Published in final edited form as:

J Occup Environ Med. 2018 August ; 60(8): 683–687. doi:10.1097/JOM.0000000000001343.

Cost effectiveness of a weight management program implemented in the worksite: Translation of *Fuel Your Life*

Phaedra S. Corso, PhD,

College of Public Health, University of Georgia, Athens, Georgia

Justin B. Ingels, MPH,

College of Public Health, University of Georgia, Athens, Georgia

Heather M. Padilla, MS,

College of Public Health, University of Georgia, Athens, Georgia

Heather Zuercher, MPH,

College of Public Health, University of Georgia, Athens, Georgia

David M. DeJoy, PhD,

College of Public Health, University of Georgia, Athens, Georgia

Robert J. Vandenberg, PhD, and

Terry College of Business, University of Georgia, Athens, Georgia

Mark G. Wilson, HSD

College of Public Health, University of Georgia, Athens, Georgia

Abstract

Objective—Conduct a cost-effectiveness analysis of the *Fuel Your Life (FYL)* program dissemination.

Methods—Employees were recruited from three workplaces randomly assigned to one of the conditions: telephone coaching, small group coaching, and self-study. Costs were collected prospectively during the efficacy trial. The main outcome measures of interest were weight loss and quality-adjusted life years (QALYs).

Results—The phone condition was most costly (\$601-\$589/employee) and the self-study condition was least costly (\$145-\$143/employee). For weight loss, delivering *FYL* through the small group condition was no more effective, yet more expensive, than the self-study delivery. For QALYs, the group delivery of *FYL* was in an acceptable cost-effectiveness range (\$22,400/QALY) relative to self-study (95% CI: \$10,600/QALY – dominated).

Conclusions—Prevention programs require adaptation at the local level and significantly affect the cost, effectiveness, and cost effectiveness of the program.

Corresponding author information: Phaedra S. Corso, PhD, Economic Evaluation Research Group, College of Public Health, University of Georgia, 316 Wright Hall, Health Sciences Campus, Athens, GA 30602, (706) 713-2708 (telephone), (706) 713-2737 (fax), pcorso@uga.edu.

Conflict of interest statement: None declared.

Introduction

Obesity has reached epidemic levels as evidenced by recent data indicating that nearly 40% of American adults age 20 years and older are obese¹ and are consequently at risk for a myriad of health problems such as type-2 diabetes, cardiovascular disease, and cancer.² Although the prevalence of obesity has not significantly changed in the last few years, obesity is higher among middle-aged adults (42.8%) than among younger adults (35.7%).¹ This suggests that employers are not immune from the obesity epidemic and they stand to bear much of the costs and other adverse consequences as their workers age. Hertz et al. estimated that 34% of the workforce is overweight and nearly 30% are obese, with obese workers having the highest prevalence of work limitations and obesity-related conditions.³

From an employer perspective, the rising prevalence of obesity has affected costs associated with absenteeism, presenteeism, and the costs of employer-covered health insurance.⁴ Obesity in the workplace is estimated to cost U.S. businesses \$73.1 billion dollars annually (in 2003\$) in both health insurance costs and reduced productivity.⁵ Others have estimated that health-related presenteeism and absenteeism costs US companies \$11.7 billion (in 2002\$) annually for obese workers.⁶ A recent comparison of lost productivity and medical costs of obese compared to normal-weight employees found more than a \$4000 differential (in 2011\$) in annual costs for covered medical, sick days, short-term disability, and workers comp claims.⁷

Evidence-based interventions to help manage weight and prevent obesity are well-established⁸ and the translation of these interventions to the worksite is advancing.⁹ One systematic review suggests that worksite programs result in modest weight loss, an average of 2.8 pounds per participating employee.^{10,11} As the evidence grows, employers will want to know the return on their investment (ROI) in these programs before they financially support widespread adoption. Some evidence exists on the ROI of worksite programs to reduce obesity, although the results have been mixed.^{12–14} For example, Baker et al. calculated a return of \$1.17 for every \$1.00 invested in an obesity management program at the worksite, of which 59% was related to healthcare expenditures and 41% was related to productivity.¹² In a meta-analysis of worksite wellness programs, Baicker et al. reported a return of \$3.27 in health care costs and a return of \$2.73 in reduced absenteeism for every \$1 invested in worksite wellness.¹³ However, RAND conducted a review of the literature and found that for every \$1 invested in lifestyle management programs, which includes weight management and obesity prevention programs, the return to the employer, \$0.50, was below the initial investment.¹⁴

