


The Impact of Incentives on Weight Control in Men: A Randomized Controlled Trial

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Abstract

Overweight and obese men were recruited to a 6-month, randomized controlled weight loss trial, which compared the Gutbusters weight loss program alone to the Gutbusters program with incentives for successful weight loss. The intervention was delivered primarily online, with weekly in-person weight collections. Gutbusters was designed using a template from the REFIT intervention and encouraged participants ($N = 102$, 47.0 ± 12.3 years, 32.5 kg/m^2) to make six 100-calorie changes to their typical daily diet for a total of 42 changes per week. Weight loss was significantly greater in the Gutbusters+Incentive group compared to the Gutbusters alone group at both 12 and 24 weeks (p 's $< .01$). The Gutbusters+Incentive group's a mean weight loss was 9.9 pounds at 12 weeks (95% CI: 6.9, 12.9) and 8.4 pounds at 24 weeks (95% CI: 3.9, 13.0). The Gutbusters alone group mean weight loss was 3.7 pounds at 12 weeks (95% CI: $-.06$, 7.5) and 3.4 pounds at 24 weeks (95% CI: -2.2 , 9.0). This study adds to the literature of behavioral weight programs that are designed for men. Unlike the majority of previous male weight loss interventions, which were designed with an intervention comparison to a no treatment or waitlist control, Gutbusters was implemented as a comparative effectiveness trial, which will help bolster the evidence base for real-world application.

Keywords

Obesity, behavioral issues, nutrition, general health and wellness, behavioral research, research

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Approximately 300,000 adult deaths are attributable to obesity each year in the United States (Allison et al., 1999; Lancet, 2002). Men and women have similar overall rates of obesity, but the combined prevalence of overweight/obesity is much higher among men (74.1%) compared to women (64.5%) for all age groups (Flegal et al., 2012). Men who are overweight are a high-risk group for many obesity-related chronic diseases, as they are more likely to carry excess weight in the abdomen, which is generally more harmful than weight stored in the lower body (Wardle et al., 2004). Unfortunately, men are less likely than women to perceive themselves as overweight and are not likely to sense that they are overweight until they reach a substantially higher BMI threshold than women, and thus are less likely to initiate weight loss through organized weight loss programs (Gregory et al, 2008).

A review of weight loss trials reported that, on average, 27% of participants were men (Pagoto et al., 2012). It has been reported that men may perceive too many barriers to

weight loss and that current weight management programs do not appeal to them. Men have conveyed that they desire programs that are convenient, include other relatable participants, and offer individualized feedback (Sabinsky et al., 2007). Men have also stated a preference to avoid strict meal plans and would like the autonomy to customize their diet based on preferences (Gough, 2007; Sabinsky et al., 2007; Wolfe & Smith, 2002). Constructing weight loss interventions that explicitly accommodate their reported needs and preferences may help improve male recruitment as well as commitment and satisfaction

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(Hunt et al., 2014; Robertson et al., 2017). Failure to lose weight, however, is not the reason men steer clear of organized weight loss programs. In fact, research has demonstrated that men often lose as much weight, if not more, than women in the same programs (R. L. Williams et al., 2014).

Despite these few known preferences for weight loss program components, the weight loss literature specific to programs primarily for men is quite limited. The literature is relatively new and current available studies represent huge variations in treatment approach. Most study designs have relied on intervention comparison to no treatment controls rather than comparative effectiveness trials and most did not have adequate retention or use intent-to-treat (Young et al., 2012). Overall, this suggests that there is ample room for interventions that utilize more scientific rigor while also implementing innovation to improve outcomes for men.

Incentives in Weight Management

Incentives are an effective tool to motivate behavior change. There is ample evidence to support the use of incentives as beneficial in encouraging many health-promoting behaviors, such as weight loss, physical activity, and smoking cessation (Giles et al., 2014).

Incentives work based on two theoretical ideas: operant conditioning and behavioral economics. Based on operant learning theory, incentives can be used as a type of behavioral reinforcement. They can be positive (receipt of an incentive for a positive behavior) or negative (removal of an incentive for a negative behavior) (Skinner, 1953). Behavioral economics theorizes that people like to behave in ways to maximize benefits and minimize costs. These costs and benefits can be financial, emotional, or psychological. Increasing the benefits associated with behaviors like weight loss may outweigh the difficulty of making better health decisions, such as choosing a food that is lower in calories but less enjoyable. Financial incentives take many forms, including deposit contracts, lottery systems, and direct payments, and can be used to reward process measures (such as attendance at a health class) or outcome measures (meeting a weight loss goal) (Hall, 2008; Schmidt et al., 2012). Monetary incentives undoubtedly work in improving weight outcomes on a short-term basis in mixed gender studies (Finkelstein et al., 2007, 2017; Jeffery, 2012; Jeffery et al., 1993; John et al., 2011) though they have not yet been tested as an adjunct to a men's weight loss program. There is a need to test how motivation enhancement strategies could be added to men's weight loss to enhance participation. Women typically report losing weight as more important to them than men do and report the willingness to do more to achieve weight loss than men (Harris et al., 1990). Therefore, incentivizing weight

loss for men could provide an appropriate motivator to enhance behavior change.

