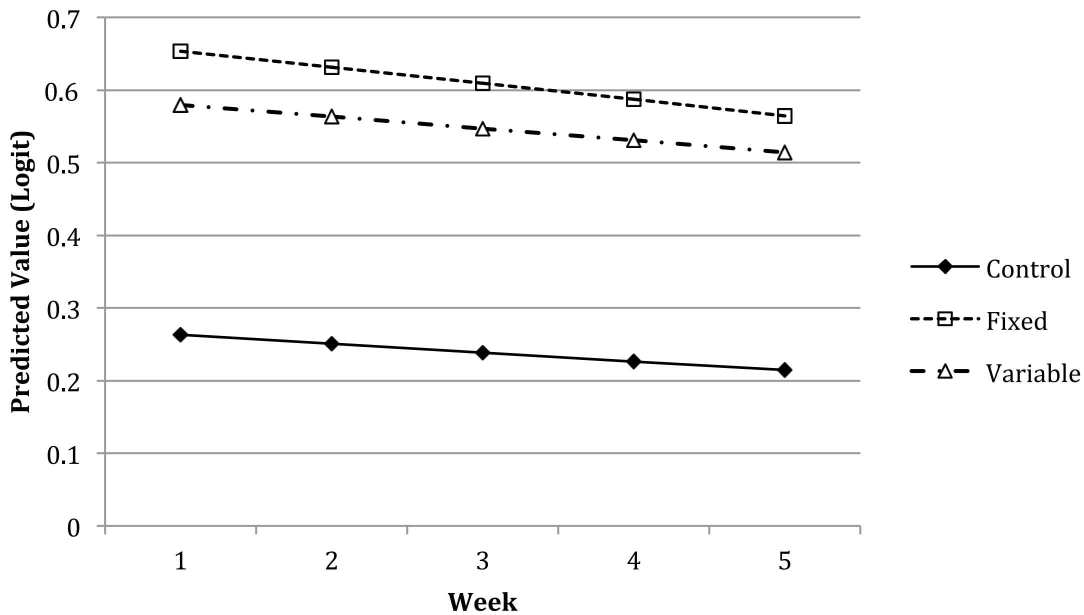
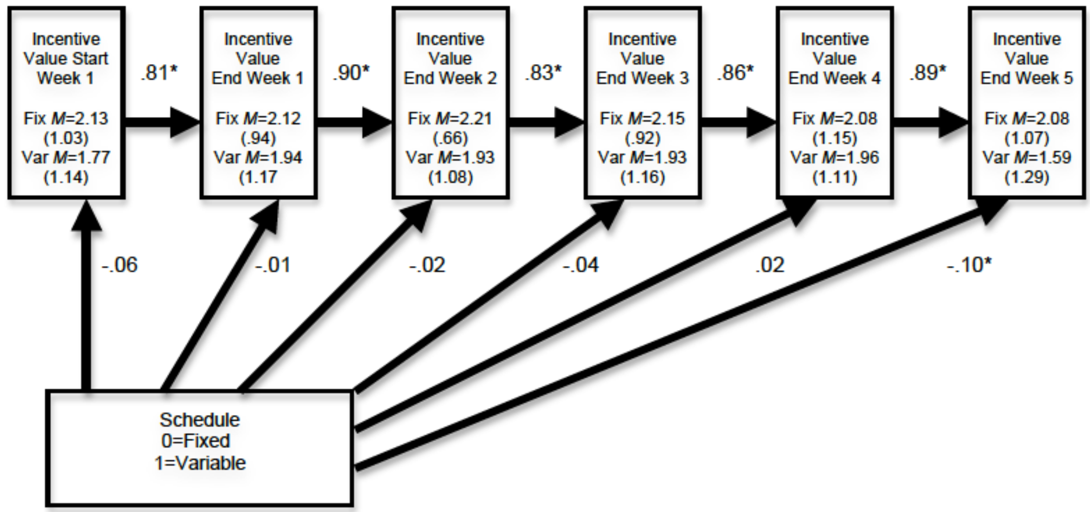


Figure 6. Graph of model that best fits differences amongst schedule conditions over time.



Notes: Estimates are standardized regression weights; *p<.05.

Figure 7. Effects of schedule on the perceived value of the incentive during active treatment

References

Aaker, J. L. (1999). The malleable self: The role of self-expression in persuasion. *Journal of Marketing Research*, *36,* 45-57.

Ajzen, I. (2006). Constructing a theory of planned behavior questionnaire. Retrieved from http://people.umass.edu/aizen/pdf/tpb.measurement.pdf

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179-211.

Ajzen, I. & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Akaike, H. (1985). Prediction and Entropy. In A. C. Atkinson & S. E. Fienberg (Eds.) *A Celebration of Statistics* (pp. 1-24) New York: Springer-Verlag.

Anderson, D. R. (2008). *Model based inference in the life sciences: A primer on evidence.* New York: Springer.

Ashford, S., Edmunds, J., & French, D. P. (2010). What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis. *British Journal of Health Psychology, 15*, 265-288.

Baldwin, A. S., Rothman, A. J., Hertel, A. W., Linde, J. A., Jeffery, R. W., Finch, E. A., & Lando, H. A. (2006). Specifying the determinants of the initiation and maintenance of behavior change: an examination of self-efficacy, satisfaction, and smoking cessation. *Health Psychology*, *25*, 626-634.

Bates, D. M. (2008). *Fitting mixed-effects models using the lme4 package in R*. Retrieved from http://www.stat.wisc.edu/~bates/PotsdamGLMM/LMMD.pdf

Behling, O., & Starke, F. A. (1973). The postulates of expectancy theory. *Academy of Management Journal*, *16*, 373-388.

Betsch, T., Haberstroh, S., Molter, B., & Glöckner, A. (2004). Oops, I did it again—Relapse errors in routinized decision making. *Organizational Behavior and Human Decision Processes, 93*, 62-74.

Blair, S. N., LaMonte, M. J., & Nichaman, M. Z. (2004). The evolution of physical activity recommendations: How much is enough? *The American Journal of Clinical Nutrition*, *79*, 913S-920S.

Bohannon, R. W. (2007). Number of pedometer-assessed steps taken per day by adults: A descriptive meta-analysis. *Physical Therapy, 87,* 1642-1650.

Boyce, G., Padmasekara, G., & Blum, M. (2012). Accuracy of mobile phone pedometer technology. *Journal of Mobile Technology in Medicine,1,* 23-27.

Burns, R. J., Donovan, A. S., Ackermann, R. T., Finch, E. A., Rothman, A. J., & Jeffery, R. W. (2012). A theoretically grounded systematic review of material incentives for weight loss: Implications for interventions. *Annals of Behavioral Medicine*, *44,* 1-14.