ROI, however, is somewhat limited in its perspective by only including the costs and savings to the employer in the short-term, and by assessing impacts at the program-level in the aggregate.¹⁵ Cost-effectiveness analysis (CEA), on the other hand, can include all costs and impacts at the individual level and for longer periods of time.^{16,17} In this study, we advance the field by conducting a CEA of a worksite obesity prevention program, *FUEL Your Life (FYL)*, previously shown to be effective.¹⁸ *FYL* is a workplace translation of the Diabetes Prevention Program (DPP) lifestyle management program, often considered the gold standard for behavioral weight loss among people with pre-diabetes.⁸ In a previous study, we

tested three different approaches for implementing *FYL* on the outcomes of body weight, nutrition, and physical activity.⁹ We found that participants in three *FYL* implementation conditions (self-study, phone, and group) lost weight, but at varying degrees. In another study, we reported separately the aggregate costs for each condition, with phone condition as the most costly, followed by the group and self-study conditions, respectively.¹⁸

An important remaining research question is to determine how the costs of these *FYL* intervention conditions compares to the effectiveness of the conditions to help policy makers decide if the added costs, of phone coaching for example, are worth the added benefits from additional weight loss.⁹ In this study, we incrementally compare the cost-effectiveness of one delivery mode of *FYL* compared to another, for the primary outcomes of cost, weight, and quality-adjusted life years (QALYs).

Methods

Study Design and Participants

A full description of the original DPP translation to the worksite has been described elsewhere,¹⁹ and the description of the current study design to measure different *FYL* delivery formats has been described in detail in Wilson et al.⁹ The *FYL* translation retained the core components of DPP, including a 6-month core intervention period followed by a 6-month maintenance period. The study used an experimental design with three workplaces randomly assigned to one of three intervention conditions: (tele)phone coach, small group coach, and self-study. All participants received a DPP manual that included 16 lessons on healthy eating, physical activity, and problem solving; all participants had an orientation session with a health coach where weight loss and physical activity goals were set. Participants in the group and phone coaching conditions were further invited to participate in eight sessions that were facilitated by a trained health coach. Group sessions were 50 minutes and held at the worksites with eight to ten participants. Phone sessions were 20 minutes and held one-on-one with the participant at pre-determined times. At the end of the core intervention period (6 months), all participants met with a health coach at the worksite for a 20-minute transition session to reflect on progress toward goals and to create a plan for the following 6-month maintenance period. Programmatic activities during the maintenance period included three meetings or sessions for the group and phone conditions, respectively.

Measures

Data were collected between 2013-2016 and analyses were conducted between 2016-2017.

Outcomes—Outcome data were collected at baseline, 3 months (midpoint), 6 months (posttest) and 12 months (follow-up) and were analyzed using a latent change model with results fully reported in Wilson et al.¹⁹ For the current analysis, we assessed the interventions' impact on two primary outcomes: weight and health-related quality of life (HRQoL), from baseline to the end of the maintenance period (at 12 months), to fully incorporate all resources required to implement the intervention. Trained research staff measured weight using a portable, calibrated electronic scale. At each time point, two

readings were taken in a private setting at each workplace. If the measures varied by more than 0.2 kg, then a third reading was obtained.