Despite evidence supporting use of incentives in health promotion, no studies were identified that tested whether incentives could be used to enhance weight loss in men. It was hypothesized that men randomized to the incentive arm (Gutbusters+Incentive) would have greater weight losses at 12 and 24 weeks compared to the nonincentive group (Gutbusters alone). Additionally it was hypothesized that men in the incentive arm would have greater reductions in total body fat and waist circumference.

Methods

Participants

Participants were recruited from in and around the University of Vermont campus through email, printed recruitment posters, online advertisements to the university community, Facebook users in the Burlington area, and two local newspaper ads between March and December 2017. To be eligible, men had to be between the ages of 18–65 years with a body mass index (BMI) between 25 and 40 kg/m². Participants were required to have regular Internet access and have no known medical condition that would put them at risk when losing weight, changing their diets, or participating in physical activity. Men were excluded if they had weight loss greater than 10 pounds in the previous 6 months, were currently participating in another weight loss program, had plans to leave Vermont in the 6 months following recruitment, had a significant mental illness diagnosis or hospitalization, or were currently being treated for cancer.

Recruitment materials directed potential participants to a study website which contained a brief study description and screening questionnaire. The questionnaire collected basic demographic information, self-reported height and weight, major exclusion criteria based on health history, and contact information. Potential participants completed the initial screening questionnaire and then were contacted for final screening and in-person orientation scheduling. At orientation, participants gave written informed consent and were briefed on all study procedures, including the incentive scheme. Following orientation, participants were randomized to the Gutbusters+Incentive condition or Gutbusters alone group using a random online number generator with a 1:1 ratio. In-person assessments were conducted at baseline, 12 weeks, and 24 weeks. All participants were paid \$25 USD to complete each of the three assessments, for a total of \$75 USD.

All study procedures were reviewed and approved by the University of Vermont Institutional Review Board (CHRBSS:16-587) for human research in the behavioral and social sciences.

Weight Loss Treatment

Gutbusters Program Description. Both study conditions received the identical online intervention. Only the presence of incentives differed. The Gutbusters intervention was designed using a modified version of the REFIT program developed by Crane et al. (2015). The program was designed for men to have autonomy on the eating and exercise behaviors they would like to adjust, within a structured program, with the goal of long term adherence. The REFIT program was designed to utilize social cognitive theory (Bandura, 1991) and self-determination theory (Ryan & Deci, 2000) constructs, which have been used previously in successful weight loss interventions (Burke et al., 2012; Clark et al., 1991; Crane et al., 2016; Sallis et al., 1988; Teixeira et al., 2006; Webber et al., 2010; G. C. Williams et al., 1996).

The goal of the Gutbusters intervention, similar to the REFIT program, was to reduce daily caloric intake by making six 100-calorie adjustments to their typical daily diet (for a total of 600 calories per day, or 4,200 calories per week) with the goal to produce 1–2 pounds of weight loss per week. The weight loss program included two major components, weekly face-to-face weigh-ins and an online program, which included weekly reports of behaviors and access to online lessons. In order to guide participants in how to make these 100-calorie adjustments, a Gutbusters website was created with 13 written lessons focusing on different eating behaviors and activities all of which could be used to reach the goal of making 100-calorie changes. These lessons were available all at once and included information on portion sizes, caloric beverages, modifying eating in fast food and restaurant environments, increasing fruit and vegetable consumption, snacking, eating while watching television, walking for weight management, reducing fat, establishing consistent meal patterns, limiting sweets, managing meat consumption, and eating in social situations. Lessons could be accessed at any time by participants and could be printed for use offline, if desired. Many of these same lessons were used in the REFIT program and utilized traditional weight loss behaviors that have been implemented in other successful weight loss interventions (DPPRG, 2002). The majority of the lessons focused on behavioral changes related to diet and one lesson provided information on walking as a way to create a calorie deficit (the message was that walking 1 mile burns approximately 100 calories).

For the first 12 weeks of the intervention, participants were asked each week in an online survey to report the number of 100-calorie diet changes from the previous week, as well as select the two to three Gutbusters lessons they wanted to focus on for the subsequent week. Participants were given the option each week to select two to three behaviors/lessons to focus on, with the understanding that not all of the selected behaviors

needed to be completed each day. If the participant had not completed the online check-in by mid-week, an email reminder was sent. If it was not completed by the following week's weight collection, they were encouraged in person, while attending their weekly weigh-in, to complete the online check-ins.

Weights were collected in person each week for the first 12 weeks on campus at the University of Vermont. Individualized feedback was emailed to each participant following his weight collection, including baseline assessment weight for reference. The online check-in was completed using the Gutbusters website and an online survey platform, LimeSurvey.

Between the 12 week and 24 week assessments, participants had access to the Gutbusters website with the 13 lessons but had no contact with study staff.