Camerer, C. F., & Loewenstein, G. (2004). Behavioral economics: Past, present, future. In C.F. Camerer, G. Loewenstein & M. Rabin (Eds.) *Advances in behavioral economics* (pp. 3-51). Princeton, NJ: Princeton University Press.

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Houghton: Mifflin.

Carpenter, C.J. (2010). A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Communication, 25*, 661-669.

Cash, T. F., Novy, P. L., & Grant, J. R. (1994). Why do women exercise? Factor analysis and further validation of the Reasons for Exercise Inventory. *Perceptual and Motor Skills*, *78*, 539-544.

Cohen, L. R. (1969). Generalization during acquisition, extinction, and transfer of matching with an adjustable comparison. *Journal of the Experimental Analysis of Behavior*, *12*, 463-474.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum.

Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., ... & Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine and Science in Sports and Exercise*, *35*, 1381-1395.

Curry, S. J., Wagner, E. H., & Grothaus, L. C. (1991). Evaluation of intrinsic and extrinsic motivation interventions with a self-help smoking cessation program. *Journal of Consulting and Clinical Psychology*, *59*, 318-324.

Daddario, D. K. (2007). A review of the use of the health belief model for weight management. *Medsurg Nursing*, *16*, 363-366.

Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology*, *18*, 105-115.

Deci, E. L. (1972). The effects of contingent and non-contingent rewards and controls on intrinsic motivation. *Organizational Behavior and Human Performance*, *8*, 217-229.

Deci, E. L. (1975). *Intrinsic motivation*. New York: Plenum Publishing.

Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, *125*, 627-668.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determinaton in Human Behaviour*. New York: Plenum.

Dinger, M. K., Heesch, K. C., Cipriani, G., & Qualls, M. (2007). Comparison of two email-delivered, pedometer-based interventions to promote walking among insufficiently active women. *Journal of Science and Medicine in Sport*, *10*, 297-302.

Dishman, R. K., Sallis, J. F., & Orenstein, D. R. (1985). The determinants of physical activity and exercise. *Public Health Reports*, *100*, 158-171.

Eagly, A. H., Ashmore, R. D., Makhijani, M. G., & Longo, L. C. (1991). What is beautiful is good, but…: A meta-analytic review of research on the physical attractiveness stereotype. *Psychological Bulletin, 110*, 109-128.

Edwards, W. (1954). The theory of decision making. *Psychological Bulletin*, *51*, 380-414.

Epstein, L. H., Rodefer, J. S., Wisniewski, L., & Caggiula, A. R. (1992). Habituation and dishabituation of human salivary response. *Physiology & Behavior*, *51*, 945-950.

Epstein, L. H., Temple, J. L., Roemmich, J. N., & Bouton, M. E. (2009). Habituation as a determinant of human food intake. *Psychological Review*, *116*, 384-407.

Epstein, L. H., Wing, R. R., Thompson, J. K., & Griffin, W. (1980). Attendance and fitness in aerobics exercise: The effects of contract and lottery procedures. *Behavior Modification*, *4*, 465-479.

Erdogan, B. Z. (1999). Celebrity endorsement: A literature review. *Journal of Marketing Management*, *15*, 291-314.

Feather, N. T. (2011). Expectancy-value theory and unemployment effects. *Journal of Occupational and Organizational Psychology*, *65*, 315-330.

Ferster, C.B. & Skinner, B.F. (1957). *Schedules of reinforcement*. Englewood Cliffs, NJ: Prentice-Hall.

Finch, E. A., Linde, J. A., Jeffery, R. W., Rothman, A. J., King, C. M., & Levy, R. L. (2005). The effects of outcome expectations and satisfaction on weight loss and maintenance: Correlational and experimental analyses-a randomized trial. *Health Psychology*, *24*, 608-616.

Finkelstein, E. A., Brown, D. S., Brown, D. R., & Buchner, D. M. (2008). A randomized study of financial incentives to increase physical activity among sedentary older adults. *Preventive Medicine*, *47*, 182-187.

Finkelstein, E. A., & Kosa, K. M. (2003). Use of incentives to motivate healthy behaviors among employees. *Gender Issues*, *21*, 50-59.

Finkelstein, E. A., Linnan, L. A., Tate, D. F., & Birken, B. E. (2007). A pilot study testing the effect of different levels of financial incentives on weight loss among overweight employees. *Journal of Occupational and Environmental Medicine*, *49*, 981-989.

Fishbach, A. & Dhar, R., (2007). Dynamics of goal-based choice. In C. P. Haugtvedt, P. M. Herr & F. R. Kardes (Eds.), *Handbook of Consumer Psychology*, (pp. 611-637). New York: Psychology Press.

Fishbein, M. (1963). An investigation of relationships between beliefs about an object and the attitude toward that object. *Human Relations, 16*, 233-240.

Florida Agency for Health Care Administration. (n.d.). Enhanced Benefits Reward$ Program. Retrieved from http://www.fdhc.state.fl.us/medicaid/Enhanced_Benefits

Forster, J. L., Jeffery, R. W., Sullivan, S., & Snell, M. K. (1985). A work-site weight control program using financial incentives collected through payroll deduction. *Journal of Occupational Medicine, 27,* 804-808.

Francisco, V. T., Paine, A. L., Fawcett, S. B., Johnston, J., & Banks, D. (1994). An experimental evaluation of an incentive program to reduce serum cholesterol levels among health fair participants. *Archives of Family Medicine*, *3*, 246-251.

Gao, Z., Lee, A. M., Kosma, M., & Solmon, M. A. (2010). Understanding students' motivation in middle school physical education: examining the mediating role of self-efficacy on physical activity. *International Journal of Sport Psychology*, *41*, 199-215.

Gerend, M.A., & Shepherd, J.E. (2012). Predicting human papillomavirus vaccine uptake in young adult women: Comparing the health belief model and theory of planned behavior. *Annals of Behavioral Medicine, 22*, 171-180.

Godin, G. (1993). The theories of reasoned action and planned behavior: Overview of findings, emerging research problems and usefulness for exercise promotion. *Journal of Applied Sport Psychology, 5,* 141–157.

Godin, G., & Kok, G. (1996). The theory of planned behavior: A review of its applications to health-related behaviors. *American Journal of Health Promotion, 11*, 87–98.

Godin, G., Valois, P., Lepage, L., & Desharnais, R. (1992). Predictors of smoking behaviour—An application of Ajzen's theory of planned behaviour. *British Journal of Addiction, 87*, 1335–1343.