HRQoL was assessed to determine intervention impacts on quality-adjusted life years (or QALYs). A QALY is a common metric used in the economic evaluation of health interventions that combines life expectancy and HRQoL, which was measured at baseline and 12-months using the Euroqol 5-dimension, EQ-5D, scale.²⁰ The EQ-5D measures five domains of health including mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The scoring of the EQ-5D for these dimensions were valued using published generic US weighting factors.²¹ EQ-5D scores were used to calculate mean quality-adjusted life expectancy, assuming a linear change over time between each EQ-5D score. We collected the SF-12 as another measure of HRQoL, with sub-scales that measure mental and physical components of health. However, the EQ-5D was the primary tool used to calculate QALYs for study participants, given recommendations from the field of economic evaluation.¹⁵ For these calculations, there were no expected nor observable changes in life expectancy for the participants given the short timeframe for the study.

Costs—Cost data were collected prospectively throughout the study and are described in more detail in Ingels et al.¹⁸ Briefly, we used a micro-costing approach to assess all resources required to deliver the intervention in 2013 US dollars. Costs were assessed from the societal perspective, including program-specific expenditures, the costs for participants to spend time engaging in the intervention, and the opportunity costs associated with using workspace to conduct the intervention. All costs were collected at the participant-level when appropriate. To estimate the potential savings generated by *FYL* in terms of reduced medical care utilization and increased productivity, this information was collected by self-report at baseline and 12-months. Information on absenteeism and presenteeism was measured with questions from the World Health Organization's Health and Work Performance Questionnaire (HPQ).²²

Analysis

For the CEA, we used person-level data on two primary outcome measures and costs across the three intervention conditions. Sample sizes differed based on weight data reported in Wilson et al.,¹⁹ which included some imputed and non-imputed data for n=418 participants; and new data on non-imputed HRQoL reported here, n=320 participants. To first examine differences among conditions by HRQoL, ordered logistic regressions were conducted on each of the five components of the EQ-5D at 12 months using the baseline measurement and indicators for condition assignment as the independent variables. For the summary scores of the SF-12, a similar analysis was conducted.

Next, we conducted linear regressions with the outcome measure (either weight or HRQoL) as the dependent variable, along with the baseline measure of the outcome and an indicator for intervention assignment as the independent variables. Costs were estimated with person-level data and using a linear regression analysis with indicators for intervention assignment as the independent variables. Costs were not highly skewed nor were there any zero costs, so neither log-transformations nor zero-inflated models were necessary. Because costs were

assessed within a 12-month time-period, no discounting was required. All costs are presented in 2016 US\$.

Best practice guidelines prescribe calculating an incremental cost-effectiveness ratio (ICER) when comparing the cost-effectiveness of one program condition to another condition.^{15–17} In this study, the ICER describes the additional cost of each intervention condition relative to the next least effective condition in separate analyses for change in weight at 12-months for one CEA, and for change in QALYs at 12-months for the other CEA. To test our model for uncertainties in the parameters and assumptions, we calculated a confidence interval (CI) around the ICER estimate using Fieller's theorem, where uncertainty is jointly modeled around the outcome and cost.²³ In this case, uncertainty is estimated using a regression framework rather than bootstrapping, as bootstrapping does not allow for control of covariates. We examined the impact of all assumptions on our findings by calculating additional estimates of the ICER (and its 95% CI) under alternative, plausible sets of assumptions. These assumptions include the most impactful cost assumptions from Ingels et al.¹⁸ Further, we tested a scenario where only participants with weight recorded at baseline and 12 months were included, leaving out imputed weight values. All analyses were conducted using R (R: A language and environment for statistical computing, 2015) along with the MASS package²⁴ for ordered logistic regression and the ceaR package for all ICER analyses.

Results

Costs

Table 1 shows that there were no significant differences in costs per person within condition comparing the weight and HRQoL samples. Based on the confidence intervals, the average cost by condition did significantly differ in both samples where the self-study condition was the least expensive and the phone condition was the most expensive. There were no significant or consistent changes in medical utilization or productivity losses, and therefore they are not included in the main analysis (see Tables S3 and S4, Supplemental Digital Content 1, which contain medical utilization and productivity loss data, respectively).

