Weight Control

FUEL Your Life: A Translation of the Diabetes Prevention Program to Worksites

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Abstract

Purpose. *To evaluate the effectiveness of FUEL Your Life, a translation of the Diabetes Prevention Program for worksites.*

Design. *A randomized control group design was conducted in five worksites of a large transportation company. Measures were collected pretest, posttest (6 months), and follow-up (12 months).*

Setting. *Railroad maintenance facilities of Union Pacific Railroad.*

Subjects. *Participants consisted of 362 workers (227 treatment, 135 control).*

Intervention. *FUEL Your Life was translated from the Diabetes Prevention Program to better fit within the context of the worksite. The primary difference was the use of peer health coaches to provide social support and reinforcement and an occupational nurse to provide lesson content (six sessions of 10 minutes) to participants instead of the lifestyle coaches employed by the Diabetes Prevention Program, resulting in a less structured meeting schedule.*

Measures. *The primary outcomes were weight and body mass index (BMI), with secondary outcomes including eating behaviors, physical activity, and social support.*

Analysis. *Latent growth modeling was used to measure changes in the outcomes over time.*

Results. *Participants in the intervention group maintained weight/BMI (−.1 pounds/−.1 BMI), whereas the control participants gained weight/BMI (+2.6 pounds/+.3 BMI), resulting in a statistically significant difference between groups. Fifty-five percent of intervention participants lost some weight, whereas only 35% of the control group lost weight.*

Conclusions. *FUEL Your Life, a low intensity intervention, was not effective for promoting weight loss, but was effective for helping workers maintain weight over a 12-month period. (Am J Health Promot 2016; 30[3]:188–197.)*

Key Words: Workplace, Diabetes, Intervention, Evaluation, Weight Management, Prevention Research. Manuscript format: research; Research purpose: intervention evaluation; Study design: randomized trial; Outcome measure: biometric (weight and BMI); Setting: workplace; Health focus: obesity/weight management; Strategy: skill building/behavior change; Target population age: adults; Target population circumstances: geographic location

PURPOSE

Obesity in the United States has reached epidemic levels, with recent National Health and Nutrition Examination Survey data showing that 68% of American adults are overweight or obese.[1] Consequently, they are at risk for a myriad of health problems such as type 2 diabetes, cardiovascular disease, and cancer.[2] Worksites are not immune to the obesity epidemic. Hertz et al.[3] estimate that 34% of the workforce is overweight and nearly 30% are obese, with increased prevalence with increased age. Obese workers have the highest prevalence of work limitations and type 2 diabetes,[3] and obesity-related conditions are estimated to cost employers as much as $73.1 billion dollars annually.[4] Studies have shown that obese employees take more sick leave than their nonobese counterparts, and they are twice as likely to experience high levels of absenteeism, defined as seven or more absences due to illness over a 6-month period.[5]

Given the impact of obesity at the worksite, it is not surprising that both employers and employees found worksite weight management interventions to be appropriate and effective.[6] In the

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Guide to Community Preventive Services, the Task Force recommends worksite programs that improve diet and/or physical activity behaviors. The studies included in the systematic review suggest that worksite programs result in modest weight loss, an average of 2.8 pounds.[7,8] Employers continue to seek innovative and evidence-based interventions that can be translated into the workplace to address this growing public health epidemic.

Translation of Interventions

Considerable discussion in public health has revolved around the need to translate or disseminate effective interventions into practice settings.[9–12] Translation involves the process by which a proven discovery is successfully integrated into established practice or policy in a specific public health setting. Although there is considerable interest in translating research to practice, there is little evidence on effective means for doing so. The primary assumption underlying the translation process is that an intervention has been proven to be efficacious (the extent to which the intended effects are achieved under optimal conditions) and effective (the extent to which the intended effects that were achieved under optimal conditions are also achieved in real-world settings) through research.[13] With this foundation, the translation process generally involves three phases: *dissemination*, *implementation*, and *institutionalization*. First, an effective or evidence-based intervention is *disseminated* to public health organizations with the intent to encourage them to adopt the intervention within their organization. Once adopted, the intervention needs to be carried out or *implemented* throughout the organization with fidelity to the core components known to be efficacious or effective.[14] Implementation is accomplished with the understanding that some adaptation is necessary to fit within the specific context and culture characterizing the adopting organization and targeted audience.[11,15] Finally, the intervention is *institutionalized* and/or eventually abandoned as newer, effective interventions are introduced. The entire process needs to be carefully researched to ascertain the key characteristics that would influence successful dissemination, implementation, and institutionalization. The purpose of this research project was to examine the effectiveness of the implementation of the Diabetes Prevention Program (DPP) in a worksite setting. This is the first translation of a clinically efficacious program to a worksite setting.

