Journal of
Obesity & Weight Loss Therapy

Hashemi et al., J Obes Weight Loss Ther 2015, 5:1
DOI: 10.4172/2165-7904.1000247

Research Article Open Access

# Identifying Financial Incentive Designs to Enhance Participation in Weight Loss Programs

**Ali Hashemi[1*], Wen You[2], Kevin J. Boyle[2], Christopher F. Parmeter[3], Barbara Kanninen[4] and Paul A. Estabrooks[5]**

[1]*Department of Economics and Finance, Ashland University, 401 College Ave, Ashland, OH 44805, USA*

[2]*Department of Agricultural & Applied Economics, Virginia Tech, Blacksburg, Virginia, USA*

[3]*Department of Economics, University of Miami, USA*

[4]*BK Econometrics, LLC, Arlington, Virginia, USA*

[5]*Department of Human Nutrition Food and Exercise, Virginia Tech, Blacksburg, Virginia, USA*

[*]**Corresponding author:** Ali Hashemi, Department of Economics and Finance, Ashland University, 401 College Ave, Ashland, OH 44805, USA, Tel: 419.289.5734; E-mail: ahashemi@ashland.edu

**Received date:** February 04, 2015; **Accepted date:** February 20, 2015; **Published date:** February 27, 2015



## Abstract

**Background:** Financial incentives are routinely recommended to attract participants to weight loss programs; however there is a paucity of research that uses a systematic approach to determine incentive packages that may be most beneficial in increasing program reach or participation.

**Methods:** The purpose of this study was to determine monetary incentive designs (in terms of magnitude, form, and timing of payment) that could increase the likelihood of participation in weight loss programs. Participants (n=863) completed surveys to collect stated preferences regarding to the magnitude, timing, and form of monetary incentives as well as willingness to participate in a weight loss program.

**Results:** The results of our model show that, as expected, higher values of monetary incentive will increase the participation. Additionally, more flexible forms of payments (cash or grocery card as compared to gym pass or copay waiver) and more immediate payments (monthly as compared to quarterly payments) will enhance the participation in a weight loss program. Further, our second model, with respondent demographic interaction terms, shows significant differences between various groups of male participants (healthy, overweight, and obese males). This simply means that each group of male participants requires different incentive design to achieve a desired level of participation. The results do not show significant differences in incentive preference across women in different weight categories, which implies that the same monetary incentive design could be used for all women to achieve a given participation rate in a weight loss program.

**Conclusion:** It is critical to carefully construct incentive packages offered in weight loss programs to enhance program reach. A one-size-fit-all weight loss program incentive design that ignores potential nuances in participation decisions are unlikely to be as successful in maximizing programs' reach as programs that provide customized designs to attract different cohorts of people.

**Keywords:** Financial incentives; Weight loss program; Program reach; Stated-preference method

## Background

Obese adults on average spend 48% more inpatient days per year than normal-weight adults [1], are more vulnerable to short-term disability [2], experience more absenteeism from work [3], and exhibit decreased productivity (presenteeism) in the workplace [4,5]. In the U.S., the aggregate annual costs attributable to obesity alone are estimated to be $73.1 billion [6]. These undesirable health and economic consequences have motivated the federal government and employers to invest in various weight loss programs. A growing number of these programs use financial incentives to encourage individuals to participate and lose weight [7,8], but little is known about the impact of the provided monetary incentive on program participation.

The role of financial incentives in stimulating healthy behaviors such as smoking cessation [9,10], gym attendance [11,12] or weight loss [13-15] has been studied, but in the context of weight loss the focus has been on measuring the impact of incentives on the "effectiveness" (weight loss), measured in terms of pounds lost as opposed to "participation" (reach), which would be measured in terms of the program enrollment rate for the target population. While "effectiveness" studies have shown that monetary incentives can stimulate short-term weight loss [8,11,16-18], participation rates have been consistently low (~10%-15%) and participants may not be representative of those who would benefit most from the program (e.g., obese males) [19]. Jeffery [20] reviews research studies evaluating incentivized weight loss programs conducted from 1972 to 2010 and concludes that all existing research has been about volunteers who are already interested in losing weight. Undermining the programs' reach has cast doubts on the efficacy of incentives in the target population when lower participation rates are considered. The positive impact of

monetary incentives on participation choices has been reported in other contexts. For example, it has been shown that prepaid monetary incentives can enhance participation in longitudinal surveys where people are asked to participate in multiple replications of a survey [21]. Few recent studies have examined the impact of monetary incentives on program uptake and reported mixed results. Gingerich et al. [22] examined the impact of financial incentives on behavior change program participation and completion rate and found while the incentive was influential in terms of increasing the completion rate but there were no significant association with program registration. Their finding is in contrast with the results of Farooqui et al. [23] that reported the potential for even modest incentives to improve uptake of walking programs among older adults.