Weight Loss

Table 1 shows that weight differed among the three conditions at baseline, but not significantly. Weight change was highest in the phone condition; however, based on simple mean comparisons this change was not significant. Table 2 presents the results of the regression analyses assessing weight change at 12 months controlling for baseline weight (in pounds), with the self-study condition used as the reference case. At 12 months, phone participants lost 2.3 more pounds on average relative to self-study participants, which was not significant at $p < 0.10$. Group participants lost 0.2 more pounds on average relative to self-study participants, although this was not significant. Baseline weight was highly significant suggesting that the heavier the participant was at baseline, the more pounds they lost at 12-months follow-up, although the amount is not clinically significant ($< \frac{1}{2}$ pound for every additional 10 pounds at baseline).

HRQoL and QALYs

Table 1 shows that the EQ-5D index differed among the three conditions at baseline, but not significantly. QALYs were highest in the group condition; however, based on simple mean comparisons, these results were not significant. Table 3 shows the results of the regression analysis at 12 months, using HRQoL data derived from the EQ-5D. With the self-study group as the reference, participants in the group condition experienced a marginally significant ($p<0.10$) increase in QALYs at 12-months follow-up relative to the self-study condition. There were no significant differences in QALYs comparing the phone condition to the self-study condition. The difference between group and phone conditions (results not shown), was also not significant ($p=0.322$).

Exploring the domains of health within each HRQoL measure, only a comparison of the group relative to the self-study conditions showed significant differences from baseline to 12-months for the EQ-5D. Group condition participants were roughly 57% (1-0.43) less likely to report a problem with anxiety/depression relative to self-study participants at 12 months (controlling for baseline responses). These results were confirmed by an assessment of HRQoL using the SF-12. While all three intervention conditions saw improvements in the physical health summary score of the SF-12, neither the phone nor group conditions had significantly larger improvements than self-study. However, the group condition had an improvement in the mental health summary score at 12 months, which was significant relative to the self-study condition after controlling for baseline assessments (see Tables S5 and S6, Supplemental Digital Content 1, which show the full results of mental health summary scores).

Incremental Cost-effectiveness Analyses

Table 4 shows incremental differences in outcomes relative to costs in an incremental CEA. For weight, we removed the group condition from consideration as it costs \$1744 per additional pound lost relative to the self-study condition, compared to only \$190 per additional pound lost for the phone condition relative to the self-study condition. Therefore, if a decision maker was willing to pay the additional \$1744 per additional pound lost for the group condition, he or she should be willing to pay a much smaller \$190 per additional pound lost for the phone condition (this is a situation commonly referred to as weak dominance, see Haddix/Drummond for a complete description^{16,17} and see Tables S1 and S2, Supplementary Digital Content 1, which demonstrate the results of dominant conditions). The 95% confidence interval for the ICER comparing the phone to self-study for weight as the primary outcome had a lower bound below \$100 per additional pound lost but had an upper bound that was negative. This suggests that there is a small probability that the self-study can be both more effective and less costly than the phone condition. The ICERs were recalculated under several different plausible assumptions in the estimation of costs and impacts, including a 20% increase and decrease in coach salaries, changes to overhead costs, and a reduction of sample size to exclude cases for which weight had to be imputed. Under all assumptions, the group condition was weakly dominated by the self-study condition as in the base case analysis. In these analyses, the ICER comparing the phone to the self-study condition varied from \$121 to \$251 per additional pound lost, and confidence intervals had a lower bound as low as \$56 per additional pound lost and under all

assumptions a dominated upper bound (see Table S7, Supplemental Digital Content 1, for full results).

For the incremental comparison using QALYs, the phone condition was strongly dominated by the group condition, as the phone condition was significantly more costly and resulted in significantly lower QALYs at 12-months. Relative to the self-study, the group condition cost ~\$22,000 per 1 additional year of quality-adjusted life year gained, which is well within the range of currently funded public health and clinical interventions.^{25,26} The 95% confidence interval for QALYs as the outcome measure reveals that the lower bound is in the acceptable range of funding but the upper bound suggests that there is a small probability that the self-study can be both more effective in impacting QALYs and less costly than the group condition. The ICERs were recalculated under different assumptions described previously, including using the SF-12 to calculate QALYs (results available upon request)²⁷, with no significant impacts on study results.