Incentive Structure. The Gutbusters+Incentive group received the full Gutbusters intervention described above and were eligible to earn a weekly monetary incentive for successful weight loss (defined as a loss of at least one pound from the previous week). The Gutbusters alone group was not paid for any weight loss.

During the Gutbusters intervention, the Gutbusters+Incentive group could earn a weekly incentive. This incentive schedule involved escalating rewards each week with a reset contingency. At the week one weight collection, participants received \$4.00 if they had lost one pound since their baseline assessment the previous week. Each week the incentive increased by \$4.00 USD if they lost an additional pound (\$8.00 USD for week two, \$12.00 USD for week three, etc.). The reset contingency meant that if the participant did not meet the weekly weight loss goal, they earned \$0.00 USD at that weekly visit and the amount of money earned at the subsequent visit returned to the initial \$4.00 USD. Participants then had to work their way back to the normal pay scale after 2 weeks of successful weight loss (earning \$4.00 USD 1 week and then \$8.00 USD the next before returning to the original payment for the appropriate week). This schedule was designed to help participants build consistency in their behaviors. This schedule has been effectively utilized in a smoking cessation trial as well as a weight management intervention (Pope & Harvey-Berino, 2013; Roll et al., 1996).

Outcome Measures

The Gutbusters program included three assessment time points (baseline, 12 weeks, and 24 weeks). The primary outcome was weight change at 12 and 24 weeks. Secondary outcomes were changes in waist circumference and percent body fat. All measures below were collected at baseline, 12 weeks, and 24 weeks unless

otherwise noted. Assessors were not blinded to treatment assignment.

Demographic Information. Demographic information including age and years of education was collected at baseline.

Anthropometrics. Weight was measured to the nearest 0.1 lb on a calibrated digital scale (Tanita BF-684W), which was also used to measure body fat percentage. Height was measured to the nearest 0.25" using a wall-mounted stadiometer. Waist circumference (inches) was measured with a cloth tape measure at the umbilicus. Weight change was calculated as change from baseline at 12 weeks and 24 weeks. Percentage of baseline weight was calculated by dividing the number of pounds lost by the baseline weight and multiplying by 100 for each individual participant. Percentage of weight was also used to classify participants on whether or not they had achieved a clinically significant weight loss of 5% of their initial weight at each time point (Jensen et al., 2013).

Questionnaires. *Weight Efficacy Lifestyle Questionnaire (WEL)* is a measure of self-efficacy for controlling eating in a variety of situations. The five subscales are negative emotions, availability, social pressure, physical discomfort, and positive activities (Clark et al., 1991). This questionnaire has demonstrated high internal consistency when given to men in a behavioral weight loss program (Linde et al., 2004).

Godin Leisure-Time Exercise Questionnaire (GLTEQ) is a self-report measure used to quantify overall mild, moderate, and strenuous physical activity in a 7-day period. The GLTEQ is widely used in a variety of populations and has been determined to be an appropriate measurement tool based on test-retest reliability compared to other physical activity questionnaires and CALTRAC accelerometer data (Jacobs et al., 1993). Activity scores of 24 units and more classify an individual as active, 14–23 units qualify as moderately active, and scores of 13 units and less qualify as inactive (Godin, 2011).

Treatment Self-Regulation Questionnaire (TSRQ) is designed to assess different forms of motivation within self-determination theory. There are three separate subscales: autonomous motivation, externally controlled motivation, and amotivation. This questionnaire has exhibited high levels of internal consistency and is a common tool for measuring motivation for weight loss (Webber et al., 2010).

Process Measures

Program utilization (number of weekly online check-ins and selection of Gutbusters lessons through the LimeSurvey platform) was calculated from participants'

saved weekly online check-in responses. Additionally, program utilization was measured based on number of in-person weekly weigh-ins.

Statistical Analysis. The anticipated effect size for the Gutbusters intervention was determined based on the results from the previous REFIT intervention (Crane et al., 2015). In order to have sufficient power to detect a statistically significant 4.0 kg difference between the two groups at 12 and 24 weeks with a standard deviation of 6.6 kg within each group, 44 participants were required in each group. The initial aim was to recruit 20% more participants to account for reasonable attrition, giving us a total of 106 participants. Due to time constraints, recruitment concluded at 102 participants, which allows for 15% loss to attrition.

Data were analyzed using IBM SPSS Statistics Version 23. Linear mixed models were used to analyze all available data from weight, waist circumference, and percent body fat measurements across the three time point of this study. A completers' analysis was also conducted and included participants who attended all three assessments ($n = 58$). Descriptive statistics were used to describe the demographic data and assess differences in baseline characteristics between the two groups. Chi-squared and t -tests were used to examine group differences at baseline, 12 weeks, and 24 weeks. Linear mixed models were also used to assess all questionnaire data.