Diabetes Prevention Program

The DPP was developed and tested to reduce the risk of developing diabetes by modifying individual lifestyles. More specifically, previous research showed that improvements in glucose tolerance were related to both increased fitness and weight reduction. Hence, DPP was developed to test the efficacy of using a lifestyle intervention to increase physical activity and decrease body weight.[16,17] The DPP intervention was proven to be effective for managing weight by decreasing caloric intake and increasing energy expenditure in clinical studies,[18] showing a reduction of 4.9% of initial body weight. The DPP also is consistent with the U.S. Community Preventive Services Task Force recommendations for multicomponent worksite interventions involving both dietary modification and increased levels of physical activity.[19]

One of the barriers to translation of research to practice that is under the control of the researcher is the characteristics of the intervention.[12] The more clearly the characteristics or core components of an intervention are known and defined, the more readily the program can be successfully translated and implemented. There are six core components of DPP: (1) weight loss and physical activity goal-based behavioral intervention, (2) "lifestyle coach" delivery, (3) frequent contact, (4) individual tailoring of the intervention, (5) materials and strategies for an ethnically diverse population, and (6) network support for the interventionist.[17]

Worksite Context

Although there are considerable advantages to offering health promotion programs in worksite settings, there are still considerable challenges to implementing programs in worksites. Even the best worksite health promotion programs in the most dedicated organizations often suffer from a lack of infrastructure and resources to conduct the programs throughout their organization. Outside of corporate headquarters, most company sites do not have health promotion–trained staff, adequate facilities, and/or strong enough management support to conduct the programs. This is particularly true of small to medium-sized organizations.[20] As a result, any intervention designed for worksite settings must be relatively easy to implement, cost-effective, and not disruptive of normal site operations. Worksites also have control over their physical environments, which can be modified to support healthy behaviors. Although little research has shown the effectiveness of environmental changes as a stand-alone intervention strategy, it is becoming increasingly common in worksites to include such features as a way to support behavior change and create a healthy culture.[21] In this study, DPP was adapted with this context in mind.

One important adaptation was the use of peer health coaches, also referred to as lay health educators, *promotoras*, or community health workers in the public health literature. This delivery strategy has been previously tested with some success in community settings[22] but has seldom been employed in worksites. In work settings, peer health coaches can provide basic information and the social network support important for successful behavior change,[23] ultimately impacting subjective norms.[24] The ideal peer health coach is outgoing, is respected and trusted by his or her peers, and is a good communicator. Peer coaches can help worksite practitioners extend their reach into all corners of the workplace, a very appealing strategy for understaffed programs.

Fundamental to this adaptation was the modification of the intensity of the intervention. Intensity is defined as the number of interactions with the participants and the duration of those interactions. Considerable evidence has shown that the greater the intensity of the intervention, the greater the effect.[7,25,26] However, highly intensive interventions are typically focused on a smaller number of individuals, often

within clinical settings, which ultimately reduces the reach of the program and the overall impact on population prevalence.[7,25] Additionally, increasing the intensity of the intervention also increases the cost. DPP is a high intensity intervention (16 one-on-one 1-hour sessions with a lifestyle coach plus follow-up) that does not translate well to worksites that are concerned about cost, ease of implementation, and minimal disruption of work routines. The Fuel Your Life (FYL) intervention tried to offer a practical and more cost-effective approach suitable for widespread application in work settings.

METHODS

Design

The study used an experimental control group design to test the effectiveness of the FYL weight management program. Six sites were matched based on the number of employees and randomly assigned to treatment or control groups. The control sites had no planned intervention but may have had health and safety activities ongoing as part of their normal operations. Toward the end of the study, it became apparent that one control group experienced what Cook and Campbell[27] referred to as compensatory rivalry. Contrary to study protocols, the site coordinator initiated a variety of intervention strategies (i.e., biggest loser contest, motivational interviewing sessions, group educational sessions) to "make their site look better," according to an interview that was conducted with the site coordinator. Per Cook and Campbell,[27] this created a threat to the internal validity of the study, and as a result the site was removed from the final analyses. It could not be included as part of the treatment condition, as the strategies used differed from the planned intervention.

Sample

The study was conducted in the Union Pacific Railroad Mechanical Group that is responsible for locomotive maintenance. The average age of employees at these locations was 46 years, with approximately 94% being male and 95% unionized. Site size ranged from 232 to 933 employees. Table 1 lists the demographics for the study participants. Each site had an occupational nurse on site who served as the site coordinator at that location. Although DPP was originally targeted to prediabetic individuals, all employees at the sites were eligible to participate. This is typical of worksite programs, which tend to be all-inclusive to avoid issues related to fairness and access.[28] However, as part of the recruitment process at the treatment sites, special attention was made to encourage employees with body mass index (BMI) over 27 to participate, which consisted of approximately 70% of the employee population (77% of our study participants). The control sites served as a true control in that they received no organized intervention activities.