Discussion

Weight loss is considered an important metric of success when conducting evaluations and economic evaluations of wellness programs in the workplace because it is easy to measure, observable and immediate. However, the results from this study suggest that when employee weight loss is the primary motivation for conducting a DPP adaptation to the workplace such as *FYL*, there may not be an economic argument for delivering the intervention in a small group format, relative to more inexpensive delivery modes (like self-study). We found that delivering *FYL* in a small group was no more effective, yet more expensive, than delivering *FYL* as self-study. Further, there may be an economic argument for delivering *FYL* by phone compared to self-study, only if the decision maker feels there is value in paying nearly \$200 per additional pound loss for each participant.

However, weight loss alone may not be the only factor to consider when determining success of wellness programs, particularly when group delivery is considered. The results of the CEA with QALYs as the outcome measure led to a different conclusion. We found that delivering *FYL* in a group had impacts on anxiety/depression and mental health in comparison to self-study, in addition to the primary goal of reducing weight, thus resulting in a favorable cost/QALY ratio. In a study on weight loss by Wing and Jeffrey, both recruitment strategy and social support affected treatment completion and weight-loss maintenance.²⁸ In those recruited alone and given therapy, 76% completed treatment and 24% maintained their weight loss in full; among those recruited with friends and given therapy plus social support, 95% completed treatment and 66% maintained their weight loss in full. In another study of exercise interventions for women with breast cancer, the authors concluded that [although not statistically different], “group exercise interventions may still have potential to be superior to individual exercise interventions, [because] it may be that the designs of current group exercise programs may not involve sufficient social interaction to create psychosocial improvements over and above those of individual programs.”²⁹ For an employer, the indirect benefits of wellness programs introduced in a group format may go beyond what costs they cover in the short-term and the tangible benefits (reductions in obesity-related healthcare costs) they may only incur long-term.

Conclusion

Translation of a program such as *Fuel Your Life (FYL)* requires adaptation at the local level. This adaptation can significantly affect the cost, effectiveness, and cost-effectiveness of the program, as demonstrated in this study. CEA can provide guidance on implementation and dissemination modalities for employers and CEA that includes QALYs can show broader indirect impacts of interventions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The authors gratefully acknowledge the efforts of the participants, staff, and employer partners who contributed to the success of this study. Additionally, we thank Hannah Southall for assistance with reviewing the literature, and Sarah Adams and Tiffany Howard for assistance with data collection. This project was funded by a National Institute of Diabetes and Digestive and Kidney Diseases grant (5R18DK090672-03) Translational Research to Improve Obesity and Diabetes Outcomes. The contents are solely the responsibility of the authors and do not reflect NIH views or policies. No financial disclosures were reported by the authors of this paper.

Financial disclosure: This project was funded by a National Institute of Diabetes and Digestive and Kidney Diseases grant (5R18DK090672-03) Translational Research to Improve Obesity and Diabetes Outcomes. The contents are solely the responsibility of the authors and do not reflect NIH views or policies.

References

1. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of obesity among adults and youth: United States, 2015–2016. NCHS Data Brief. 2017; (288):1.
2. Dowd JB, Zajacova A. Long-term obesity and cardiovascular, inflammatory, and metabolic risk in US adults. Am J Prev Med. 2014; 46(6):578–584. [PubMed: 24842734]
3. Hertz RP, Unger AN, McDonald M, Lustik MB, Biddulph-Krentar J. The impact of obesity on work limitations and cardiovascular risk factors in the US workforce. J Occup Environ Med. 2004; 46(12):1196–1203. [PubMed: 15591970]
4. Hammond RA, Levine R. The economic impact of obesity in the United States. Diabetes Metab Syndr Obes. 2010; 3:285–295. [PubMed: 21437097]
5. Finkelstein E, Fiebelkorn IC, Guijing W. The Costs of Obesity Among Full-time Employees. Am J Health Promot. 2005; 20(1):45–51. [PubMed: 16171161]
6. Ricci JA, Chee E. Lost productive time associated with excess weight in the US workforce. J Occup Environ Med. 2005; 47(12):1227–1234. [PubMed: 16340703]
7. Van Nuys K, Globe D, Ng-Mak D, Goldman D, Hoiwan C, Sullivan J. The Association Between Employee Obesity and Employer Costs: Evidence From a Panel of U.S. Employers. Am J Health Promot. 2014; 28(5):277–285. [PubMed: 24779722]
8. Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med. 2002; 346:393–403. [PubMed: 11832527]
9. Wilson MG, DeJoy DM, Vandenberg RJ, Corso P, Padilla H, Zuercher H. Effect of Intensity and Program Delivery on the Translation of Diabetes Prevention Program to Worksites. J Occup Environ Med. 2016; 58(11):113–1120.
10. Services TFoCP. A recommendation to improve employee weight status through worksite health promotion programs targeting nutrition, physical activity, or both. Am J Prev Med. 2009; 37(4): 358–359. [PubMed: 19765508]
11. Anderson LM, Quinn TA, Glanz K, et al. The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity: a systematic review. Am J Prev Med. 2009; 37(4):340–357. [PubMed: 19765507]