Results

The flow of participants through the study is illustrated in Figure 1. A total of 432 individuals visited the recruitment website and 251 men (58.1%) filled out the screening questionnaire. In total, 129 (29.9%) were eligible for the study; however, 27 (6.3%) were excluded prior to randomization, primarily due to not attending the orientation session. In total, 102 (23.6%) men attended orientation and completed baseline assessments. Seventy-five men (73.5%) attended the 12-week assessment visit and 58 (56.7%) attended the 24-week assessment.

Baseline demographics are presented in Table 1. There was no statistical difference between the treatment groups at baseline. Overall, subjects were 47.0 ± 12.3 (M \pm SD) years of age with an average weight of 220.9 ± 40.3 lbs and mean BMI of 32.5 kg/m^2 . The majority of participants had at least 2 years of college ($n = 91$, 89%). Race was not collected; however, the majority of participants appeared Caucasian.

Weight Loss and Secondary Outcomes

Table 2 presents baseline values as well as values at 12 and 24 weeks for weight, percent body fat and waist

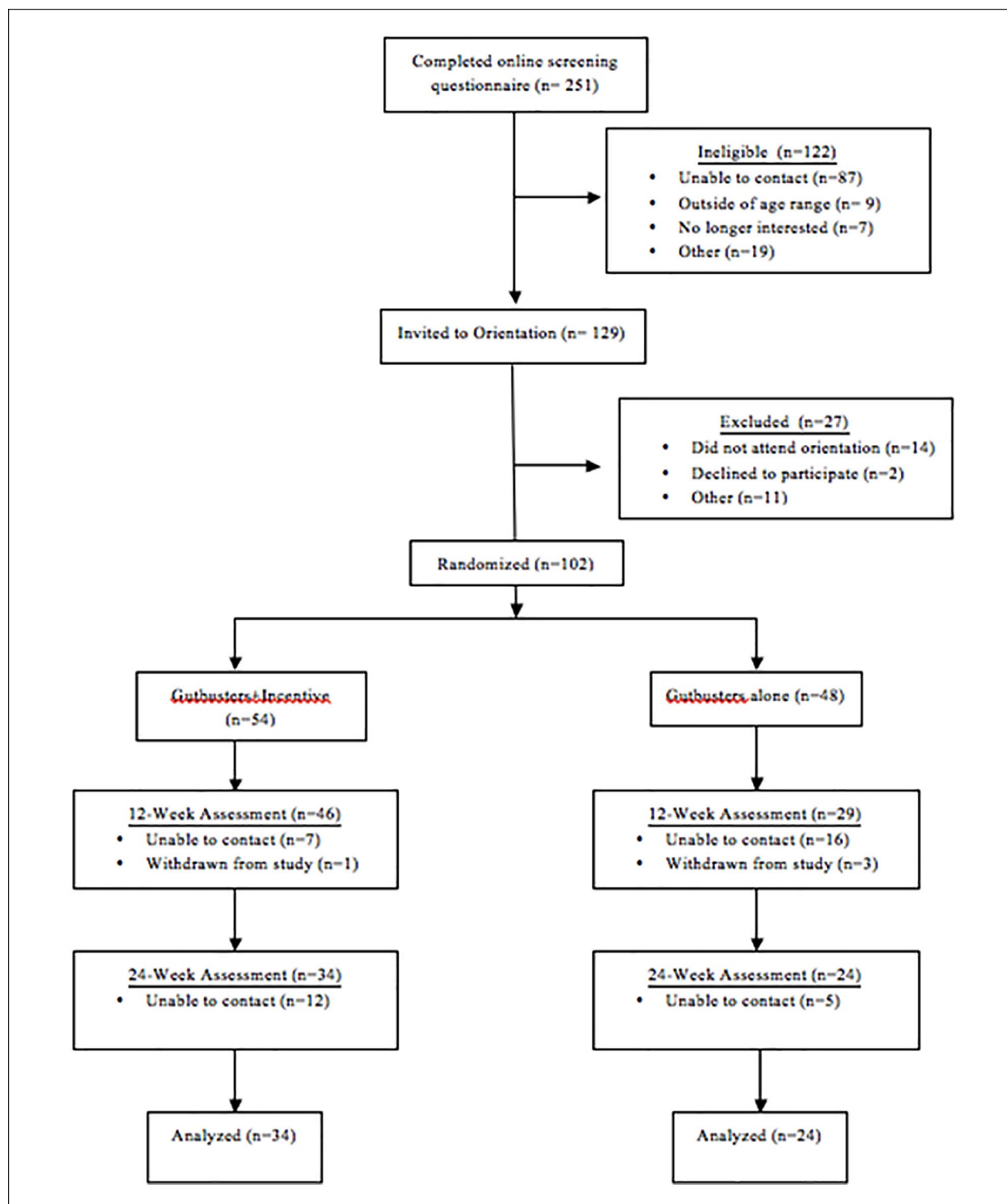


Figure 1. Gutbusters CONSORT Flow Diagram

circumference. The Gutbusters+Incentive group lost an average of 9.9 pounds at 12 weeks (95% CI: 6.9, 12.9) and 8.4 pounds at 24 weeks (95% CI: 3.9, 13.0). The Gutbusters alone group lost an average of 3.7 pounds at

12 weeks (95% CI: -0.06 , 7.5) and an average of 3.4 pounds at 24 weeks (95% CI: -2.2 , 9.0). There were significant ($p < .05$) between group differences at each time point. As shown in Table 2, there were also greater

Table 1. Baseline Characteristics (Mean \pm SD).