Table 1
Demographics of Study Participants at Baseline*

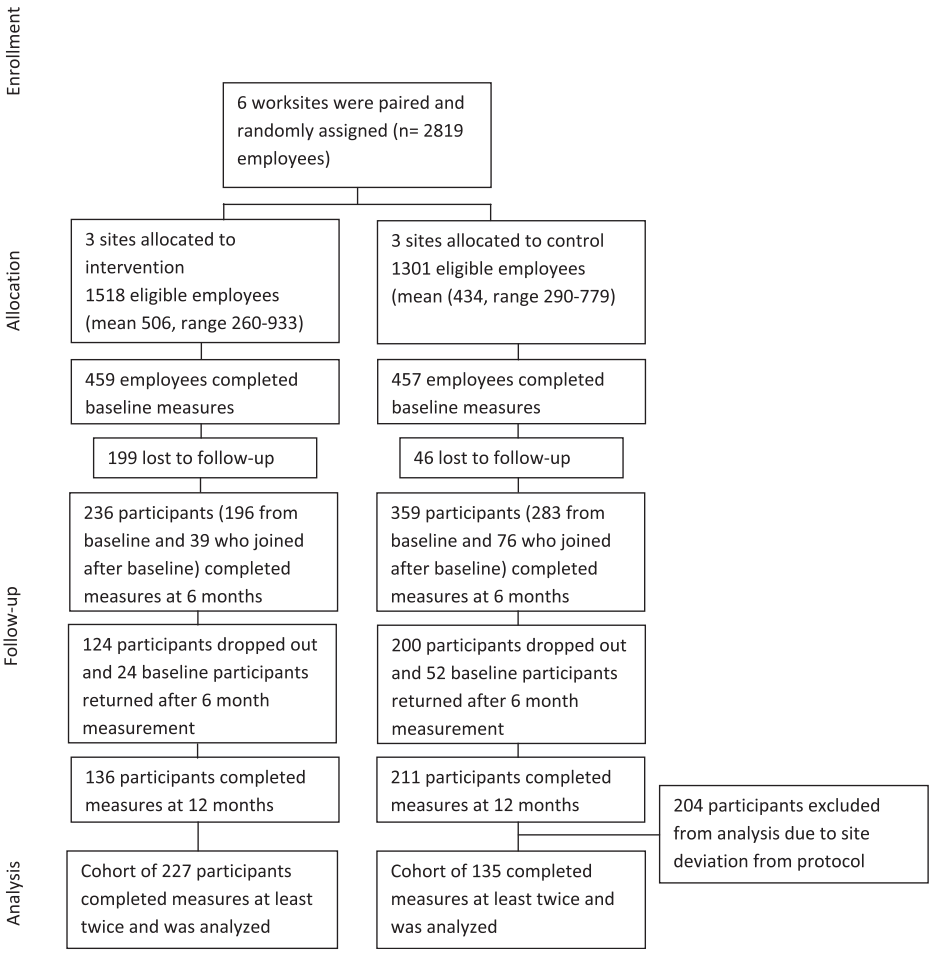
	Control	Treatment	*p*
Age, y	47	44	0.18
% Male	93.70	94.60	0.29
Ethnicity/race, %			
White	80.60	71.60	0.09
Black/African-American	9.90	17.50	0.001
Hispanic/Latino	9.50	12.20	0.19
Other†	2.50	1.50	0.77
Marital status, %			0.01
Single	14.90	14.90	
Divorced/separated/widowed	13.50	11.90	
Married/living with partner	71.60	73.10	
Education, %			0.22
Some high school	1.40	1.00	
High school graduate or GED	25.00	7.50	
Some college or technical/vocational training	52.50	55.00	
Associate degree	12.50	20.50	
Bachelor degree and above	8.60	7.00	
Income, %			0.22
$0–$20,000	2.20	1.00	
$20,001–$40,000	8.60	5.20	
$40,001–$60,000	37.50	40.70	
$60,001–$100,000	37.90	38.70	
$100,001+	13.80	14.40	
Shift, %			NA
First	57.70	51.30	
Second	27.60	29.60	
Third	14.70	19.10	
Body weight, pounds	206.13	218.43	NA
% Overweight (BMI 25–29.9)	43.50	32.90	NA
% Obese (BMI 30 or greater)	42.80	59.40	NA

* GED indicates general educational development; NA, not applicable; and BMI, body mass index.
† Other includes Asian, American Indian/Alaskan Native, and Native Hawaiian/Pacific Islander.

