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Comparing Weight Loss–Maintenance Outcomes of a Worksite-Based Lifestyle Program Delivered via DVD and Face-to-Face: A Randomized Trial

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Abstract

Background—Native Hawaiians and other Pacific Islanders have high rates of overweight and obesity compared with other ethnic groups in Hawai‘i. Effective weight loss and weight loss–maintenance programs are needed to address obesity and obesity-related health inequities for this group.

Aims—Compare the effectiveness of a 9-month, worksite-based, weight loss– maintenance intervention delivered via DVD versus face-to-face in continued weight reduction and weight loss maintenance beyond the initial weight loss phase.

Method—We tested DVD versus face-to-face delivery of the PILI@Work Program’s 9-month, weight loss–maintenance phase in Native Hawaiian–serving organizations. After completing the 3-month weight loss phase, participants ($n = 217$) were randomized to receive the weight loss–maintenance phase delivered via trained peer facilitators or DVDs. Participant assessments at randomization and postintervention included weight, height, blood pressure, physical functioning, exercise frequency, and fat intake.

Results—Eighty-three face-to-face participants were retained at 12 months (74.1%) compared with 73 DVD participants (69.5%). There was no significant difference between groups in weight loss or weight loss maintenance. The number of lessons attended in Phase 1 of the intervention ($\beta = 0.358$, $p = .022$) and baseline systolic blood pressure ($\beta = -0.038$, $p = .048$) predicted percent weight loss at 12 months.

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Authors’ Note

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Discussion and Conclusion—Weight loss maintenance was similar across groups. This suggests that low-cost delivery methods for worksite-based interventions targeting at-risk populations can help address obesity and obesity-related disparities. Additionally, attendance during the weight loss phase and lower baseline systolic blood pressure predicted greater percent weight loss during the weight loss–maintenance phase, suggesting that early engagement and initial physical functioning improve long-term weight loss outcomes.

Keywords

Asian/Pacific Islander; health promotion; low-cost technology; obesity; race/ethnicity; weight loss; worksite health promotion

Native Hawaiians and other Pacific Islanders (e.g., Samoans; NHOPI) are disproportionately burdened by overweight and obesity compared with other groups in Hawai'i (Nguyen & Salvail, 2013). Obesity-related diseases, such as diabetes and cardiovascular disease, adversely affect this group at greater rates and at younger ages of onset than other ethnic groups (Juarez, Davis, Brady, & Chung, 2012; Mau, Sinclair, Saito, Baumhofer, & Kaholokula, 2009). Effective weight loss and weight loss–maintenance programs are needed to reduce these chronic disease inequities (Kaholokula et al., 2014).

Behavioral-based programs that encourage participants to make and maintain lifestyle changes (i.e., controlling caloric intake and increasing physical activity) to achieve and maintain a healthy weight have been found effective (Diabetes Prevention Program Research Group, 2002b). Research has shown that adherence to these programs is related to psychosocial variables including social support, locus of weight control, and self-efficacy for eating healthy and exercising. Social support is positively associated with adherence to lifestyle change interventions (Wing & Jeffery, 1999) and weight loss (Kiernan et al., 2012). Locus of weight control refers to the degree to which individuals believe that their ability to lose weight is under their control (i.e., internal) or out of their control (i.e., external), and individuals with an internal locus of weight control are more likely to complete a weight loss program than those with an external locus of weight control (Saltzer, 1982). Exercise and eating self-efficacy beliefs are strongly associated with weight loss behaviors (e.g., physical activity and healthy eating) and have been found to predict weight loss (Linde, Rothman, Baldwin, & Jeffery, 2006).

A weight loss/weight loss–maintenance intervention specific to NHOPI is the Partnership for Improving Lifestyle Intervention (PILI) Lifestyle Program (PLP). This intervention involves two phases: an 8-session, 3-month weight loss phase and a 6-session, 6-month weight loss–maintenance phase. The purpose of this article is to present the results of the weight loss–maintenance phase of the PLP adapted for Native Hawaiian–serving organizations (NHSOs). Specifically, we compare the weight loss–maintenance outcomes of the intervention delivered via DVD versus face-to-face in a group setting.

The PLP is a translation of the Diabetes Prevention Program's Lifestyle Intervention (DPP-LI) tailored for NHOPI, and it builds on DPP-LI strategies to maintain healthy lifestyle changes with a focus on family and community supports (Mau et al., 2010). The DPP-LI is a 16-lesson program, individually delivered by trained "lifestyle coaches," that encourages

participants to achieve two complementary goals; 7% weight loss and 150 minutes of moderate exercise per week (Diabetes Prevention Program Research Group, 2002a). Also included in the DPP-LI was frequent contact between lifestyle coaches and participants; individually tailored strategies for participants; and support, training, and feedback for the lifestyle coaches. This program was found to decrease the incidence of type 2 diabetes by 58%, compared with a placebo control group (Diabetes Prevention Program Research Group, 2002b).