Another point raised by Jeffery [20] is that the efficacy of monetary incentives varies by the size, schedule, and other contextual factors. One limitation of current effectiveness studies is that they have typically used a single monetary incentive so they provide limited insights on how people would respond to a range of incentives that vary in terms of contextual factors. A few recent studies have considered multiple monetary incentives instead of a single one but still they have done it in a limited scope. Finkelstein et al. [24] considered two financial incentive amounts ($7 and $14) and Volpp et al. [25] investigated monetary incentives that varied in terms of form of payment (lottery or deposit) but fixed in terms of the magnitude of the maximum award within each form. In our study, we examine the impact of contextual factors on a different type of response than these effectiveness studies (participation instead of weight loss).

Our study fills these gaps in the literature by investigating the impacts of incentive designs that vary in terms of magnitude, form and timing of payment on the decision to participate in a weight loss program (i.e., reach). Such an investigation is important because ultimately, success of a weight loss program depends not only on the ability to lose and sustain weight (effectiveness), but also on the initial decision to participate (reach). If very few eligible individuals from a target population choose to participate, the weight loss program cannot achieve its most desirable public health impacts even if it is effective for its participants. Our results shed insight on the role of varying the constructs of monetary incentive on decisions to participate in a weight loss program and will inform future clinical trials on how to design their monetary incentives to improve enrollment.

Furthermore, it has been shown that socioeconomic characteristics such as income, race and marital status can influence how people respond to the same amount of monetary incentives [21]. We extend our investigation to consider if different subgroups of participants might respond differently to monetary incentives in terms of their acceptance to participate in a weight loss program. These subgroups are defined based on gender and weight status. Some studies in the obesity literature have shown that men are more likely to be overweight or obese [26], but are underrepresented in weight loss trials [27]. Weight status is another factor that influences participation decisions [28]. Obese individuals are more likely to develop obesity-related diseases such as diabetes and hypertension compared to overweight and normal weight individuals [29,30]. Therefore, it is relevant to design targeted policies in order to reach specific populations. We investigate the role of monetary incentives on gender-based and weight status-based subgroups of potentially at risk individuals.

## Methods

### Conceptual framework

We use a random-parameters logit model to estimate individuals' preference for participating in a weight loss program. The model allows some preference parameters to vary across individuals [31,32] and captures heterogeneity in people's preferences for participation in a weight loss program. We use two different model specifications. The specification, our baseline model, is as follows:

$$U_{ij}=\beta_{0i}\ \text{Constant}+\beta_1\ \text{Value}_j+\beta_{2i}\ \text{Form}_j+\beta_{3i}\ \text{Timing}_j+\varepsilon_{ij}\ ;\ j=1,2,3$$

Where, $U_{ij}$ is an indicator of how pleased is individual i with the offered incentive j. Each individual chooses between Program A and Program B (j=1,2) which are identical weight loss programs with different monetary incentives or chooses to opt-out (j=3). The person will pick the alternative with the highest value of $U_{ij}$.

The constant term will take value of 1 for the opt-out option and -1 for either of the offered incentive designs and captures the overall tendency to not participate independent of the specific incentive characteristics presented. The reason for this way of coding (known as effect coding) of the constant term and other categorical variables is that a clear interpretation of the decision to not participate is possible [33].

For the remaining terms in the equation *Value* is the monetary incentive payment, *Form* is the method of payment and *Timing* is when participants receive the payment. The levels of each of these variables used in the experiment are shown in Table 1.

| Attribute | Level | Value |
|---|---|---|
| **Monetary value** | 1 | $5 (total maximum of $15)* |
| | 2 | $24 (total maximum of $72) |
| | 3 | $55 (total maximum of $165) |
| | 4 | $72 (total maximum of $216) |
| | 5 | $98 (total maximum of $294) |
| **Form of incentive** | 1 | Cash |
| | 2 | Grocery cards |
| | 3 | Gym pass |
| | 4 | Co-pay waiver for doctor visits |
| **Timing of payment** | 1 | Pay at the last follow-up weigh-in (12-month) |
| | 2 | Pay at the end of active program weigh-in (3-month) |
| | 3 | Pay at each weigh-in (3 possible payments) |

**Table 1:** Choice experiment attribute levels.
*Monetary incentives can be paid up to three times (at each weigh-in) in the program

*Value* is coded as a continuous variable, and effect coding is used for the categorical *Form* and *Timing* design features with one variable for each category. The βs are the effects of each of the program characteristics in the experiment to be estimated. Finally, $\varepsilon_{ij}$ represents

the error term that reflects factors that influence participation decisions that are not observable to the empirical investigator.