Giuffrida, A., & Torgerson, D.J. (1997). Should we pay the patient? Review of financial incentives to enhance patient compliance. *British Medical Journal, 315,* 703-707.

Grubbs, L., & Carter, J. (2002). The relationship of perceived benefits and barriers to reported exercise behaviors in college undergraduates. *Family & Community Health*, *25*, 76-84.

Grube, J. W., Morgan, M., & McGree, S. T. (2011). Attitudes and normative beliefs as predictors of smoking intentions and behaviours: A test of three models. *British Journal of Social Psychology*, *25*, 81-93.

Hagger, M. S., Chatzisarantis, N. L., & Biddle, S. J. (2002). A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and the contribution of additional variables. *Journal of Sport & Exercise Psychology, 24,* 3-32.

Hamner, W. C., & Foster, L. W. (1975). Are intrinsic and extrinsic rewards additive: A test of Deci's cognitive evaluation theory of task motivation. *Organizational Behavior and Human Performance*, *14*, 398-415.

Higgins, E. T. (1997). Beyond pleasure and pain. *American Psychologist*, *52*, 1280-1300.

Higgins, E. T. (2000). Making a good decision: Value from fit. *American Psychologist*, *55*, 1217-1230.

Higgins, E. T., Friedman, R. S., Harlow, R. E., Idson, L. C., Ayduk, O. N., & Taylor, A. (2001). Achievement orientations from subjective histories of success: Promotion pride versus prevention pride. *European Journal of Social Psychology*, *31*, 3-23.

Higgins, E. T., Idson, L. C., Freitas, A. L., Spiegel, S., & Molden, D. C. (2003). Transfer of value from fit. *Journal of Personality and Social Psychology*, *84*, 1140-1153.

Hillhouse, J. J., Adler, C. M., Drinnon, J., & Turrist, R. (1997). Application of Ajzen's theory of planned behavior to predict sunbathing, tanning salon use, and sunscreen use intentions and behaviors. *Journal of Behavioral Medicine, 20*, 365–378.

Idaho Department of Health and Welfare. (n.d.). Preventive Health Assistance (PHA). Retrieved from http://www.healthandwelfare.idaho.gov/Medical/Medicaid/PreventiveHealthAssistance/tabid/221/Default.aspx

Janz, N.K. & Becker, M.H. (1984). The health belief model: A decade later. *Health Education Quarterly, 11*, 1-47.

Jeffery, R. W., Linde, J. A., Finch, E. A., Rothman, A. J., & King, C. M. (2006). A satisfaction enhancement intervention for long-term weight loss. *Obesity, 14*, 863-869.

Jeffery, R. W., Thompson, P. D., & Wing, R. R. (1978). Effects on weight reduction of strong monetary contracts for calorie restriction or weight loss. *Behaviour Research and Therapy*, *16*, 363-369.

Jeffery, R. W., Wing, R. R., Thorson, C., & Burton, L. R. (1998). Use of personal trainers and financial incentives to increase exercise in a behavioral weight-loss program. *Journal of Consulting and Clinical Psychology*, *66*, 777-783.

Jeffrey, D. B. (1974). A comparison of the effects of external control and self-control on the modification and maintenance of weight. *Journal of Abnormal Psychology*, *83*, 404-410.

Jenkins Jr, G. D., Mitra, A., Gupta, N., & Shaw, J. D. (1998). Are financial incentives related to performance? A meta-analytic review of empirical research. *Journal of Applied Psychology*, *83*, 777-787.

John, L. K., Loewenstein, G., Troxel, A. B., Norton, L., Fassbender, J. E., & Volpp, K. G. (2011). Financial incentives for extended weight loss: a randomized, controlled trial. *Journal of General Internal Medicine*, *26*, 621-626.

Kahn, B. E. (1995). Consumer variety-seeking among goods and services: An integrative review. *Journal of Retailing and Consumer Services*, *2*, 139-148.

Kahneman, D. (2003). Maps of bounded rationality: Psychology for behavioral economics. *American Economic Review*, *93,* 1449-1475.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the Econometric Society*, *47*, 263-291.

Kane, R.L., Johnson, P.E., Town, R.J., & Butler, M. (2004). A structured review of the effect of economic incentives on consumers' preventive behavior. *American Journal of Preventive Medicine*, *27*, 327-352.

Kimmons, J., Gillespie, C., Seymour, J., Serdula, M., & Blanck, H. M. (2009). Fruit and vegetable intake among adolescents and adults in the United States: percentage meeting individualized recommendations. *The Medscape Journal of Medicine*, *11*, 26.

Laibson, D. (1997). Golden eggs and hyperbolic discounting. *The Quarterly Journal of Economics*, *112*, 443-478.

Landy, E J., & Becker, W. S. (1990). Motivation theory reconsidered. In B. M. Staw & L. L. Cummings (Eds.) *Work in Organizations* (pp. 1-38). Greenwich, CT: JAI Press.

Lee, R., Sturmey, P., & Fields, L. (2007). Schedule-induced and operant mechanisms that influence response variability: A review and implications for future investigations. *The Psychological Record*, *57*, 429-455.

Lepper, M. R., Greene, D., & Nisbett, R. E. (1973). Undermining children's intrinsic interest with extrinsic reward: A test of the "overjustification" hypothesis. *Journal of Personality and Social Psychology*, *28*, 129-137.

Lindsley, D. H., Brass, D. J., & Thomas, J. B. (1995). Efficacy-performance spirals: A multilevel perspective. *Academy of Management Review, 20,* 645-678.

London, A. M., & Zentall, T. R. (1999). Transfer of value from S+ to S-in simultaneous discriminations in humans. *The American Journal of Psychology, 112*, 21-39.

Long, J. D. (2011). *Longitudinal data analysis for the behavioral sciences using R*. Thousand Oaks, CA: Sage.

Lovell, G. P., El Ansari, W., & Parker, J. K. (2010). Perceived exercise benefits and barriers of non-exercising female university students in the United Kingdom. *International Journal of Environmental Research and Public Health*, *7*, 784-798.

Luley, C., Blaik, A., Aronica, S., Dierkes, J., Kropf, S., & Westphal, S. (2010). Evaluation of three new strategies to fight obesity in families. *Journal of Nutrition and Metabolism*, *2010*.

Lussier, J. P., Heil, S. H., Mongeon, J. A., Badger, G. J., & Higgins, S. T. (2006). A meta-analysis of voucher-based reinforcement therapy for substance use disorders. *Addiction*, *101*, 192-203.