The Figure is the CONSORT diagram showing levels of participation throughout the study. There were three data collection points: baseline, posttest (6 months), and follow-up (12 months); each involved completing questionnaires and providing biometric data (body weight and BMI). After randomization, 459 employees at the intervention sites and 457 at the control sites completed the baseline measures. An additional 39 employees at the intervention sites and 76 employees from the control sites joined the study prior to the posttest, resulting in 236 and 359 participants respectively at posttest. All participants at the intervention sites received the intervention. One hundred ninety-nine participants in the intervention sites and 46 participants at the control

sites did not complete additional measures (posttest or follow-up) and were excluded from the final analyses. At the posttest, 236 participated in the intervention (39 who joined after baseline) and 359 participated in the control (52 who joined after baseline). At follow-up, 136 participants in the intervention group and 211 in the control group completed the surveys and measures. Removing the one control group from the final analysis because of contamination resulted in 227 (49.5%) participants in the final intervention and 135 (69.9%) in the final control cohort for outcome analyses. No differences existed between completers and noncompleters on BMI, age, or gender.

Figure
CONSORT Diagram of Participant Flow Through the Study



Measures

Data were collected at baseline, posttest (6 months), and follow-up (12 months) using surveys and biometric measures. Data were collected by trained research staff at the worksite, usually in a break room and/or empty adjacent office during work hours. Participants received an incentive ($10 gift card) for completing each data collection, but not for participating in the intervention. Participation was voluntary and responses were confidential. Responses were tracked across time using a participant ID that was generated and known only by the participant. The study methods were approved by the Institutional Review Board at the University of Georgia.

Primary Outcome Measures. Weight was measured using a portable, calibrated electronic scale (Seca 770) and height was measured using a portable stadiometer (Seca 241). For both height and weight, two measures were taken in a private setting. If height or weight measures differed by more than 5 mm or 0.2 kg, respectively, a third measure was obtained. The mean of the measures was used to calculate BMI according to the following formula: BMI = weight (kilograms) divided by height (meters) squared.

Secondary Outcome Measures. *Food Intake.* Each individual's percentage of energy from fat was estimated using the 16-item Fat Screener developed by National Cancer Institute Risk Factor Monitoring and Methods.[29,30] Scoring followed the rubric developed by the scale developers, which results in a calculation of percentage of calories from fat. Additionally, a Fruit and Vegetable Screener was used to estimate the total number of fruit and vegetable servings consumed daily.[31,32] Scoring followed the rubric developed by the scale developers, which results in a calculation of daily servings for fruit and vegetables. Additional questions asked about regular (nondiet) sodas and other sweetened beverages, dessert intake, and alcohol use.

Physical Activity. Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ) short form,[33] which estimates hourly participation each week in activities rated according to multiples of metabolic equivalent of task (MET) expressed as MET h · wk^{-1}. The IPAQ assesses frequency and duration of moderate (≥4 METs) and vigorous (≥8 METs) physical activity and walking. Reliability and criterion validity judged against accelerometry are comparable to those of other self-report measures.[33,34]

Social Support. Measures of support for the intervention were adapted from Sorensen and colleagues,[35] who examined support from coworkers, family, and friends for efforts to make healthful food choices, be more physically active, and manage their weight (example: How supportive are each of the following groups of people of your efforts to be more physically active?). Responses were recorded on a five-

point Likert scale (1 = not supportive to 5 = extremely supportive) and means were calculated by outcome (healthy eating, physical activity, and weight management) and source (coworkers, family, and friends). Reliability (coefficient alpha) for the various scales ranged from .79 to .91.

Intervention

The FYL program was DPP with minor adaptations occurring in the program manual and larger adaptations occurring in the means by which the program was delivered—the lifestyle coaches. The following describes those adaptations.

Intervention Program Manual. The FYL program manual contained the same content as the DPP Lifestyle Change Program manual, but the formatting (i.e., larger print, more readable), graphics (varying colors and headers), pictures (gender neutral), and examples (pertinent to both genders) were modified to make the manual more tailored to male workers and reader friendly. Similar to DPP, at the end of each lesson participants were asked to write down their weight, physical activity levels, and foods eaten. These served as a self-monitoring exercise to create awareness of their behaviors and reinforce goals. Participants in the program were expected to work through the program lessons on their own, at the same pace as they would for DPP (16 lessons over 24 weeks).

Health Coaches. The health coaches in FYL followed a lay health worker model in that they were coworkers (or colleagues) who were respected and trusted, and participants themselves.[36–38] They were responsible for providing basic information, answering simple questions, providing encouragement and support, and referring participants to the site coordinator or research team for more complex questions or issues. Health coaches participated in a 1-hour training session and received a coaching manual and an incentive for encouraging participation in the study. The site coordinator at each site was the occupational nurse who was already an employee at the site. In this study she was responsible for facilitating data collection, providing assistance in program implementation (hanging posters biweekly, leading sessions during safety meetings, serving as a resource to the health coaches, and supporting participants), and conducting the maintenance phase (hanging posters biweekly, leading three group sessions, and providing ongoing support to health coaches and participants). Site coordinators also received a 1-hour training session and a manual that detailed their role and tasks with the project.