The random parameter logit model that is used in this study extends the standard logit model by allowing one or more of the parameters in the model to be randomly distributed. One of the advantages of this model over the standard model is that it accounts for preference heterogeneity among respondents even when it is related to unobservables. In our baseline specification, all the parameters are assumed to be randomly distributed except the coefficient of Value ($\beta_1$) which is assumed fixed. This is a standard practice in the stated preference literature mainly for the ease of calculating participants' willingness to accept (the minimum dollar amount a person requires for participation) without losing generality.

The second specification, the Interaction Model, adds a three-way interaction term between the constant, gender and weight status to the baseline model to further consider heterogeneity in preference across selected population groups. It has been discussed in the literature that gender and weight status are personal characteristics that influence weight loss decisions [28]. Unlike the baseline model, the constant in this model is assumed fixed so it can be interacted with other variables.

$$U_{ij}=\beta_0 Constant+\beta_{1i} Valuej+\beta_{2i} Formj+\beta_{3i} Timingj+\beta_4(Constant)(Gender)+\beta_5(Constant)(Weight\ Status)+\beta_6(Constant)(Gender)(Weight\ Status)+\varepsilon_{ij}$$

Where, Gender indicates whether the individual is a male or female; and Weight Status is a categorical variable indicating whether the individual is normal weight, overweight, or obese.

## Study design

We employed a choice experiment technique to support the estimation of preferences for the above described characteristics of the monetary incentives (e.g. magnitude, from and timing of payment) provided by the weight loss programs [32]. Choice experiments have gained popularity in the field of health economics for applications such as the choice of health plans [34], choice of medication [35], preferences for different aspects of health care services [36], preferences in doctor-patient relationship [37] and practitioner preference [38]. Figure 1 shows a sample question from our study which follows a common type of choice question where subjects choose between two or more alternatives and an opt-out option [39,40].

## Survey design

This study was approved by the Virginia Tech Institutional Review Board and the Virginia Tech Center for Survey Research. Phone recruitment followed the approved protocol. Before the survey was implemented two focus groups were conducted with participants from the target population (men and women with at least 18 years of age). The results were used to refine survey content with a specific focus on the description of the weight loss program and the framing of the choice question. Survey participants were asked to indicate their participation choices for a realistic, proposed 3-month weight loss program. The program was described as a package including an initial face-to-face consultation with a dietitian, personalized eating and exercising plans and tracking tools, weekly telephone support calls, monthly weigh-in visits (1st, 2nd, and 3rd months), two follow-up weigh-in visits to monitor maintenance of weight loss after the active 3-month program is completed (6th and 12th months) and a monetary incentive.

11. Please consider the following two weight loss programs.

| | Program A | Program B |
|---|---|---|
| Monetary value of incentive received per weigh-in | $24 | $72 |
| Form of incentive | Cash | Grocery gift cards |
| Timing of incentive payment | Pay at each weigh-in | Pay at the last booster weigh-in (12-month) |
| Total Maximum Amount Earned | $24 + $24 + $24 = $72 in cash | $72 + $72 + $72 = $216 worth of grocery cards |

Which weight-loss program would you choose to participate in? (PLEASE CHECK ONE BOX)

- ☐1 I would choose Program A.
- ☐2 I would choose Program B.
- ☐3 I would not choose either program.

**Figure 1:** Sample choice question.

This type of weight loss program is considered a relative standard program in the weight loss literature. Survey participants were informed that losing 5% of body weight for overweight and obese individuals would greatly reduce the risk of chronic diseases. The 5% was used as the fixed criteria for the eligibility of receiving the monetary incentive; participants were told if they achieved and maintained at least 5% weight loss at each weigh-in, based on their weight at the beginning of the program, they would receive a financial incentive.

Each participant was asked to answer four questions where he/she had to choose between two weight loss programs, differed by monetary incentives designs, and the opt-out alternative (Figure 1). The monetary incentive in the choice questions was defined in terms of three attributes (Table 1): the value of the incentive ($); form of the payment (cash, prepaid grocery card, pre-paid gym pass, and healthcare co-pay waiver); and timing of payment. The participants were told that while they could qualify for the reward at each monthly weigh-in, but the payment of the earned rewards in a program could occur based on the following schedules: at each of the three weigh-ins, at the end of the 3-month program, or at the last follow-up at 12th months.

## Choice experiment design

The experimental design for this study is developed using a modification of the LMA design approach summarized in Johnson et al. [41]. The LMA approach explicitly addresses the fact that each choice set includes a binary-choice design where two alternatives are paired against each other. There are 20 possible binary combinations (permutations) for the first attribute (Value), 12 for the form of payments, and 6 for the timing of payments. To keep the sample size manageable, we assumed the value of monetary incentive to be continuous. We, therefore, randomized the assignment of the 20

possible monetary incentive pairings across the design. The pairings of the attributes "form" and "timing" were drawn from a 72-row main effects (12×6 pairings) orthogonal design using Kuhfeld's on-line design catalog [42].