Lytle, L. A., Murray, D. M., Evenson, K. R., Moody, J., Pratt, C. A., Metcalfe, L., & Parra-Medina, D. (2009). Mediators affecting girls' levels of physical activity outside of school: Findings from the trial of activity in adolescent girls. *Annals of Behavioral Medicine*, *38*, 124-136.

MacKinnon, D. P. (2008). *Introduction to statistical mediation analysis*. Mahwah, NJ: Erlbaum.

McAlister, L., & Pessemier, E. (1982). Variety seeking behavior: An interdisciplinary review. *Journal of Consumer Research*, *9,* 311-322.

McAuley, E. (1992). The role of efficacy cognitions in the prediction of exercise behavior in middle-aged adults. *Journal of Behavioral Medicine*, *15*, 65-88.

McAuley, E., & Jacobson, L. (1991). Self-efficacy and exercise participation in sedentary adult females. *American Journal of Health Promotion*, *5*, 185-207.

McAuley, E., Peña, M.M., & Jerome, G.J. (2001). Self-efficacy as a determinant and an outcome of exercise. In G. Roberts (Ed.), *Advances in Motivation in Sport and Exercise* (pp. 235-261). Champaign, IL: Human Kinetics.

McSweeney, F. K. (2004). Dynamic changes in reinforcer effectiveness: Satiation and habituation have different implications for theory and practice. *The Behavior Analyst*, *27*, 171-188.

McSweeney, F. K., & Swindell, S. (1999). General-process theories of motivation revisited: The role of habituation. *Psychological Bulletin*, *125*, 437-457.

Mestek, M. L., Plaisance, E., & Grandjean, P. (2008). The relationship between pedometer-determined and self-reported physical activity and body composition variables in college-aged men and women. *Journal of American College Health*, *57*, 39-44.

Michie, S. & Abraham, C. (2004). Interventions to change health behaviours: Evidence-based or evidence inspired? *Psychology and Health, 19*, 29-49.

Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008) From theory to intervention: Mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology: An International Review, 57*, 660-680.

Mitchell, M. S., Goodman, J. M., Alter, D. A., John, L. K., Oh, P. I., Pakosh, M. T., & Faulkner, G. E. (2013). Financial incentives for exercise adherence in adults: Systematic review and meta-analysis. *American Journal of Preventive Medicine, 45*, 658-667.

Moran, W. P., Nelson, K., Wofford, J. L., Velez, R., & Case, L. D. (1996). Increasing influenza immunization among high-risk patients: Education or financial incentive? *American Journal of Medicine*, *101*, 612-620.

Müller-Riemenschneider, F., Reinhold, T., Nocon, M., & Willich, S. N. (2008). Long-term effectiveness of interventions promoting physical activity: A systematic review. *Preventive Medicine: An International Journal Devoted to Practice and Theory, 47*, 354-368.

Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion patterns. *Journal of personality and social psychology*, *74*, 774-789.

Myers, R. S., & Roth, D. L. (1997). Perceived benefits of and barriers to exercise and stage of exercise adoption in young adults. *Health Psychology*, *16*, 277-283.

Newcomb, P. A., & Carbone, P. P. (1992). The health consequences of smoking. Cancer. *The Medical Clinics of North America*, *76*, 305-331.

Nigg, C.R., Rossi, J.S., Norman, G.J. & Benisovich, S.V. (1998). Structure of decisional balance for exercise adoption. *Annals of Behavioral Medicine, 20,* S211.

Ory, M. G., Lee Smith, M., Mier, N., & Wernicke, M. M. (2010). The science of sustaining health behavior change: The Health Maintenance Consortium. *American Journal of Health Behavior*, *34*, 647-659.

Pope, L., & Harvey-Berino, J. (2013). Burn and earn: A randomized controlled trial incentivizing exercise during fall semester for college first-year students. *Preventive Medicine, 56*, 197-201.

Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion*, *12*, 38-48.

Raedeke, T. D., Focht, B. C., & King, J. S. (2010). The impact of a student-led pedometer intervention incorporating cognitive-behavioral strategies on step count and self-efficacy. *Research Quarterly for Exercise and Sport*, *81*, 87-96.

Redden, J. P., & Haws, K. L. (in press). Healthy satiation: The role of decreasing desire in effective self-control. *Journal of Consumer Research*.

Roberts, C. K., & Barnard, R. J. (2005). Effects of exercise and diet on chronic disease. *Journal of Applied Physiology*, *98*, 3-30.

Rodgers, W. M., Wilson, P. M., Hall, C. R., Fraser, S. N., & Murray, T. C. (2008). Evidence for a multidimensional self-efficacy for exercise scale. *Research Quarterly for Exercise and Sport*, *79*, 222-234.

Roger, V. L. & Turner, M.B. (2011). Executive summary: Heart disease and stroke statistics—2011 update a report from the American Heart Association. *Circulation*, *123*, 459-463.

Romanowich, P., & Lamb, R. J. (2013). The effect of framing incentives as either losses or gains with contingency management for smoking cessation. *Addictive Behaviors, 38*, 2084-2088.

Rothman, A. J. (2000). Toward a theory-based analysis of behavioral maintenance.*Health Psychology*, *19*, S64-S69.

Rothman, A. J., Sheeran, P., & Wood, W. (2009). Reflective and automatic processes in the initiation and maintenance of dietary change. *Annals of Behavioral Medicine*, *38*, 4-17.

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Education & Behavior*, *15*, 175-183.

Rosenstock, I.M., Strecher, V.J. & Becker, M. H. (1994). The health belief model and HIV risk behavior change. In R..J. DiClemente & J.L. Peterson (Eds.), *Preventing AIDS: Theories and Methods of Behavioral Interventions* (pp. 5-24). New York: Plenum Press.

Sallis, J. F., Hovell, M. F., Hofstetter, C. R., & Barrington, E. (1992). Explanation of vigorous physical activity during two years using social learning variables. *Social Science & Medicine*, *34*, 25-32.

Schuldt, J. P. & Schwarz, N. (2010). The "organic" path to obesity? Organic claims influence calorie judgments and exercise recommendations. *Judgment and Decision Making, 5,* 144-50.

Schwarz, N. (1999). Self-reports: How the questions shape the answers. *American Psychologist*, *54*, 93-105.

Sechrist, K. R., Walker, S. N., & Pender, N. J. (1987). Development and psychometric evaluation of the Exercise Benefits/Barriers Scale. *Research in Nursing & Health, 10,* 357-365.

Selig, J. P., & Preacher, K. J. (2009). Mediation models for longitudinal data in developmental research. *Research in Human Development, 6*, 144-164.