	Gutbusters+Incentive	Gutbusters alone
N	54	48
Age (yrs)	49.0 \pm 11.8	44.7 \pm 12.6
Weight (lb)	223.8 \pm 41.6	217.4 \pm 38.9
BMI	32.3 \pm 5.1	32.6 \pm 5.7
Body fat (%)	29.6 \pm 7.5	26.8 \pm 7.7
Waist circumference (in)	44.5 \pm 6.0	43.2 \pm 5.9
Education; n(%)		
<1 year of college	5 (4.9)	7 (6.9)
1–2 years of college	6 (5.9)	2 (2.0)
>2 years of college	43 (42.2)	48 (47.1)

reductions in the Gutbusters+Incentive group for waist circumference but not percent body fat at 12 and 24 weeks.

Weight loss as a percentage of baseline weight was calculated at 12 and 24 weeks. Mean percent weight loss in the Gutbusters+Incentive group was 4.5% at 12 weeks (95% CI: $-5.6, -3.4$) and 4.3% at 24 weeks (95% CI: $-5.7, -3.0$). Mean percent weight loss in the Gutbusters alone group was 1.4% at 12 weeks (95% CI: $-2.7, -0.1$) and 0.8% at 24 weeks (95% CI: $-3.2, 1.7$). There was a significant difference in percent weight loss between the two groups at both 12 weeks ($p = .001$) and 24 weeks ($p = .007$). As an indicator of clinically significant weight loss, at 12 weeks, significantly more Gutbusters+Incentive participants (50.0%) had lost at least 5% of their baseline weight compared to the control group (20.6%) ($\chi^2 = 6.44, df = 1, p = .010$). At 24 weeks, more participants in the Gutbusters+Incentive group (44.1%) had lost at least 5% of their baseline weight, compared to the Gutbusters alone group (16.7%) ($\chi^2 = 4.81, df = 1, p = .028$).

Table 3 displays all completers' analysis data. The results in this sensitivity analysis were similar to those of the intent-to-treat analysis.

Program Utilization

All participants attended the in-person orientation session. Gutbusters+Incentive participants attended a mean 9.3 (± 1.6) of the 12 in-person weekly weight collections. The participants in the Gutbusters alone group attended an average of 6.4 (± 3.5) in-person weight collections. There was a significant positive association between frequency of in-person weight collection and weight loss ($r = .242, p = .036$) across both groups combined. Participants completed an average of 6.9 (± 3.5) of the 12 weekly online check-ins. Participants reported making an average of 29.2 (± 11.1) of the 42 suggested 100-calorie behavior changes per week during the first 12 weeks. Table 4 illustrates the completion rates of each of the

weekly check-ins. Table 5 presents participant selection of Gutbusters lessons.

Questionnaires

There was no significant effect of condition group on the GLTEQ scores ($F[1, 99.73] = .123; p = .727$), nor was there a significant group by time interaction effect ($F[2, 150.26] = .766; p = .766$). There was, however, a significant effect of time between baseline and 12 weeks for participants overall ($F[1, 150.26] = 4.62; p = .011$). Analysis using estimated marginal means identified an increase of 15.0 on scores for the GLTEQ between baseline and 12 weeks (Table 6) indicating that all participants increased their physical activity. There was no significant difference in motivation as assessed through total TSRQ scores between the groups or over time. There was no effect by group or time for any of the three subscales (Table 6). There were no significant differences between groups or over time for overall eating control self-efficacy (WEL) scores. For four of the five WEL subscales, there was no significant difference in scores by group or over time. For the availability subscale, there was a significant effect of time ($F[2, 138.75] = 5.61; p = .005$). A pairwise comparison was conducted and there was an overall mean difference of $-.497$ (SE = $.166; p = .010$) between baseline and 12 weeks as well as an overall mean difference of $-.659$ (SE = $.226; p = .012$) between baseline and 24 weeks (data not shown for 24 weeks). This indicates that participants expressed greater self-efficacy to resist eating when food is readily available as the study progressed (greater self-efficacy at 12 weeks than at baseline as well as greater self-efficacy at 24 weeks than at baseline).

Discussion

The Gutbusters program was a behavioral weight loss intervention, which added incentives to a previously successful weight loss intervention for men with overweight

Table 2. Weight, Waist Circumference, and Percent Body Fat by Treatment Group (Analysis of all Available Data).