The 72 program pairings were then divided into 18 survey versions with four choice questions per survey (the decision on the number of choices per respondent were made based on several factors including the number of combinations in the design matrix, the complexity of the choice task for respondents, the amount of other tasks in the survey, and the mode of survey implementation [43-47]. Further constraints such as survey length limit and the specific needs of low income and low education level target population were considered in determining the proper number of choices in this study. The final design was evaluated in the focus groups). The survey versions were randomly assigned to participants.

## Survey implementation

Survey participants were recruited using random-digital dialing and those who agreed to participate in the study were mailed the survey. In order to oversample overweight and obese population, the survey's sampling frame targeted counties with higher obesity rates (around 60% as compared to 28% state average).

The phone recruitment and survey mailing were conducted by the Virginia Tech Center for Survey Research. Potential participants were screened over the phone to ensure eligibility (i.e., at least 18 years old). Individuals provided self-reported weight and height and research staff used this information to calculate Body Mass Index (BMI) for each individual.

The recruitment goal for the telephone survey was to have about 300 normal weight adults (normal weight individuals were told to treat the program as a weight control program that would help them maintain their healthy weight) and about 1,200 overweight or obese adults (with equal split among the two groups) agree to participate in the follow-up mail survey. A total of 1,500 surveys were mailed in 2009-2010. No follow-up calls or secondary mailings were used. We received 863 complete and usable surveys, which is a 60% completion rate for the mail survey.

## Respondent characteristics

Table 2 reports the characteristics of mail survey respondents in male and female subsamples as well as in the full sample. Because of the oversampling of the overweight and obese individuals, the demographic distribution of respondents is expected to differ from Virginia census figures. There are more obese people and more Caucasians in our sample (39%, and 84%, respectively) comparing to census.

In terms of gender, there are more women than men (67% vs. 33%). The average age of participants was 55 and majority of them had at least some college education. Approximately half (48%) of female respondents were not working at the time of the survey either because they were retired, unemployed, students or unpaid home workers. This ratio is 40% in the male subsample. Males also earn more than female respondents on average.

Male and female subsamples are also different in terms of the ratio of overweight and obese participants. Nearly half of all male respondents (49%) were overweight and 35% were obese. In contrast, fewer females were overweight (35%) and more were obese (41%).

| Variables | Male (%) | Female (%) | Full Sample (%) |
|---|---|---|---|
| | (n=273) | (n=581) | (n=863) |
| **Race** | | | |
| Caucasian | 87 | 83 | 84 |
| African American | 7 | 13 | 11 |
| Other | 6 | 4 | 5 |
| **Age (in years)** | | | |
| 18-29 | 4 | 5 | 5 |
| 30-39 | 4 | 11 | 9 |
| 40-49 | 19 | 20 | 20 |
| 50-59 | 31 | 25 | 27 |
| >60 | 42 | 38 | 39 |
| **Education** | | | |
| High school and less | 27 | 28 | 28 |
| Some college | 24 | 32 | 29 |
| College graduate | 25 | 22 | 23 |
| Postgrad degree | 24 | 18 | 20 |
| **Employment status** | | | |
| Full-time employed | 55 | 39 | 44 |
| Part-time employed | 5 | 13 | 10 |
| Unemployed | 5 | 4 | 5 |
| Retired | 32 | 23 | 26 |
| Student | 1 | 1 | 1 |
| Unpaid homemaker | 0 | 15 | 10 |
| On disability | 2 | 5 | 4 |
| **Income** | | | |
| 30k or less | 15 | 22 | 20 |
| 30k-75k | 30 | 42 | 38 |
| 75k-120k | 32 | 22 | 25 |
| 120k or more | 22 | 14 | 17 |
| **Body Mass Index** | | | |
| Normal | 16 | 25 | 22 |
| Overweight | 49 | 35 | 39 |
| Obese | 35 | 41 | 39 |

**Table 2:** Summary statistics for mail survey respondents.

## Results

Table 3 reports results from the baseline model and also the interaction model with gender and weight category terms.