Shah, J., & Higgins, E. T. (1997). Expectancy× value effects: Regulatory focus as determinant of magnitude and direction. *Journal of Personality and Social Psychology*, *73*, 447-458.

Shah, J., Higgins, T., & Friedman, R. S. (1998). Performance incentives and means: How regulatory focus influences goal attainment. *Journal of Personality and Social Psychology*, *74*, 285-293.

Shaw, J. E., Sicree, R. A., & Zimmet, P. Z. (2010). Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Research and Clinical Practice*, *87*, 4-14.

Sheeran, P., Norman, P., Orbell, S. (1999). Evidence that intentions based on attitudes better predict behaviour than intentions based on subjective norms. *European Journal of Social Psychology, 29*, 403-406.

Sherwood, N. E., & Jeffery, R. W. (2000). The behavioral determinants of exercise: implications for physical activity interventions. *Annual Review of Nutrition*, *20*, 21-44.

Siegel, R., Ward, E., Brawley, O., & Jemal, A. (2011). Cancer statistics, 2011.*CA: A Cancer Journal for Clinicians*, *61*, 212-236.

Skinner, B. F. (1938). *The behavior of organisms: An experimental analysis*. New York: Appleton-Century.

Skinner, B.F. (1953). *Science and human behavior*. New York: Macmillan.

Sutherland, K., Christianson, J. B., & Leatherman, S. (2008). Impact of targeted financial incentives on personal health behavior: A review of the literature. *Medical Care Research and Review*, *65*, 36S-78S.

Tildesley, A. E., & Coote, L. V. (2009). This brand is me: A social identity based measure of brand identification. *Advances in Consumer Research*, *36*, 627-628.

Troiano, R. P., Berrigan, D., Dodd, K. W., Mâsse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine and Science in Sports and Exercise*, *40*, 181-188.

Tversky, A. & Kahneman, D. (1991). Loss aversion in riskless choice: A reference dependent model. *Quarterly Journal of Economics, 106*, 1039-1061.

U.S. Department of Health and Human Services. (2011). $100 million in affordable care act grants to help create healthier U.S. communities [Press release]. Retrieved from http://www.cms.gov/apps/media/press/release.asp?Counter=3903&intNumPerPage=10&checkDate=&checkKey=&srchType=1&numDays=3500&srchOpt=0&srchData=&keywordType=All&chkNewsType=1%2C+2%2C+3%2C+4%2C+5&intPage=&showAll=&pYear=&year=&desc=&cboOrder=date

Van Eerde, W., & Thierry, H. (1996). Vroom's expectancy models and work-related criteria: A meta-analysis. *Journal of Applied Psychology*, *81*, 575-586.

Volpp, K. G., Levy, A. G., Asch, D. A., Berlin, J. A., Murphy, J. J., Gomez, A., ... & Lerman, C. (2006). A randomized controlled trial of financial incentives for smoking cessation. *Cancer Epidemiology Biomarkers & Prevention*, *15*, 12-18.

Volpp, K. G., John, L. K., Troxel, A. B., Norton, L., Fassbender, J., & Loewenstein, G. (2008). Financial incentive–based approaches for weight loss. *JAMA: The Journal of the American Medical Association*, *300*, 2631-2637.

Vroom, V. H. (1964). *Work and Motivation*. New York: Wiley.

Wadsworth, D.D. & Hallam, J.S. (2010). Effect of a Web Site Intervention on Physical Activity of College Females. *American Journal of Health Behavior, 34,* 60-69.

Wagner, A. R., & Brandon, S. E. (2001). A componential theory of Pavlovian conditioning. In R. R. Mower & S. B. Klein (Eds.), *Handbook of contemporary learning theories* (pp. 23–64). Mahwah, NJ: Lawrence Erlbaum Associates.

Wall, J., Mhurchu, C. N., Blakely, T., Rodgers, A., & Wilton, J. (2008). Effectiveness of monetary incentives in modifying dietary behavior: a review of randomized, controlled trials. *Nutrition reviews*, *64*, 518-531.

Warburton, D. E., Nicol, C. W., & Bredin, S. S. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal*, *174*, 801-809.

Wathieu, L. (2004). Consumer habituation. *Management Science*, *50*, 587-596.

Weinstein, N. D. (1988). The precaution adoption process. *Health Psychology*,*7*, 355-386.

Wiersma, U. J. (1992). The effects of extrinsic rewards in intrinsic motivation: A meta-analysis. *Journal of Occupational and Organizational Psychology*, *65*, 101-114.

Wigfield, A., & Eccles, J. S. (2000). Expectancy–value theory of achievement motivation. *Contemporary Educational Psychology*, *25*, 68-81.

Wilbur, J., Miller, A.M., Chandler, P., & McDevitt, J. (2003). Determinants of physical activity and adherence to a 24‐week home‐based walking program in African American and Caucasian women. *Research in Nursing & Health*, *26*, 213-224.

Williams, B. R., Bezner, J., Chesbro, S. B., & Leavitt, R. (2006). The effect of a walking program on perceived benefits and barriers to exercise in postmenopausal African American women. *Journal of Geriatric Physical Therapy*, *29*, 43-49.

Williams, D. M., Lewis, B. A., Dunsiger, S., Whiteley, J. A., Papandonatos, G. D., Napolitano, M. A., ... & Marcus, B. H. (2008). Comparing psychosocial predictors of physical activity adoption and maintenance. *Annals of Behavioral Medicine*, *36*, 186-194.

Wright, P. M. (1989). Test of the mediating role of goals in the incentive-performance relationship. *Journal of Applied Psychology, 74,* 699-705.

Wright, P. M. (1991). Goals as mediators of the relationship between monetary incentives and performance: A review and NPI theory examination. *Human Resource Management Review*, *1*, 1-22.

Wright, P. M. (1992). An examination of the relationships among monetary incentives, goal level, goal commitment, and performance. *Journal of Management*, *18*, 677-693.

Yarbrough, S. S., & Braden, C. J. (2008). Utility of health belief model as a guide for explaining or predicting breast cancer screening behaviours. *Journal of Advanced Nursing*, *33*, 677-688.

Appendix 1: Schedule of Data Collection

	Screening Questionnaire	Orientation Session	Weekly Assessment	Final Session	Follow-Up
Activity Level	X			X	X
Direct Attitudes		X	X	X	X
Demographics/ Background		X			
Perceived Barriers		X		X	
Expectancy & Value of Physical Benefits & Incentive		X	X	X	X
Satisfaction			X	X	X
Self-efficacy		X		X	
Regulatory Focus		X			

Appendix 2: Screening Questionnaire

In this study, participants are compensated with REP points. Thus, you must be enrolled in a class that is using REP points. However, all participants have the opportunity to earn up to $50 IN ADDITION TO (NOT instead of) the REP points. Are you enrolled in a class that is using REP points? If you aren't sure, look at your course syllabus.