	Assessment period						p-value		
	Baseline mean (95% CI)		Week 12		Week 24			Group	Group × time
	Week 12 vs. BL	Week 24 vs. BL	Week 12	Week 24	Week 12 vs. BL	Week 24 vs. BL			
Weight (lb)									
Gutbusters + Incentive	223.8 (213.2, 234.5)	214.0 (203.3, 224.6)	215.4 (204.6, 226.2)	<.001	<.001	.726	<.001	<.001	
Gutbusters alone	217.4 (205.8, 228.9)	213.6 (202.0, 225.3)	213.9 (202.1, 225.8)	.055	.418				
Waist circumference (in)									
Gutbusters + Incentive	44.5 (42.9, 46.1)	42.7 (41.1, 44.3)	43.3 (41.6, 45.0)	<.001	.058	.411	<.001	.007	
Gutbusters alone	43.2 (41.5, 45.0)	42.2 (40.4, 44.0)	42.2 (40.3, 44.1)	.053	.334				
Percent body fat									
Gutbusters + Incentive	29.5 (27.3, 31.6)	27.5 (25.3, 29.7)	26.1 (23.7, 28.6)	.050	.014	.675	.030	.325	
Gutbusters alone	26.8 (24.5, 29.2)	26.0 (23.4, 28.6)	28.4 (25.4, 31.3)	1.000	0.832				

Note. Values are estimated marginal means with 95% confidence intervals.

Table 3. Weight, Waist Circumference and Percent Body Fat by Treatment Group (Completers' Analysis).

	Assessment period						p-value		
	Baseline mean (95% CI)		Week 12		Week 24			Group	Group × time
	Week 12 vs. BL	Week 24 vs. BL	Week 12	Week 24	Week 12 vs. BL	Week 24 vs. BL			
Weight (lb)									
Gutbusters + Incentive	223.4 (208.8, 238.0)	212.0 (197.5, 226.6)	213.5 (199.0, 228.1)	<.001	<.001	.741	<.001	<.001	
Gutbusters alone	222.4 (205.1, 239.8)	218.8 (201.4, 236.1)	219.0 (201.6, 236.3)	.106	.461				
Waist circumference (in)									
Gutbusters + Incentive	44.4 (42.2, 46.6)	42.1 (39.9, 44.3)	42.7 (40.5, 44.9)	<.001	.013	.903	<.001	.001	
Gutbusters alone	44.2 (41.6, 46.8)	42.9 (40.3, 45.5)	42.8 (40.2, 45.4)	.030	.175				
Percent body fat									
Gutbusters + Incentive	27.8 (25.1, 30.5)	25.9 (23.3, 28.5)	24.9 (22.2, 27.6)	.095	.048	.272	.025	.208	
Gutbusters alone	28.5 (25.3, 31.7)	27.3 (24.1, 30.5)	29.1 (25.9, 32.2)	.783	1.000				

Note. Values are model estimated means and 95% confidence intervals.

Table 4. Online Check-in Completion Rates.

Program week	Gutbusters+Incentive <i>n</i> (%)	Gutbusters <i>n</i> (%)
1	50 (93)	35 (73)
2	48 (89)	31 (65)
3	42 (78)	23 (48)
4	36 (67)	21 (44)
5	35 (65)	23 (48)
6	36 (67)	21 (44)
7	32 (60)	19 (40)
8	35 (65)	19 (40)
9	32 (60)	21 (44)
10	29 (54)	17 (35)
11	30 (59)	16 (33)
12	26 (48)	18 (38)

Note. Percentages indicate percentage of subjects in each group who completed weekly check-in.

and obesity. Weight loss in the incentive group was significantly greater than the treatment only group. Percent weight loss was close to 5% in the incentive group, an amount that has widely been associated with improvements in many obesity-related biomarkers (Douketis et al., 2005; Hamman et al., 2006; Williamson et al., 2015; Wing et al., 2011). There were also greater reductions in waist circumference as well as total body fat in the incentive group, as compared to the intervention only group.

Unlike the REFIT program, participants were asked to attend an in-person weight collection weekly (vs. weekly self-report) as well as completing the online check-in. Previous research has identified that Internet-based programs are an appropriate substitute to in-person behavioral weight control programs (Harvey-Berino et al., 2010; Tate et al., 2001), but because financial incentives were implemented for weight loss in the Gutbusters program, the in-person weight collection was added for validity. Compared to REFIT (Crane et al., 2015), the Gutbusters program utilization (measured by number of online check-ins) was lower (6.9 ± 3.5 in Gutbusters vs. 11.2 ± 2.7 in REFIT) but participants attended two-thirds or more of the in-person weight collections, on average. Overall, participant interaction with the program components was encouraging.