| | **Baseline Model** | | **Interaction Model** | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| Constant | -0.141 | 2.464*** | 0.438*** | |
| | (0.132)[a] | (0.155) | (0.040) | |
| Total Monetary Value | 0.010***[b] | | 0.006*** | |
| | (0.001) | | (0.000) | |
| **Pay form (Base: Copay waiver)** | | | | |
| Cash | 0.770*** | 0.920*** | 0.538*** | 0.504*** |
| | (0.083) | (0.125) | (0.055) | (0.116) |
| Grocery card | 0.707*** | 1.038*** | 0.501*** | 0.793*** |
| | (0.080) | (0.131) | (0.060) | (0.097) |
| Gym pass | -0.455*** | 1.060*** | -0.290*** | 0.815*** |
| | (0.078) | (0.139) | (0.062) | (0.110) |
| Copay waiver[c] | -1.022*** | | -0.750*** | |
| | (0.117) | | (0.082) | |
| **Timing of payment (Base: payment at 12 month)** | | | | |
| Payment at each weigh-in | 0.330*** | 0.512*** | 0.205*** | 0.404*** |
| | (0.058) | (0.116) | (0.045) | (0.087) |
| Payment at 3-months | 0.137* | 0.161 | 0.078 | 0.033 |
| | (0.065) | (0.113) | (0.052) | (0.568) |
| Payment at 12-monthsc | -0.467*** | | -0.283*** | |
| | (0.069) | | (0.049) | |
| **Gender Interaction** | | | | |
| Constant × female | | | -0.053* | |
| | | | (0.023) | |
| **BMI interaction (Base: Normal individuals)** | | | | |
| Constant×overweight | | | -0.024 | |
| | | | (0.030) | |
| Constant×obese | | | -0.110*** | |
| | | | (0.032) | |
| Constant×overweight×female | | | 0 | |
| | | | (0.030) | |
| Constant×obese×female | | | 0.092** | |
| | | | (0.032) | |
| Log likelihood | -2,576 | | -3,006 | |
| Observations | 9,726 | | 9,726 | |

**Table 3:** Random parameter logit model results.
a. Robust standard errors in parentheses
b. *p<0.1; **p<0.05; ***p<0.01
c. The mean coefficients for the base categories were recovered as the negative sum of the estimated coefficients for the included levels. For example, the mean coefficient for copay waiver under Baseline Model was recovered through: -(-0.455+0.707+0.770) = -1.022.

Key results pertaining to program participation are nearly identical across the two models. Both models indicate that individuals are more likely to participate if they receive a higher monetary incentive, and this result is robust to the inclusion/exclusion of gender and weight status interaction terms (We also checked for the robustness of our results in the following cases: 1) after excluding the normal weight individuals from the sample 2) after excluding the responses received from each version of the survey from the sample (Version effect). In both cases our results remained robust).

Results show that cash and grocery cards are preferred to the gym pass and insurance co-pay waiver ($p$<0.00 in both models), while the preference towards cash and grocery cards are not statistically different ($p$=0.58 in model 1 and $p$=0.66 in model 2). Furthermore, the gym pass is also significantly preferred to the insurance co-pay waiver ($p$<0.00 in both models). Thus, individuals respond favorably to more flexible financial incentives. Payment at 12-months is the least preferred timing while payment at each weigh-in is the most preferred timing, indicates that frequent payments are preferred. Thus, results show that for a given amount of incentives, individuals would prefer to be paid more often, which may reflect the desire to receive reward recognition during the process or simply a time preference for money sooner.

The standard deviation estimates generated by the random parameter logit models enable us to investigate heterogeneity in preferences for attributes across individuals. The estimated standard deviations are significant for all three payment forms, which indicate subjects have differing preferences for each payment form.

The estimated standard deviation of the constant term in the baseline model exhibits significant preference heterogeneity. In the interaction model, the coefficient of the constant term, $\beta_0$, is positive and significant which signals a significant preference towards opt-out for people in the reference group (e.g. healthy male participants) in the absence of incentives. All interaction terms in Model 2 are statistically significant, which shows considerable heterogeneity in participation preferences across gender and weight status.

The inclusion of gender and weight-status interactions with the opt-out constant enables comparisons of the unobserved preferences toward program participation that are not captured by incentive attributes across six subgroups of participants. In other words, it reveals whether those six subgroups respond differently to a weight loss program with similar incentive constructs (i.e. same magnitude, form and same payment frequency). This will further inform whether a single take-it or leave-it incentivized program option is able to achieve desirable program reach. In Table 4 we report the results of pairwise group comparisons across different groups of gender and weight status. The results show that participation preferences beyond the incentive attributes we are studying are significantly different when comparing females of any weight status with normal weight males. Healthy female participants are less likely to opt-out from the program than healthy male participants. Comparing overweight and obese female participants with overweight or obese male participants does not show statistically significant differences. All the pairwise comparisons across different groups of male participants are

significant. Overweight males are more likely to participate than healthy males, and similarly, obese males are more likely to participate than overweight males. This signals significant preference heterogeneity across males with different weight status. This pattern does not exist among female participants. Females, regardless of their weight status, expressed similar preference for participation in the program.