Frequent Contact. DPP was a high intensity intervention with regular one-on-one meetings between participants and their lifestyle coach and access to considerable resources to support participant change efforts (up to $200 per participant). This clinical approach does not translate well to other settings, where there are competing priorities and time limitations, and which typically lack the highly trained personnel and large budgets required for this type of intervention.[11] Accordingly, FYL adopted a low intensity approach more typical of worksite programs, fully understanding that this would probably impact the magnitude of the outcomes. However, an important goal in translating DPP was to provide a more realistic, generalizable, and sustainable model suitable for widespread adoption in diverse work settings. Site coordinators conducted six group sessions that lasted approximately 10 minutes each and made weekly announcements in safety meetings through the first 6 months of the program. All employees were required to attend a safety meeting prior to beginning their shift, so this was the most efficient way of reaching all employees at the site. Health coaches were responsible for talking with employees on a regular basis to provide support and encouragement.

FYL Implementation. At baseline, an initial one-on-one session was conducted by a master's-level dietitian or health educator with each participant in a private setting to discuss the participant's weight loss and physical activity goals (which were similar to those for DPP: 7% body weight loss and 150 minutes of physical activity a week) and daily dietary fat intake goal (which was chosen based on their starting weight). Participants were also instructed on how to use the fat counter to measure their daily fat intake and given an overview of the participant manual and program components.

Environmental Supports. Worksite environmental supports, some of which existed before the study began, were put in place to facilitate individual behavior change. These supports consisted of (1) saturating the environment with messages through posters and information during safety meetings, (2) carefully adhering to company policies requiring healthy food options in vending machines and company-sponsored events, and (3) encouraging peer support through the health coaches and other participants. Finally, because eating and physical activity are influenced by the home environment, home environmental supports were activated that included (1) sending home a packet of materials that described the program and ways the family could support the participant; (2) providing access to a Web site that included copies of all materials, a chat room, family support strategies, and additional information and recipes; and (3) allowing spouses of participants to take part in the program themselves. DPP did involve participants' spouses in the intervention, so the primary difference between DPP and FYL would be the worksite environmental support. It was not the expectation in this study that the increased environmental supports would offset the decreased intensity, as there is no evidence for that in the literature.

Analysis

The purpose of the analyses was to answer the broad question as to whether the treatment sites differed favorably from the control sites on the outcome variables. Although repeated measures analysis of variance (ANOVA) is commonly used with longitudinal data, it is a relatively weak analytical tool relative to more contemporary analytical procedures.[39] One such procedure is latent growth modeling (LGM), and it was the primary analytical tool used in the current study.

Among the many advantages of LGM over traditional techniques such as ANOVA is the ability to model the

actual change in a variable across time as a latent variable in its own right; that is, there is an actual variable that represents the change in an outcome variable, and the change variable in one group may be compared to the change variable in other groups. Therefore, not only can we ascertain whether or not change in the focal outcome variable occurred in the FYL and control, but we can also evaluate whether the conditions differed significantly from one another in terms of both direction of change and strength of change—attributes that cannot be compared with ANOVA.[39–43] Finally, that the variances of the outcome variable at each time period are estimated and included in the estimation of the change latent variable for that outcome means that any violations of sphericity are controlled in the analyses—a statistical assumption that cannot be met using ANOVA.

Data were analyzed using the Cluster command feature in the Mplus statistical package, which was used to undertake the LGM analyses. It is the same feature used in STATA and SAS when there is the potential for the nonindependence of responses among observations belonging to the same unit. In general, it is referred to as the Huber-White sandwich estimation procedure.[44–48] The primary concern in the presence of nonindependence is the accuracy of the standard errors associated with the observed parameter estimates (e.g., the growth or change parameters in the current case). In particular, because the standard error is used in estimating the statistical significance of the focal parameter estimate, the alpha level for the significance test will not be accurate.[49] The Huber-White sandwich estimator corrects the standard errors in the presence of nonindependence. These corrected terms are often referred to as clustered robust standard errors. Therefore, the alpha level associated with the statistical test is the corrected one.

Building upon the advice of Aguinis and Vandenberg,[50] Becker,[51] and Edwards,[52] we took a two-step approach before deciding whether to include a control variable in a particular analysis. The first step was to evaluate whether there were any significant differences between the control and treatment conditions among the variables listed in Table 1. To evaluate race, we created three new binary variables out of the original categories (African-American vs. all others; white vs. all others; and other races vs. all others). Similarly, one dichotomous variable was created for the marital status variable, married or not. Across the 10 analyses, only two variables emerged as statistically significant. Specifically, there were disproportionally fewer African-Americans in the control vs. the treatment condition ($\chi^2_1 = 11.37$, $p < .0007$), and there were disproportionally fewer nonmarried participants in the control vs. treatment conditions ($\chi^2_1 = 6.47$, $p < .01$). None of the other differences were statistically significant. Thus, out of all of the variables listed in Table 1, only two emerged as a *potential* difference between the conditions that could act as an alternative explanation for differences on the dependent variables.