12. Baker KM, Goetzel RZ, Pei X, et al. Using a return-on-investment estimation model to evaluate outcomes from an obesity management worksite health promotion program. *J Occup Environ Med.* 2008; 50(9):981–990. [PubMed: 18784545]
13. Baicker K, Cutler D, Song Z. Workplace wellness programs can generate savings. *Health Aff.* 2010; 29(2):304–311.
14. Caloyeras JP, Liu H, Exum E, Broderick M, Mattke S. Managing manifest diseases, but not health risks, saved PepsiCo money over seven years. *Health Aff.* 2014; 33(1):124–131.
15. Neumann PJ, Sanders GD, Russell LB, Siegel JE, Ganiats TG. *Cost-effectiveness in Health and Medicine.* 2nd. New York: Oxford University Press; 2017.
16. Haddix AC, Teutsch SM, Corso PS. *Prevention Effectiveness: A Guide to Decision Analysis and Economic Evaluation.* 2nd. New York: Oxford University Press; 2003.
17. Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW. *Methods for the Economic Evaluation of Health Care Programmes.* 4th. New York: Oxford University Press; 2015.
18. Ingels JB, Walcott RL, Wilson MG, et al. A Prospective Programmatic Cost Analysis of Fuel Your Life: A Worksite Translation of DPP. *J Occup Environ Med.* 2016; 58(11):1106–1112. [PubMed: 27820760]
19. Wilson MG, DeJoy DM, Vandenberg R, Padilla H, Davis M. Fuel your life: a translation of the diabetes prevention program to worksites. *Am J Health Promot.* 2016; 30(3):188–197. [PubMed: 25615707]
20. Group TE. EuroQol-a new facility for the measurement of health-related quality of life. *Health policy.* 1990; 16(3):199–208. [PubMed: 10109801]
21. Shaw JW, Johnson JA, Coons SJ. US valuation of the EQ-5D health states: development and testing of the D1 valuation model. *Med Care.* 2005:203–220. [PubMed: 15725977]
22. Kessler RC, Barber C, Beck A, et al. The world health organization health and work performance questionnaire (HPQ). *J Occup Environ Med.* 2003; 45(2):156–174. [PubMed: 12625231]
23. Willan AR, Briggs AH. *Statistical analysis of cost-effectiveness data.* Vol. 37. John Wiley & Sons; 2006.
24. Venables WN, Ripley BD. *Modern Applied Statistics with S.* 4th. New York: Springer; 2002.
25. Neumann PJ, Cohen JT, Weinstein MC. Updating cost-effectiveness—the curious resilience of the \$50,000-per-QALY threshold. *N Engl J Med.* 2014; 371(9):796–797. [PubMed: 25162885]
26. Grosse SD. Assessing cost-effectiveness in healthcare: history of the \$50,000 per QALY threshold. *Expert Rev Pharmacoecon Outcomes Res.* 2008; 8(2):165–178. [PubMed: 20528406]
27. Brazier JE, Roberts JR, et al. The estimation of a preference-based index from the SF-12. *Medical Care.* 2004; 42(9):851–859. [PubMed: 15319610]
28. Wing RR, Jeffery RW. Benefits of recruiting participants with friends and increasing social support for weight loss and maintenance. *J Consult Clin Psychol.* 1999; 67(1):132. [PubMed: 10028217]
29. Floyd A, Moyer A. Group versus individual exercise interventions for women with breast cancer: A meta-analysis. *Health Psychol Rev.* 2010; 4(1):22–41.