| | | | Group B | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Normal weight | | Overweight | | Obese | |
| | | | Male | Female | Male | Female | Male | Female |
| Group A | Normal weight | Male | - | -0.290***a (0.001)b | -0.250*** (0.007) | -0.356*** (0.000) | -0.428*** (0.000) | -0.351*** (0.000) |
| | | Female | | - | 0.040 (0.576) | -0.066 (0.314) | -0.138* (0.086) | -0.061 (0.335) |
| | Overweight | Male | | | - | -0.105 (0.121) | -0.178* (0.031) | -0.101 (0.126) |
| | | Female | | | | - | -0.072 (0.351) | 0.005 (0.936) |
| | Obese | Male | | | | | - | 0.077 (0.309) |
| | | Female | | | | | | - |

**Table 4:** Comparing the coefficient of the constant term across groups of Gender and Weight Status.
a: The number in each cell shows the coefficient of the constant term in Group A minus that in Group B. *p<0.1;**p<0.05; ***p<0.01.
b: Standard deviation (in parenthesis) is calculated using bootstrap with 100 replications.

We use a simple graphical representation to show the aforementioned within-gender heterogeneity. Figure 2 shows the predicted participation rates for males and females of different weight status when they were offered cash payments at each weight-in. The wider spread of participation curves for males (left panel) comparing to females (right panel) in this figure shows larger preference differences across groups of male participants (normal, overweight, and obese) than their female counterparts.

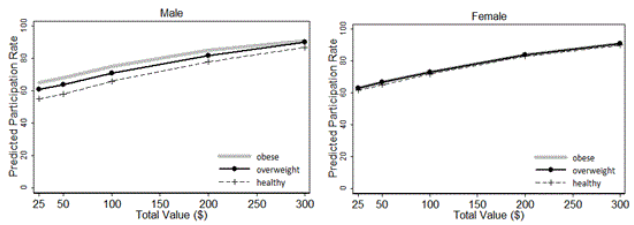


**Figure 2:** Predicted participation rates by weight status for males and females with cash payments at each weigh-in.

This finding is important as it reveals that offering the similarly constructed incentivized weight loss program for healthy, overweight, or obese female participants might not be an issue as it would be for males. When it comes to male participants, achieving the optimal participation rates requires taking into account the significant preference differences among healthy, overweight, and obese males.

## Discussion

The potential public health impact of incentivized weight loss programs can be limited by low reach and poor representativeness of participants from at risk groups. Having a better understanding of how different incentive packages influence people's decision to participate in a program can lead to more successful incentivized weight loss trials, and ultimately more successful weight loss programs with better reach.

Our findings confirm that larger monetary incentive amounts will lead to higher reach of weight loss programs. But more importantly, we find that for a given incentive amount, weight loss programs with different incentive packages can achieve different participation rates. The programs with immediate incentive payments (i.e., pay at each weigh-in) are likely to deliver higher participation rates (reach) than programs with deferred payments. Not surprisingly, payment forms that give people more usage flexibility, such as cash or grocery cards, are more likely to induce higher participation.

Furthermore, we find that there is unobserved preference heterogeneity among some subgroups and therefore offering the same incentive package would not have the same effect across these groups. The incentive that encourages an obese male to participate in a weight loss program will not be as effective among overweight or healthy males. However, this is not an issue for females who generally show a more homogeneous preference toward participation. This simply means that offering similar incentive packages is less likely to affect a program's reach among female subgroups while it can negatively influence the reach among the males.

Our findings also suggest that it may be more cost-effective to tailor monetary incentives by pairing desirable payment forms and timing of payments for a given incentive amount. The current general practice

in randomized control trials is to use large monetary incentives with limited variation in form and timing. Besides failing to accomplish the potential reach of a weight loss program, these trials are likely to overestimate the dollar amount of incentive needed. The excess incentive amount offered by these programs may hinder the sustainability of weight loss programs-an issue that is currently discussed in the Motivation Crowding Theory literature [43].

## Conclusion

Current studies in the literature have mainly focused on the role of monetary incentives on the effectiveness of weight loss programs rather than on program reach. Additionally, these studies usually examine a single amount of monetary incentive rather than comparing multiple incentives packages (varying in magnitude, forms and timing of payments). Tailoring the design of monetary incentives to target population is understudied. This paper contributes to the literature by addressing these issues. We studied the role various designs of monetary incentive (defined by random combinations of incentive attributes such as magnitude, form, and timing of payment) on people's decision to participate in a weight loss program.