Data from the questionnaires was interesting, but not remarkable. Reported increases in physical activity in Gutbusters participants over the course of the study were measured by the GLTEQ, despite the fact that increasing physical activity was not a particular goal of this study. One of the Gutbusters lessons did focus on walking one mile as a way to satisfy a 100-calorie change, so it is possible that the slight increase in GLTEQ score between baseline and 12 weeks was due to this. Of note, walking was also one of

the most regularly selected behaviors. Incentivizing physical activity could augment this program and perhaps lead to additional weight loss, but requires a higher level of monitoring and data collection than the current Gutbusters program. There were no significant changes in measures of motivation over the course of the Gutbusters program, as measured by the TSRQ. Utilizing a cash financial incentive was designed to increase external motivation, but didn't appear to make a difference in this population, at least according to the questionnaire results. In a study by West et al. (2011), mean weight loss of 5.5% was maintained for 18 months after a behavioral weight loss program focused on increasing participant motivation. In the future, a stronger focus on motivational factors of weight loss in the intervention components may improve long-term outcomes. There were also no substantial changes in measures of self-efficacy by the WEL throughout the intervention, except for a small increase in self-efficacy on the food availability subscale, indicating that over the course of the study, participants showed a moderate increase in self-efficacy to resist eating when tempting foods were available. Previous research has shown increased self-efficacy can lead to greater weight loss maintenance and could be an emphasis in future studies (Burke et al., 2015).

Incentives were another deviation from the original REFIT program and demonstrated value, in terms of weight loss, in the group that received them. Similar to the studies by Pope and Harvey (2013) and Roll and Higgins (2000), the escalating payment scheme with a "reset" for 2 weeks if a participant didn't reach his weight loss goal was effective overall. While the amounts of money started small (only \$4), by the end participants were eager to continue to lose weight so as not to return to baseline and miss out on the larger sums of money (\$312 total could be earned for consistent weight loss). Men randomized to the nonpayment control group achieved much lower rates of weight loss than the incentive group. This could be interpreted as additional evidence supporting the value of incentives for weight loss.

The simplified 100-calorie changes intervention provided a novel approach to weight management efforts. Interestingly, participants in Gutbusters selected the lesson on portion control as one of their top choices (it was only second to "Walking for Weight Management"). This is a surprising finding, as the idea of eating less than usual has been expressed as a major barrier to weight loss participation for men (Egger & Mowbray, 1993; Sabinsky et al., 2007). Providing information on specific, tangible behaviors and foods while allowing for autonomy in which behaviors they wanted to focus on, the program allowed men to make adjustments where they wanted and choose not to cut out things they were unwilling to give up. This was in line with what men previously stated they wanted from a weight loss program and also supports the

Table 5. Percentage of Participants who Selected Target Behavior at Least Once.

Target behavior	Gutbusters+Incentive (n = 54)	Gutbusters (n = 48)	Total (n = 102)
Walking for weight management	100%	100%	100%
Portion distortion	93%	96%	94%
Start with breakfast	93%	90%	91%
Balance your beverages	87%	88%	87%
Preventing snack attack	81%	90%	85%
Reducing in restaurants	72%	77%	75%
Eating in social situations	65%	67%	66%
Swap out sweets	56%	75%	65%
Cutting the fat	55%	60%	60%
Tune out TV	61%	52%	57%
Increase to decrease	43%	38%	40%
Manage meats	28%	27%	28%
Format fast food	22%	33%	28%

Note. Participants were able to select up to three lessons per week.

Table 6. Linear Mixed Model Analysis Assessing Questionnaire Outcomes From Baseline Through 12 Weeks.

	Assessment period		p-value		
	Baseline	Week 12	Time		Group × time
			Week 12 vs. BL	Group	Week 12
GLTEQ					
Gutbusters+Incentive	40.1 (28.9, 51.3)	52.7 (40.7, 64.7)	.011	.727	.766
Gutbusters	42.5 (29.9, 55.1)	59.9 (44.5, 75.3)			
TSRQ—Autonomous motivation					
Gutbusters+Incentive	5.4 (5.2, 5.6)	5.4 (5.1, 5.6)	.935	.064	.756
Gutbusters	5.1 (4.9, 5.5)	5.2 (4.9, 5.5)			
TSRQ—Externally controlled motivation					
Gutbusters+Incentive	4.6 (4.4, 4.9)	4.6 (4.3, 4.9)	.659	.105	.818
Gutbusters	4.4 (4.2, 4.7)	4.3 (4.0, 4.6)			
TSRQ—Amotivation					
Gutbusters+Incentive	4.7 (4.4, 5.0)	4.6 (4.3, 5.0)	.424	.417	.906
Gutbusters	4.5 (4.2, 4.8)	4.6 (4.2, 5.0)			
WEL—Total					
Gutbusters+Incentive	5.8 (5.4, 6.2)	6.1 (5.4, 6.2)	.645	.728	.179
Gutbusters	6.0 (5.6, 6.5)	5.9 (5.4, 6.3)			
WEL—Negative emotions					
Gutbusters+Incentive	5.5 (5.0, 6.0)	5.9 (5.4, 6.4)	.547	.636	.403
Gutbusters	5.8 (5.3, 6.4)	5.8 (5.2, 6.4)			
WEL - Availability					
Gutbusters+Incentive	4.4 (4.0, 4.9)	5.1 (4.6, 5.5)	.005	.840	.392
Gutbusters	4.5 (4.0, 5.0)	4.9 (4.3, 5.4)			
WEL—Social pressure					
Gutbusters+Incentive	5.7 (5.2, 6.2)	6.2 (5.7, 6.7)	.159	.422	.125
Gutbusters	5.5 (5.0, 6.0)	5.5 (5.0, 6.1)			
WEL—Physical distress					
Gutbusters+Incentive	6.8 (6.2, 7.4)	7.0 (6.3, 7.6)	.955	.520	.533
Gutbusters	6.7 (6.0, 7.3)	6.3 (5.5, 7.1)			
WEL—Positive activities					
Gutbusters+Incentive	6.4 (5.7, 7.2)	6.8 (6.0, 7.5)	.791	.647	.483
Gutbusters	7.1 (6.3, 8.0)	6.5 (5.6, 7.5)			