❍ Yes
❍ No

Do you have a smartphone?

❍ Yes
❍ No

Which type of operating system does your smartphone have?

❍ iOS (iphone)
❍ Android
❍ Other

Are you willing to download and use a free pedometer app on your smartphone for approx. eight weeks?

❍ Yes
❍ No

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. These questions are about the time you spent being physically active in <u>the last 7 days.</u> They include questions about activities you do at work, as part of house and yard work, to get from place to place, and in your spare time for recreation, exercise and sport.

Please answer each question even if you do not consider yourself an active person.

In the following questions:

Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal.

Moderate physical activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

1. During the last 7 days, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling,?

Think about only those physical activities that you did for at least 10 minutes at a time.

________ days per week   or __________none

[*If 1 or more days are indicated]* How much time in total did you usually spend on one of those days doing vigorous physical activities?

________hours _______minutes

2. Again, think only about those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

________ days per week   or __________none

[*If 1 or more days is indicated]* How much time in total did you usually spend on one of those days doing moderate physical acarevities?

________hours _______minutes

3. During the last 7 days, on how many days did you **walk** for at least 10 minutes at a time? This includes walking at work and at home, walking to travel from place to place, and any other walking that you did solely for recreation, sport, exercise or leisure.

________ days per week   or __________none

[*If 1 or more days are indicated]* How much time in total did you usually spend walking on one of those days?

________hours _______minutes

The last question is about the time you spent sitting on weekdays while at work/school, at home, while doing course work and during leisure time. This includes time spent sitting at a desk, visiting friends, reading traveling on a bus or sitting or lying down to watch television.

4. During the last 7 days, how much time in total did you usually spend **sitting** on a **week day**?

____ hours ______ minutes

Appendix 3: Lab Session 1 Questionnaire

This set of questions asks you how frequently specific events actually occur or have occurred in your life. Please read each statement carefully. Using the scale below, indicate the number that best reflects your experience.

0=Never
1
2=Seldom
3
4=Sometimes
5
6=Very often

1. Compared to most people, how often do you get what you want out of life?
2. Growing up, how often did you "cross the line" by doing things that your parents would not like?
3. How often has succeeding at things inspired you to work even harder?
4. How often did you get on your parents' nerves when you were growing up?
5. Growing up, how often did you obey the rules that were made by your parents?
6. Growing up, how often did you act in ways that your parents thought were not good?
7. How often do you do well at different things you try?
8. How often have you gotten into trouble because you were not being careful enough?
9. When it comes to succeeding at things that are important to you, how often do you not do as well as you would like to?
10. How often do you feel like you have been successful in your life?
11. How often have you found hobbies or activities in your life that you enjoy spending a lot of time doing?

For me, the goal of walking 10 000 steps (approximately 4.5 miles) per day on most days of the week is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Pleasant	❍	❍	❍	❍	❍	❍	❍	Unpleasant
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, the experience of walking 10 000 steps (approximately 4.5 miles) per day on most days of the week is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Pleasant	❍	❍	❍	❍	❍	❍	❍	Unpleasant
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, walking 10 000 steps (approximately 4.5 miles) per day on most days of the week will improve my physical fitness

❍ 1 Very Unlikely
❍ 2
❍ 3
❍ 4
❍ 5
❍ 6
❍ 7 Very Likely

My improved physical fitness is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, walking 10 000 steps (approximately 4.5 miles) per day on most days of the week will improve my physical appearance

❍ 1 Very Unlikely
❍ 2
❍ 3
❍ 4
❍ 5
❍ 6
❍ 7 Very Likely

My improved physical appearance is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

Below are statements that relate to ideas about exercise. Please indicate the degree to which you agree or disagree with the statements by checking:
SA for strongly agree, A for agree, D for disagree, SD for strongly disagree

1. Exercising takes too much of my time.
2. Exercise tires me.
3. Places for me to exercise are too far away.
4. I am too embarrassed to exercise.
5. It costs too much to exercise.
6. Exercise facilities do not have convenient schedules for me.
7. I am fatigued by exercise.
8. My spouse (or significant other) does not encourage exercising.
9. Exercise takes too much time from family relationships.
10. I think people in exercise clothes look funny.
11. My family members do not encourage me to exercise.
12. Exercise takes too much time from my family responsibilities.
13. Exercise is hard work for me.
14. There are too few places for me to exercise.

The following items reflect situations that are listed as common reasons for preventing individuals from participating in exercise sessions, or in some cases, dropping out. Using the scales below, please indicate how confident you are that you could exercise in the event that any of the following circumstances were to occur indicating the appropriate %. Select the response that most closely matches your own using the scale below, remembering that there are no right or wrong answers.

0%	10	20	30	40	50	60	70	80	90	100%
Not at Confident					Moderately Confident					Completely Confident

For example:
In question #1, if you have complete confidence that you could exercise even if "the weather was very bad", you would indicate 100%. If however, you had no confidence at all that you could exercise (i.e. confidence that you would not exercise), you would indicate 0%.

I believe that I could briskly walk for 150 minutes per week for the next 8 weeks if:

1) the weather was very bad.
2) I was bored by the activity.
3) I was on vacation.
4) I was not interested in the activity.
5) I felt pain or discomfort when exercising.
6) I had to exercise alone.
7) it was not fun or enjoyable.
8) it became difficult to get to the exercise location.
9) I didn't like the activity I was involved in.
10) my schedule conflicted with my exercise session.
11) I am self-conscious about my appearance when I exercise.
12) I do not receive any encouragement.
13) I was under personal stress of some kind.

Please select the response to each question that best describes you.

	True	False
I currently do not exercise	❍	❍
I intend to exercise in the next 6 months	❍	❍
I currently exercise regularly	❍	❍
I have exercised regularly for the past 6 months	❍	❍

Finally, we would like to ask you a little bit more about yourself.