We find that higher values of monetary incentives will have statistically significant positive affect on program reach. This is consistent with economic theory and earlier empirical findings. Our study, in response to a recent call by Jeffery [20], contributes further to the literature by evaluating the influence of contextual factors such as form and schedule of payments on incentive's degree of success. First, given a fixed amount of monetary incentive, immediate payments (as opposed to delayed ones) that are easily fungible in peoples' daily lives (such as cash and grocery cards) will achieve significantly higher participation rates. Furthermore, for programs that target males, different incentive packages should be offered to different weight status groups in order to achieve the program's potential reach. Females, on the other hand, in their participation decision respond uniformly to program incentives. Therefore, offering a single incentive package to healthy, overweight, and obese females would not negatively influence the program's reach. Overall, our results provide a better understanding of the role of incentive packages in enhancing weight loss programs reach. These results can be used in calibration of monetary incentives for randomized control trials to develop more successful weight loss programs with more participants from at-risk subgroups.

## Authors' Contributions

AH and WY conducted literature search. AH, WY, KJB, and CP performed statistical analyses. All authors (AH, WY, KJB, CFP, BK, and PAE) were involved in the manuscript development and its revision. All authors read and approved the final manuscript.

## Acknowledgment

This study is supported in part by Virginia Agricultural Experiment Station.

## References

1. Thompson D, Brown JB, Nichols GA, Elmer PJ, Oster G (2001) Body mass index and future healthcare costs: a retrospective cohort study. Obes Res 9: 210-218.
2. Arena VC, Padiyar KR, Burton WN, Schwerha JJ (2006) The impact of body mass index on short-term disability in the workplace. J Occup Environ Med 48: 1118-1124.
3. Tsai SP, Wendt JK, Ahmed FS, Donnelly RP, Strawmyer TR (2005) Illness absence patterns among employees in a petrochemical facility: impact of selected health risk factors. J Occup Environ Med 47: 838-846.
4. Burton WN, Chen CY, Conti DJ, Schultz AB, Pransky G, et al. (2005) The association of health risks with on-the-job productivity. J Occup Environ Med 47: 769-777.
5. Ricci JA, Chee E (2005) Lost productive time associated with excess weight in the U.S. workforce. J Occup Environ Med 47: 1227-1234.
6. Finkelstein EA, DiBonaventura Md, Burgess SM, Hale BC (2010) The costs of obesity in the workplace. J Occup Environ Med 52: 971-976.
7. Cawley J, Ruhm CJ (2011) The Economics of Risky Health Behaviors. Handb Heal Econ 2: 95-199.
8. Gneezy U, Meier S, Rey-Biel P (2011) When and Why Incentives (Don't) Work to Modify Behavior. J Econ Perspect 25: 191-210.
9. Dallery J, Glenn IM (2005) Effects of an Internet-based voucher reinforcement program for smoking abstinence: a feasibility study. J Appl Behav Anal 38: 349-357.
10. Giné BX, Karlan D, Zinman J (2010) Put Your Money Where Your Butt Is?: A Commitment Contract for Smoking Cessation. Am Econ J Appl Econ 2: 213-235.
11. Charness G, Gneezy U (2009) Incentive to Exercise. Econometrica 77: 909-931.
12. Royer H, Stehr M, Sydnor J (2012) Incentives, Commitments and Habit Formation in Exercise: Evidence from a Field Experiment with Workers at a Fortune-500 Company. NBER Work Pap Ser 47.
13. Paloyo AR, Reichert AR, Reinermann H, Tauchmann H (2014) The Causal Link Between Financial Incentives and Weight Loss: an Evidence-Based Survey of the Literature. J Econ Surv 28: 401-420.
14. Cawley J, Joshua A Price (2011) Outcomes in a Program that Offers Financial Rewards for Weight Loss. In: Economic Aspects of Obesity, National Bureau of Economic Research, Inc. 91-126.
15. Finkelstein EA, Hoerger TJ (2010) Can fiscal approaches help to reduce obesity risk? In Obes Epidemiol. (2nd edn). Oxford: Oxford University Press.
16. Kane RL, Johnson PE, Town RJ, Butler M (2004) A structured review of the effect of economic incentives on consumers' preventive behavior. Am J Prev Med 27: 327-352.
17. Kane RL, Johnson PE, Town RJ, Butler M (2004) Economic incentives for preventive care. Evid Rep Technol Assess (Summ) : 1-7.
18. Paul-Ebhohimhen V, Avenell A (2008) Systematic review of the use of financial incentives in treatments for obesity and overweight. Obes Rev 9: 355-367.
19. Madison KM, Volpp KG, Halpern SD (2011) The law, policy, and ethics of employers' use of financial incentives to improve health. J Law Med Ethics 39: 450-468.
20. Jeffery RW (2012) Financial incentives and weight control. Prev Med 55 Suppl: S61-67.
21. Martin E, Abreu D, Winters F (2001) Money and Motive: Effects of Incentives on Panel Attrition in the Survey of Income and Program Participation. J Off Stat 17:267–284.
22. Gingerich SB, Anderson DR, Koland H (2012) Impact of financial incentives on behavior change program participation and risk reduction in worksite health promotion. Am J Health Promot 27: 119-122.
23. Farooqui MA, Tan YT, Bilger M, Finkelstein EA (2014) Effects of financial incentives on motivating physical activity among older adults: results from a discrete choice experiment. BMC Public Health 14: 141.
24. Finkelstein EA, Linnan LA, Tate DF, Birken BE (2007) A pilot study testing the effect of different levels of financial incentives on weight loss among overweight employees. J Occup Environ Med 49: 981-989.
25. Volpp KG, John LK, Troxel AB, Norton L, Fassbender J, et al. (2008) Financial incentive-based approaches for weight loss: a randomized trial. JAMA 300: 2631-2637.