self-determination theory concept that personal autonomy is essential for long-term behavior change.

This study adds to the literature of behavioral weight programs that are designed for men. Unlike the majority of previous male weight loss interventions, which were designed with an intervention comparison to a no-treatment or waitlist control, Gutbusters was implemented as a comparative effectiveness trial, which will help bolster the evidence base for real-world application and potentially reduce future costs (Basu et al., 2011). Additional strengths of this study include a moderate retention rate and ITT analysis, as well as higher rates of weight loss in men who received a modest financial incentive.

As previously stated, men have declared that they want convenient programs that offer tailored feedback and have participants they can relate to. The overall time commitment of this program was fairly minimal. The weekly weigh-ins were done in an easily accessible location and were offered during several different days and time slots to accommodate busy schedules. The online component only took a few minutes. The program as a whole was streamlined for minimal communication between participants and the research team. While the majority of the men did not overlap with others during their weigh-ins, occasionally there was more than one man getting weighed at a time. This appeared to be valuable, and while they waited to be weighed, many men chatted with one another and were congratulatory if others shared they had met their weight loss goal. Finally, the men received individualized feedback each week via email regarding their weight loss progress and lesson selection. Compared to other successful interventions with significant personal investment and interaction from researchers and participants (Hunter et al., 2008; Tate et al., 2001), the Gutbusters program utilized the less demanding online approach of some more recent interventions with success (Crane et al., 2015; Morgan et al., 2009, 2011). While this intervention has not entirely solved the male weight loss problem, this minimally cost- and time-intensive model appears to work modestly.

Limitations and Future Research

This study had several limitations. One limitation is that the study did not reach the intended sample size of 106 participants within the intended time frame. Difficulty in recruitment was a major hurdle, and it was surprising that the most effective recruitment technique was a newspaper advertisement, instead of a more technological savvy approach (Facebook ad, website postings, etc.). Similar to the REFIT program, the majority of the participants were college-educated, white men, which is

generally representative of the population in Burlington, Vermont but is not generalizable to the American population as a whole. Initial efforts were made to recruit men outside of these characteristics, but unfortunately they were not successful. Finally, obtaining final assessment weights 12 weeks after the end of the intervention is not a proper maintenance measurement, but even 12 weeks after discontinuing incentives, the participants who completed the intervention had not regained weight.

Overall retention was moderate, but regrettably some attrition was noted. There was no significant difference in education level, age, or baseline weight between men who completed the study and those who did not (data not shown). High levels of attrition have been seen in Internet-based health behavior change programs and it is unclear which participant attributes are needed for both dynamic engagement with online program content and participation in later follow-ups (Eysenbach, 2005; Glasgow et al., 2003). At 12 weeks, 85.2% of participants in the incentive group and 60.4% of participants in the intervention only group were still actively participating. At 24 weeks, 73.9% of the incentive group and 50.0% of the control group returned for their final assessment. In the REFIT program, 94.3% of REFIT participants remained at 12 weeks versus 94.4% of the waitlist control group. Similarly, 90.6% of REFIT participants completed the 6-month assessment compared to 90.7% of the waitlist control participants (Crane et al., 2015). One reason for this could be that the majority of the study for participants was during the winter in Vermont. Many of the subjects were coming from far away and driving to the university for weight collection was challenging during some weeks. In addition, greater drop out in the nonpayment group could be attributable to disappointment or frustration that other participants were being paid for the same level of study effort. One potential explanation for the additional dropout between weeks 12 and 24 is due to lack of weight maintenance. Anecdotally, several men expressed they were embarrassed to return for their final weigh-in because they had been successful during the first 12 weeks, and then gained most or all of the weight back. Two major differences between the two interventions were that REFIT started with two face-to-face group sessions, as opposed to only one brief in-person baseline assessment for Gutbusters participants and in REFIT, new lessons were provided weekly rather than being provided all at once. This may have helped increase "buy-in" and sustained engagement for REFIT participants. Our decision to remove one of the face-to-face group sessions as well as provide all lessons up front was made to streamline the whole program and evaluate the results of a slightly modified intervention.

Despite these limitations, this study replicated the encouraging results of Crane et al. (2015) and this simplified approach to calorie reduction with minimal in-person interaction as a general program design looks to be an effective technique to help overweight and obese men lose weight.

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