The next step was to evaluate the relationships between the presumed set of control variables and the primary outcome variables. *Potential* is emphasized above because, as noted by Becker,[51] no control variable should be included that does not have a significant association with the dependent variable. To be on the conservative side here, we evaluated the statistical significance of the correlations between all of the potential control variables and the primary outcome variables separately within the control and treatment conditions. As reflected in Table 2, of the African-American and married variables, only the African-American variable had significant correlations, in only the treatment condition and only for fruit, body weight, and BMI. Thus, it was controlled during the analyses of those variables within that condition. Whether one was married or not had no bearing on any of the dependent variables within any of the conditions. Also, despite the fact that there were no gender differences between conditions, it was noted that the correlation between gender and body weight was statistically significant within both conditions. Thus, in order to be conservative in our analyses, gender was included as a control variable when conducting the longitudinal analyses for body weight. A similar reasoning governed the inclusion of age (both conditions), income (control only), and education (treatment only) when undertaking the longitudinal analyses of the MET physical activity variable. There was no compelling evidence to suggest the need for control variables in any of the remaining analyses.

With regard to missing data, we used the maximum likelihood procedure known as the expectation maximization imputation (EM) procedure. It is the default procedure in the Mplus statistical package. Prior to testing the hypotheses, however, we studied the pattern of missingness in the database to determine whether missing data for a given case were considered missing at random or not. This is important to do because the EM algorithm produces unbiased estimates when the missingness is at random. All of the cases in the current analysis, therefore, met this criterion. At the core of this procedure is that a likelihood function is derived that combines the distribution of the observed data with the conditional distribution of missing data given the observed data. Specifically, in the E step (from EM), missing values are replaced by conditional expectation functions (given the observed data). During the M step, maximum likelihood estimates of covariance matrix and means are calculated, and this process repeats itself until the convergence criteria have been met.[53–55]

In summary, LGM was used to estimate whether or not change in the outcome variables occurred, with the assumption being that the form of change would favor the treatment condition over the control condition. Further, we statistically tested between the groups the strength and direction of change.

RESULTS

FYL participants demonstrated slight reductions in the primary outcomes of BMI (.01) and weight (1.6 pounds) over the course of the intervention that were not statistically significant (Table 2). The control group, on the other hand, gained an average of 3.1 pounds (.3 BMI), most

Table 2
Mean (SD) Primary and Secondary Outcomes†

Outcome (Control)‡	Pretest	Posttest	Follow-Up	Change§	*p*
Body mass index					
Control	29.9 (5.56)	30.2 (5.31)	30.2 (5.49)	0.3	0.27
FYL (AA)	31.9 (5.38)	31.8 (5.71)	31.8 (5.79)	−0.1	0.45
Body weight, pounds					
Control (Gen)	201.4 (45.04)	203.8 (44.96)	204.5 (45.98)	3.1	0.17
FYL (Gen, AA)	220.1 (44.90)	217.4 (45.66)	218.5 (46.41)	−1.6	0.39
Physical activity—MET, min/wk					
Control (Age, Inc)	4447 (3146.44)	3720 (2930.42)	4750 (3572.43)	303	0.74
FYL (Age, Ed)	4072 (3023.97)	3862 (3902.73)	4166 (4390.62)	94	0.77
Physical activity—sitting, min/wk					
Control	281 (213.02)	287 (210.62)	254 (167.90)	−27*	0.00
FYL	338 (476.74)	271 (200.45)	237 (140.06)	−101*	0.00
Physical activity—walking, min/wk					
Control	91 (62.38)	77 (59.67)	78 (64.51)	−13*	0.00
FYL	84 (59.68)	89 (66.62)	73 (64.05)	−11	0.32
Diet—calories from fat, %					
Control	32.8	31.7	31.7	−1.1*	0.01
FYL	32.9	32.1	32.8	−0.1	0.14
Diet—fruit servings/d					
Control	0.85 (0.64)	0.86 (0.71)	0.93 (0.78)	0.08*	0.00
FYL (AA)	0.71 (0.69)	0.78 (0.68)	0.75 (0.66)	0.04	0.21
Diet—vegetable servings/d					
Control	0.76 (0.63)	0.86 (0.72)	0.86 (0.66)	0.10*	0.05
FYL	0.71 (0.63)	0.68 (0.58)	0.73 (0.67)	0.02	0.44

† AA indicates African-American; Gen, gender; FYL, FUEL Your Life; MET, metabolic equivalent of task; Inc, income; and Ed, education.
‡ Demographics in parentheses following the group were controlled for in the analyses.
§ Change is pretest to follow-up.
* $p < 0.05$.