1. What is your gender?
   - ❑Man
   - ❑Woman
   - ❑Prefer not to say

2. How old are you?
   ________ years

3. What is your race?
   - ❑ Caucasian/White
   - ❑ African-American/Black
   - ❑ Asian-American
   - ❑ Hispanic/Latino/Mexican-American
   - ❑ Middle Eastern/Arab American
   - ❑ Native-American
   - ❑ Multiracial (please specify________________________________)
   - ❑ Other____________

4. What is your relationship status?
   - ❑ Married
   - ❑ In a dating relationship
   - ❑ Single
   - ❑ Separated/divorced

5. How would you describe your current living arrangements?
   - ❑ On campus in a single person room
   - ❑ On campus in a shared room/apartment
   - ❑ Off campus in a single person dwelling
   - ❑ Off campus with family
   - ❑ Off campus in fraternity or sorority house
   - ❑ Off campus with roommates (not fraternity or sorority house)

6. How would you describe your student status and employment status?
   ❑ Full-time student ❑ Part-time student
   ❑ Full-time employment ❑ Part-time employment ❑ Unemployed
   ❑ Combination of school & employment ❑ Other ________________

7. What is the highest level of education completed by your mother or guardian?
   - ❑ Some grade school
   - ❑ Completed grade school
   - ❑ Some high school
   - ❑ Finished high school
   - ❑ Some college or two-year degree
   - ❑ 4-year college degree
   - ❑ Some school beyond college
   - ❑ Professional or graduate school
   - ❑ Don't know

8. What is the highest level of education completed by your father or guardian?
   - ❑ Some grade school
   - ❑ Completed grade school
   - ❑ Some high school
   - ❑ Finished high school
   - ❑ Some college or two-year degree
   - ❑ 4-year college degree
   - ❑ Some school beyond college
   - ❑ Professional or graduate school
   - ❑ Don't know

9. Please indicate if each of the following statements is true or false for you.

    a. I currently do not exercise ❑TRUE ❑FALSE
    b. I intend to exercise in the next 6 months❑TRUE ❑FALSE
    c. I currently exercise *regularly*❑TRUE ❑FALSE
    d. I have exercised *regularly* for the past 6 months❑TRUE ❑FALSE

10. In the last 4 years, how many times did you lose each of the following amounts of weight on purpose? If you did not lose the listed amount of weight on purpose in the past 4 years, enter "0."
    ________5-9 lbs.
    ________10-19 lbs.
    ________20-49 lbs.
    ________50+ lbs.

11. How tall are you?
    ______________ feet _____________inches

12. How much do you weigh?
    ______________ lbs.

Appendix 4: Lab Session 2 Questionnaire

You are now going to be asked a few questions about your opinions. There are no right or wrong answers. We are just interested in your honest opinion. This survey will take about 3 minutes to complete.

I intend to walk 10,000 steps on most days of the week this week.
❍ 1 Strongly Disagree
❍ 2
❍ 3
❍ 4
❍ 5
❍ 6
❍ 7 Strongly Agree

Next, we would like to ask you about your thoughts regarding the goal of walking 10,000 steps and the experience of walking 10,000 steps.

For me, the goal of walking 10 000 steps (approximately 4.5 miles) per day on most days of the week is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Pleasant	❍	❍	❍	❍	❍	❍	❍	Unpleasant
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, the experience of walking 10 000 steps (approximately 4.5 miles) per day on most days of the week is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Pleasant	❍	❍	❍	❍	❍	❍	❍	Unpleasant
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, walking 10 000 steps (approximately 4.5 miles) per day on most days of the week will improve my physical fitness

❍ 1 Very Unlikely
❍ 2
❍ 3
❍ 4
❍ 5
❍ 6
❍ 7 Very Likely

My improved physical fitness is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, walking 10 000 steps (approximately 4.5 miles) per day on most days of the week will improve my physical appearance

❍ 1 Very Unlikely
❍ 2
❍ 3
❍ 4
❍ 5
❍ 6
❍ 7 Very Likely

My improved physical appearance is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, walking 10 000 steps (approximately 4.5 miles) per day on most days of the week will make me money

- ❍ 1 Very Unlikely
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7 Very Likely

My making money in this study is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

I am losing money each week that I do not walk 10,000 steps on most days of the week.

- ❍ 1 Strongly Disagree
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7 Strongly Agree

Appendix 5: Weekly Assessment During Active Treatment

You are now going to be asked a few questions about your opinions. There are no right or wrong answers. We are just interested in your honest opinion. This survey will take about 3 minutes to complete.

I intend to walk 10,000 steps on most days of the week this week.

❍ 1 Strongly Disagree
❍ 2
❍ 3
❍ 4
❍ 5
❍ 6
❍ 7 Strongly Agree

Next, we would like to ask you about your thoughts regarding the goal of walking 10,000 steps and the experience of walking 10,000 steps.

For me, the goal of walking 10 000 steps (approximately 4.5 miles) per day on most days of the week is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Pleasant	❍	❍	❍	❍	❍	❍	❍	Unpleasant
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, the experience of walking 10 000 steps (approximately 4.5 miles) per day on most days of the week is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Pleasant	❍	❍	❍	❍	❍	❍	❍	Unpleasant
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, walking 10 000 steps (approximately 4.5 miles) per day on most days of the week will improve my physical fitness

❍ 1 Very Unlikely
❍ 2
❍ 3
❍ 4
❍ 5
❍ 6
❍ 7 Very Likely

My improved physical fitness is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, walking 10 000 steps (approximately 4.5 miles) per day on most days of the week will improve my physical appearance

❍ 1 Very Unlikely
❍ 2
❍ 3
❍ 4
❍ 5
❍ 6
❍ 7 Very Likely

My improved physical appearance is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, walking 10 000 steps (approximately 4.5 miles) per day on most days of the week will make me money

- ❍ 1 Very Unlikely
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7 Very Likely

My making money in this study is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

How much effort have you put into walking 10,000 steps/day on most days of the week?

- ❍ 0 No Effort
- ❍ 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7
- ❍ 8
- ❍ 9
- ❍ 10 A Great Deal of Effort

In the context of this study, walking can: (a) make you money(b) produce the benefits typically associated with physical activity

Given the amount of effort that you have put into your walking, how satisfied are you with your progress in terms of making money?

-4	-3	-2	-1	0	1	2	3	4
Very Dissatisfied				Neither Satisfied Nor				Very

Satisfied

Given the amount of effort that you have put into your walking, how satisfied are you with your progress in terms of the benefits typically associated with physical activity?

-4	-3	-2	-1	0	1	2	3	4
Very Dissatisfied				Neither Satisfied Nor Satisfied				Very

When it comes to making money, as of today, how satisfied are you with what you have experienced as a result of walking 10,000 steps/day on most days of the week?

-4	-3	-2	-1	0	1	2	3	4
Very Dissatisfied				Neither Satisfied Nor Satisfied				Very

When it comes to the benefits typically associated with physical activity, as of today, how satisfied are you with what you have experienced as a result of walking 10,000 steps/day on most days of the week?