Table 1

Mean $\pm$ standard error (95% confidence interval) for costs per person, by impact measure and intervention condition

	Self-study	Group	Phone
Costs (lbs sample)	143 $\pm$ 4.8 (134, 153)	457 $\pm$ 10.5 (437, 478)	589 $\pm$ 9.11 (571, 607)
Costs (QALYs sample)	145 $\pm$ 6.02 (133, 157)	473 $\pm$ 11.1 (451, 495)	601 $\pm$ 10.1 (581, 621)
Baseline weight (lbs)	218 $\pm$ 4.49 (209, 227)	209 $\pm$ 4.39 (200, 217)	210 $\pm$ 4.79 (201, 220)
Weight change (lbs)	-2.74 $\pm$ 0.876 (-4.47, -1.01)	-2.68 $\pm$ 0.84 (-4.34, -1.02)	-4.89 $\pm$ 1.06 (-6.99, -2.79)
Baseline EQ-5D index	0.877 $\pm$ 0.012 (0.854, 0.9)	0.873 $\pm$ 0.012 (0.85, 0.89)	0.851 $\pm$ 0.015 (0.821, 0.882)
QALYs	0.885 $\pm$ 0.01 (0.866, 0.904)	0.897 $\pm$ 0.009 (0.879, 0.915)	0.874 $\pm$ 0.014 (0.846, 0.902)

The sample sizes for the weight and QALYs samples are 147 and 95 for the self-study condition, 165 and 142 for the group condition, and 106 and 83 for the phone condition.

Table 2

Average 12-month weight loss per participant, by intervention modality

	Coefficient	SE	p-value
Self-study	Ref.		
Group	−0.178	1.216	0.884
Phone	−2.340	1.364	0.087
Baseline Weight	−0.025	0.010	0.011
Constant	2.650	2.294	0.249

Note: SE = standard error

Boldface indicates statistical significance (p<0.05).

Table 3

Average 12-month change in quality-adjusted life years, by intervention modality

	Coefficient	SE	p-value
Self-study	Ref.		
Group	0.0145	0.008	0.074
Phone	0.0061	0.009	0.510
Baseline EQ-5D Index	0.6915	0.026	< 0.001
Constant	0.2791	0.024	< 0.001

Note: QALY = quality-adjusted life year, SE = standard error Boldface indicates statistical significance (p<0.05).

Table 4
Incremental cost-effectiveness ratios, for weight change and quality-adjusted life-years as outcome measures

N=418	Average Cost (\$)	Average Weight Loss (lbs)	Incremental Cost (\$)	Incremental Weight Loss (lbs)	ICER (\$/lbs lost)	ICER 95% CI (\$/lbs lost)
Self-study	143	2.60	–	–	–	–
Group	457	2.78	Dominated by Self-study ^a			
Phone	589	4.94	445	2.34	190	(88, Dominated)
N=320	Average Cost (\$)	Average QALYs	Incremental Cost (\$)	Incremental QALYs	ICER (\$/QALY gained)	ICER 95% CI (\$/QALY gained)
Self-study	145	0.879	–	–	–	–
Phone	601	0.886	Dominated by Group ^b			
Group	473	0.894	327	0.015	22 400	(10 600, Dominated)

Note: CI = confidence interval, QALY = quality-adjusted life-year, ICER = incremental cost-effectiveness ratio

^a Group (weakly) dominated by Self-study as there is no significant difference in effectiveness (p=0.884), but it is significantly more costly.

^b Phone (strongly) dominated by Group as Phone is significantly more costly and results in a significantly lower QALYs.