of which occurred during the first 6 months of the study. This weight gain essentially mirrors national trends, which show steady weight gain over time among adults. The control group's increases in BMI and weight were not statistically significant (slope .171, $p < .27$, and slope 1.195, $p < .17$, respectively) from pretest to follow-up. The FYL group did not demonstrate significant within-groups effects on either primary outcome measure (BMI −.053, $p = .45$; weight −.330, $p = .39$), nor did it differ significantly over the course of the study from the control group for either BMI (Wald [1] = 1.75, $p < .17$) or weight (Wald [1] = 2.59, $p < .11$). Examining the prevalence of weight loss, Table 3 shows the proportion of participants who gained weight compared to those who lost weight in each group. Over the course of the study, 55% of the FYL participants lost weight compared to 35% of the control group.

Table 2 also reports the mean values for the secondary outcomes of physical activity and food intake. Positive changes were demonstrated on reduced levels of sitting in participants for both the FYL (−101 minutes) and control (−27 minutes) groups. Both were statistically significant (FYL −.48.01, $p < .00$; control −12.53, $p < .00$) with a significant difference also demonstrated between groups (18.58, $p < .00$). Interestingly, both groups demonstrated a decrease in walking minutes over the course of the intervention (FYL −11; control −13) with the control group being statistically significant (−7.24, $p < .00$).

The percentage of calories from fat for this working population (33% at baseline) was similar to national averages (33%)[56] and did not change from baseline to follow-up in the FYL group but did significantly decrease in the control group (−.68, $p < .01$). Self-reported fruit and vegetable intake was extremely low (less than one serving a day) for all groups and varied little over the course of the study. Dietary changes for the FYL group were in the proposed direction but nonsignificant (Table 2). Significant within-group changes in the control group also occurred in the consumption of fruits (.05, $p < .00$) and vegetables (.062, $p < .05$). There were no significant differences between the FYL and control groups on any of the secondary dietary measures.

Finally, significant increases in perceived support were demonstrated by the FYL group for physical activity (.13, $p < .03$) and weight management (.12, $p < .03$) and by coworkers (.13, $p < .05$) and family (.11, $p < .05$) as sources of support (Table 4). The control group demonstrated significant increases in support for healthy eating (.14, $p < .00$), physical activity (.06, $p <$

Table 3
Percentage Body Weight Change*

	No Loss/Weight Gain	0.01%–4.9% Loss	5%–9.9% Loss	≥10% Loss
Pretest–Posttest, %				
Control	65.9	28.4	5.7	0
FYL	47.8	42.5	8.1	1.6
Pretest–Follow-up, %				
Control	64.8	26.8	5.6	3.0
FYL	44.8	44.0	10.3	0.9

* FYL indicates FUEL Your Life.

Table 4
Mean (SD) Scores for Support Measures†

Support Variable	Pretest	Posttest	Follow-Up	Change‡	*p*
Coworker support					
Control	2.19 (0.99)	2.29 (0.96)	2.52 (1.10)	0.33	0.62
FYL	2.32 (1.03)	2.45 (1.11)	2.58 (1.13)	0.26*	0.05
Family support					
Control	3.52 (1.11)	3.48 (1.11)	3.66 (1.07)	0.14*	0
FYL	3.32 (1.14)	3.42 (1.14)	3.54 (1.04)	0.22*	0.05
Friends support					
Control	2.62 (1.06)	2.71 (1.00)	2.86 (1.08)	0.14*	0
FYL	2.73 (1.08)	2.84 (1.07)	2.91 (1.06)	0.18	0.12
Support for healthy eating					
Control	2.86 (0.96)	2.91 (0.95)	3.19 (1.02)	0.33*	0
FYL	2.83 (0.94)	2.94 (1.04)	2.98 (1.02)	0.15	0.2
Support for exercise					
Control	2.86 (1.02)	2.87 (0.94)	3.01 (0.99)	0.14*	0
FYL	2.84 (0.97)	3.00 (1.00)	3.08 (0.95)	0.24*	0.03
Support for weight management					
Control	2.61 (1.03)	2.69 (0.91)	2.84 (1.02)	0.23*	0
FYL	2.69 (1.04)	2.77 (1.05)	2.94 (1.09)	0.25*	0.03

† FYL indicates FUEL Your Life.
‡ Change is pretest to follow-up.
* $p < 0.05$.

.00), and weight management (.11, $p <$ .00) and sources of support that included family (.052, $p < .00$) and friends (.11, $p < .00$). Although all changes were in the positive direction, there were no significant differences between FYL and the control groups on any measure of support.