-4	-3	-2	-1	0	1	2	3	4
Very Dissatisfied				Neither Satisfied Nor Satisfied				Very

Appendix 6: Weekly Assessment During Follow-Up

You are now going to be asked a few questions about your opinions. There are no right or wrong answers. We are just interested in your honest opinion. This survey will take about 3 minutes to complete.

I intend to walk 10,000 steps on most days of the week this week.

❍ 1 Strongly Disagree
❍ 2
❍ 3
❍ 4
❍ 5
❍ 6
❍ 7 Strongly Agree

Next, we would like to ask you about your thoughts regarding the goal of walking 10,000 steps and the experience of walking 10,000 steps.

For me, the goal of walking 10 000 steps (approximately 4.5 miles) per day on most days of the week is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Pleasant	❍	❍	❍	❍	❍	❍	❍	Unpleasant
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, the experience of walking 10 000 steps (approximately 4.5 miles) per day on most days of the week is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Pleasant	❍	❍	❍	❍	❍	❍	❍	Unpleasant
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, walking 10 000 steps (approximately 4.5 miles) per day on most days of the week will improve my physical fitness

- ❍ 1 Very Unlikely
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7 Very Likely

My improved physical fitness is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

For me, walking 10 000 steps (approximately 4.5 miles) per day on most days of the week will improve my physical appearance

- ❍ 1 Very Unlikely
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7 Very Likely

My improved physical appearance is:

Good	❍	❍	❍	❍	❍	❍	❍	Bad
Unimportant	❍	❍	❍	❍	❍	❍	❍	Important
Desirable	❍	❍	❍	❍	❍	❍	❍	Undesirable

How much effort have you put into walking 10,000 steps/day on most days of the week?

- ❍ 0 No Effort
- ❍ 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7
- ❍ 8
- ❍ 9
- ❍ 10 A Great Deal of Effort

Given the amount of effort that you have put into your walking, how satisfied are you with your progress in terms of the benefits typically associated with physical activity?

-4	-3	-2	-1	0	1	2	3	4
Very Dissatisfied				Neither Satisfied Nor				Very Satisfied

When it comes to the benefits typically associated with physical activity, as of today, how satisfied are you with what you have experienced as a result of walking 10,000 steps/day on most days of the week?

-4	-3	-2	-1	0	1	2	3	4
Very Dissatisfied				Neither Satisfied Nor				Very Satisfied

Appendix 7: Weekly Assessment Email During Active Treatment

Subject Line: REP Walking Study Weekly Email

Here is your weekly summary of your bank account for the Physical Activity Study. The link to the weekly survey is also below.

Participants who *[did/did not]* meet the goal this past week [*gained/lost]* $*[amount stood to be gained/lost here]*

Last week, you started with a balance of *[prior balance here]*

You *[did/did not]* meet the goal of walking 10 000 steps/day on most days of the week, so you *[gained/lost]* $*[amount stood to be gained/lost or 0]*.

Therefore, as seen below, your current balance is $*[current balance here]*

[thermometer graphic ranging from $0-$50 with current balance here]

Please complete the survey below RIGHT NOW. It takes about 3 minutes to complete.

[link to online survey here]

Appendix 8: Lab Session 3 Questionnaire

Below are statements that relate to ideas about exercise. Please indicate the degree to which you agree or disagree with the statements by checking:
SA for strongly agree, A for agree, D for disagree, SD for strongly disagree

1. Exercising takes too much of my time.
2. Exercise tires me.
3. Places for me to exercise are too far away.
4. I am too embarrassed to exercise.
5. It costs too much to exercise.
6. Exercise facilities do not have convenient schedules for me.
7. I am fatigued by exercise.
8. My spouse (or significant other) does not encourage exercising.
9. Exercise takes too much time from family relationships.
10. I think people in exercise clothes look funny.
11. My family members do not encourage me to exercise.
12. Exercise takes too much time from my family responsibilities.
13. Exercise is hard work for me.
14. There are too few places for me to exercise.

The following items reflect situations that are listed as common reasons for preventing individuals from participating in exercise sessions, or in some cases, dropping out. Using the scales below, please indicate how confident you are that you could exercise in the event that any of the following circumstances were to occur indicating the appropriate %. Select the response that most closely matches your own using the scale below, remembering that there are no right or wrong answers.

0%	10	20	30	40	50	60	70	80	90	100%
Not at Confident					Moderately Confident					Completely Confident

For example:
In question #1, if you have complete confidence that you could exercise even if “the weather was very bad”, you would indicate 100%. If however, you had no confidence at all that you could exercise (i.e. confidence that you would not exercise), you would indicate 0%.

I believe that I could briskly walk for 150 minutes per week if:

1) the weather was very bad.
2) I was bored by the activity.
3) I was on vacation.
4) I was not interested in the activity.
5) I felt pain or discomfort when exercising.
6) I had to exercise alone.
7) it was not fun or enjoyable.
8) it became difficult to get to the exercise location.

9) I didn't like the activity I was involved in.
10) my schedule conflicted with my exercise session.
11) I am self-conscious about my appearance when I exercise.
12) I do not receive any encouragement.
13) I was under personal stress of some kind.

Please select the response to each question that best describes you.

	True	False
I currently do not exercise	❍	❍
I intend to exercise in the next 6 months	❍	❍
I currently exercise regularly	❍	❍
I have exercised regularly for the past 6 months	❍	❍

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. These questions are about the time you spent being physically active in <u>the last 7 days.</u> They include questions about activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise and sport.

Please answer each question even if you do not consider yourself an active person.

In the following questions:

Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal.

Moderate physical activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

1. During the last 7 days, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling,?

Think about only those physical activities that you did for at least 10 minutes at a time.

________ days per week   or __________none

[*If 1 or more days are indicated]* How much time in total did you usually spend on one of those days doing vigorous physical activities?

________hours _______minutes

2. Again, think only about those physical activities that you did for at least 10 minutes at a
time. During the last 7 days, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

________ days per week   or __________none

[*If 1 or more days are indicated]* How much time in total did you usually spend on one of those days doing moderate physical activities?

________hours _______minutes

3. During the last 7 days, on how many days did you **walk** for at least 10 minutes at a time? This includes walking at work and at home, walking to travel from place to place, and any other walking that you did solely for recreation, sport, exercise or leisure.

________ days per week   or __________none

[*If 1 or more days are indicated]* How much time in total did you usually spend walking on one of those days?

________hours _______minutes

The last question is about the time you spent sitting on weekdays while at work/school, at home, while doing course work and during leisure time. This includes time spent sitting at a desk, visiting friends, reading traveling on a bus or sitting or lying down to watch television.

4. During the last 7 days, how much time in total did you usually spend **sitting** on a **week day**?
____ hours ______ minutes