26. Flegal KM, Carroll MD, Ogden CL, Curtin LR (2010) Prevalence and trends in obesity among US adults, 1999-2008. JAMA 303: 235-241.
27. Pagoto SL, Schneider KL, Oleski JL, Luciani JM, Bodenlos JS, et al. (2012) Male inclusion in randomized controlled trials of lifestyle weight loss interventions. Obesity (Silver Spring) 20: 1234-1239.
28. Benedict MA, Arterburn D (2008) Worksite-based weight loss programs: a systematic review of recent literature. Am J Health Promot 22: 408-416.
29. Guh DP, Zhang W, Bansback N, Amarsi Z, Birmingham CL, et al. (2009) The incidence of co-morbidities related to obesity and overweight: a systematic review and meta-analysis. BMC Public Health 9: 88.
30. Malnick SD, Knobler H (2006) The medical complications of obesity. QJM 99: 565-579.
31. Swait J (2007) Advanced Choice Models. In: Valuing Environ Amenities Using Stated Choice Studies. Volume 8. Edited by Kanninen B. Springer Netherlands. 229-293.
32. Train K (2003) Discrete Choice Methods with Simulation. Cambridge University Press.
33. Bech M, Gyrd-Hansen D (2005) Effects coding in discrete choice experiments. Health Econ 14: 1079-1083.
34. Harris K, Schultz J, Feldman R (2002) Measuring consumer perceptions of quality differences among competing health benefit plans. J Health Econ 21: 1-17.
35. Bingham MF, Johnson FR, Miller D (2001) Modeling choice behavior for new pharmaceutical products. Value Health 4: 32-44.
36. Moayyedi P, Wardman M, Toner J, Ryan M, Duffett S (2002) Establishing patient preferences for gastroenterology clinic reorganization using conjoint analysis. Eur J Gastroenterol Hepatol 14:429–433.
37. Vick S, Scott A (1998) Agency in health care. Examining patients' preferences for attributes of the doctor-patient relationship. J Health Econ 17: 587-605.
38. Wordsworth S, Skåtun D, Scott A, French F (2004) Preferences for general practice jobs: a survey of principals and sessional GPs. Br J Gen Pract 54: 740-746.
39. Brown DS, Finkelstein EA, Brown DR, Buchner DM, Johnson FR (2009) Estimating older adults' preferences for walking programs via conjoint analysis. Am J Prev Med 36: 201-207.
40. Paterson RW, Boyle KJ, Parmeter CF, Neumann JE, De Civita P (2008) Heterogeneity in preferences for smoking cessation. Health Econ 17: 1363-1377.
41. Johnson FR, Kanninen B, Bingham M, Özdemir S (2007) Experimental Design For Stated-Choice Studies. In Valuing Environ Amenities Using Stated Choice Studies. Volume 8. Edited by Kanninen B. Springer Netherlands. 159–202.
42. SAS Technical Support Notes (2009), available at: http://support.sas.com/techsup/technote/ts723_Designs.txt
43. Frey BS, Jegen R (2001) Motivation Crowding Theory. J Econ Surv 15:589–611.
44. Lancsar E, Louviere J (2008) Conducting discrete choice experiments to inform healthcare decision making: a user's guide. Pharmacoeconomics 26: 661-677.
45. Boxall P, Adamowicz WL, Moon A (2009) Complexity in choice experiments: Choice of the status quo alternative and implications for welfare measurement. Aust J Agric Resour Econ 53:503–519.
46. Bech M, Kjaer T, Lauridsen J (2011) Does the number of choice sets matter? Results from a web survey applying a discrete choice experiment. Health Econ 20: 273-286.
47. de Bekker-Grob EW, Ryan M, Gerard K (2012) Discrete choice experiments in health economics: a review of the literature. Health Econ 21: 145-172.