DISCUSSION

Overall, the FYL intervention group demonstrated significantly better weight outcomes than the control group (−4.7 pounds and −.4 BMI), although not at a significant level. However, this was primarily because the control group gained weight and FYL participants slightly lost weight. These outcomes did not achieve the levels of the original DPP study. Still, FYL was able to move the majority of participants toward weight management, as demonstrated by the positive changes in the secondary outcomes and the fact that the majority of FYL participants lost some weight. Other recent worksite weight management studies that also used low intensity intervention strategies demonstrated similar maintenance outcomes.[21,57] With the control group reflecting national trends by increasing weight (3 pounds or .3 BMI a year on average), significant health benefits could be achieved in this worksite population (and others) by helping employees to maintain their weight over an extended period of time. From a population health perspective, weight maintenance could have greater long-term impact on absenteeism, productivity, and health care costs than the typical cycle of weight gain followed by weight loss. Some studies have referred to this as "weight gain prevention" and have demonstrated positive weight maintenance outcomes as a result of planned interventions designed to prevent weight gain.[58–60]

This translation of the DPP to FYL primarily revolved around (1) the significantly reduced intensity of the intervention and (2) the use of peer health coaches. This was somewhat unique in that most DPP translations tested in other settings maintained the high intensity, one-on-one contact approach that distinguished DPP.[61–64] Although our modifications were designed to facilitate the program fit within the context of the worksite setting to make the program more realistic and sustainable, they likely reduced the overall effect of the program. This issue of intervention intensity is extremely complex and requires further research. For those participants that were highly engaged and self-motivated, the infrequent contact with the peer health coach did not serve as a barrier to achieving their goals. For those individuals not self-motivated or engaged, the coach provided a support mechanism to overcome those barriers to reaching their goals. Hence, the level of intensity (interaction with the coaches) needed by the participant to achieve goals would vary with the participant's own self-motivation and engagement in the program. This should be an important consideration when determining the formula for intervention dose. Interestingly, positive changes, although not significant, occurred in most of the support measures for both intervention and control groups. This could be an artifact of the increased attention associated with the study (i.e., Hawthorne effect) but is worth further examination.

However, an important programmatic outcome that is not frequently reported in studies is the percentage of participants who lost weight.[7] In worksites, in addition to change achieved by an individual, measures of impact should include change achieved by a population. This raises several intriguing questions, including: Is moderating or reducing weight in 55% of participants across a worksite population a significant public health achievement? Is it a greater or equal achievement compared with large weight reduction in a small group of individuals? What role does sustainability of the intervention play in these dilemmas? Answers to these difficult questions will drive future worksite research and programming.

The use of peer health coaches is a growing trend in workplace health promotion and has considerable appeal to practitioners as it allows them to reach a greater audience. However, this approach does have some drawbacks. Regular participant contact with a health coach allows the coach

to hold the person accountable for his or her actions and ultimately to achieve his or her goals. Although it was not the intent, the lack of regular one-on-one contact with a peer health coach in FYL significantly reduced accountability, eliminating a source of motivation for compliance with program components or self-set goals and requiring individuals to be highly self-motivated. For practitioners considering this approach, training and ongoing monitoring of the peer health coach is critical. An effective peer health coach will keep the participants engaged and motivated. Thus, it is the responsibility of the practitioner to keep the peer health coaches engaged and motivated. If they fall off the wagon, so will many of the participants. Similar to the discussion on intervention intensity, the higher the frequency and duration of the interaction between the practitioner and peer health coach, the more likely the peer health coach will continue to be engaged and motivated.

Strengths of the study included randomization of worksites into intervention or control groups and LGM analyses that controlled for group differences by examining change over time and maximized the number of participants in the final cohort. Limitations of the study included self-report measures of secondary outcomes; voluntary nature of participation in the study; dropout of approximately half of the participants from the study; LGM analyses, which enable imputation of data based on two data points; and the need to include all interested participants regardless of risk status, which likely diluted the impact.

These results suggest that the FYL translation of the DPP, a low intensity approach, was not effective for weight loss but was effective for weight maintenance across a worksite population. Future research should further explore the public health benefits of weight maintenance and examine the impact of intervention intensity by varying the levels of intensity while maintaining the core program, an approach suited well to an efficacious program such as DPP.

SO WHAT? Implications for Health Promotion Practitioners and Researchers

What is already known on this topic?

Considerable research has been conducted on the effectiveness of weight management/weight loss programs, although much of this research has occurred in clinical or community settings. Seldom have the programs that have been found effective in clinical settings been translated to worksites to determine effectiveness at a population level.

What does this article add?

This study provides an example of a successful translation of the Diabetes Prevention Program, opening the door for future worksite translation studies.

What are the implications for health promotion practice or research?

Practitioners can use this as an example of using peer health coaches to implement programs, which can be a practical, low-cost means of expanding programs. Researchers should note the low intensity level of the intervention and further examine the benefits of weight maintenance or weight gain prevention on population health.

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