The adaption of the DPP-LI to the PLP was informed by extensive community engagement including interviews, focus groups, and surveys with more than 300 community members and leaders (Mau et al., 2010). PLP participants are given the modest goal of losing 3% of their baseline body weight and engaging in moderate physical activity for 150 minutes weekly. A reduction in fat consumption is encouraged as a means to promote weight loss (Diabetes Prevention Program Research Group, 2004). Trained community-peer educators deliver the PLP in group settings at community-based organizations. It has two phases; an 8-lesson, 3-month weight loss phase and a 6-lesson, 6-month weight loss–maintenance phase. Both the weight loss and weight loss–maintenance phases of the PLP adhere to DPP-LI strategies and foci, with cultural adaptations to increase saliency, relevance, and feasibility for NHOPI (e.g., cultural eating expectations; Kaholokula et al., 2014; Mau et al., 2010). It was modified to be culturally/linguistically appropriate and to maximize participation. Because of the lower SES of the NHOPI communities and the difficulties they find in discussing personal matters with their doctor, two lessons were added including (1) economical healthy eating and (2) effective communication with your doctor.

Initial testing of the weight loss phase yielded statistically significant improvements in all the outcome measures, including weight ($M = -1.5$ kg) and systolic ($M = -6.0$ mmHg) and diastolic ($M = -2.8$ mmHg) blood pressure (Mau et al., 2010). A more definitive study had similar findings in weight loss ($M = -1.7$ kg) and systolic ($M = -3.3$ mmHg) and diastolic blood pressure ($M = -3.4$ mmHg) outcomes (Kaholokula et al., 2014). In a randomized controlled trial of Phase 2 (i.e., 6-month weight loss–maintenance intervention), participants were 2.5-fold more likely to maintain their initial weight loss than participants assigned to standard follow-up (Kaholokula et al., 2012).

Translating effective behavioral weight loss/weight loss–maintenance interventions to worksites expands the reach of these interventions into environments where adults spend most of their waking of these interventions hours (Benedict & Arterburn, 2008). Environment factors (e.g., availability of healthy foods) and interpersonal factors (e.g., eating behaviors of others) typical of worksites can influence weight loss and its long-term maintenance (Sorensen et al., 2011; Wang, Kim, Gonzalez, MacLeod, & Winkleby, 2007). Thus, worksites offer an ideal venue for delivering lifestyle interventions and modifying the environmental and interpersonal factors that facilitate (e.g., workplace wellness policies) or hinder (e.g., availability of calorie-dense snacks) achieving and maintaining a healthy weight (World Health Organization, 2014). Because of escalating medical insurance premiums and decreased productivity associated with obesity-related conditions, employers are increasingly supportive of such programs (Heinen & Darling, 2009).

A systematic review of the effectiveness of worksite-based weight loss programs was conducted in 2008 (Benedict & Arterburn, 2008). The review included worksite interventions studies published between 1995 and 2006 at least 8 weeks in duration and assessed pre- and postintervention weight. This review identified 11 randomized controlled trials, with follow-up periods ranging from 2 to 18 months, most of which were focused on healthy eating and physical activity. Average weight loss for the intervention groups was between 1.0 and 6.3 kg. The authors noted a need for longer term follow-up (i.e., >6 months) and more rigorously designed trials to establish the efficacy of worksite interventions (Benedict & Arterburn, 2008).

Weerasekara et al. (2016) conducted a more recent systematic review that included worksite-based weight loss interventions at least 6 months in duration published through 2015. Among the 23 studies included, the authors found a wide variation in weight loss (i.e., 8.8 kg to nonsignificant results in 12-month studies) and in interventions components (i.e., diet, physical activity, etc.). More research is needed to identify successful components of worksite weight loss interventions and examine different sociocultural and geographical contexts (Weerasekara et al., 2016).

Additionally, despite their success, implementing and sustaining in-person behavior change interventions can be challenging. Addressing barriers to accessing in-person interventions (e.g., time constraints) is cited as a reason for delivering a lifestyle intervention via DVD (Kramer et al., 2010). Technology-based interventions (including those delivered by DVD) offer the potential of reaching more people and at lower cost (Berkel, Poston, Reeves, & Foreyt, 2005; Kramer et al., 2010; Ma et al., 2013; Xiao, Yank, Wilson, Lavori, & Ma, 2013). Internet- and computer-based weight loss/weight loss–maintenance interventions have had favorable outcomes when compared with no or minimal intervention (Wieland et al., 2012). Compared with in-person interventions, computer-based interventions resulted in less weight loss; however, the difference was small and diminished over the follow-up period (Wieland et al., 2012).

The PILI@Work Program is an adaptation of the PLP to worksites with a large number of NHOPI employees (Townsend et al., 2016). Similar to PLP, PILI@Work is delivered in two phases: a 3-month weight loss phase and a 9-month weight loss–maintenance phase. The 3-month weight loss phase is composed of eight, group-based, 90-minute sessions. A test of the PILI@Work 3-month weight loss phase yielded significant improvements in weight ($M = -1.2$ kg), systolic ($M = -2.8$ mmHg) and diastolic blood pressure ($M = -2.0$ mmHg), physical functioning as measured by a 6-minute walk test ($M = 69.4$ feet), exercise frequency, and fat in diet (Townsend et al., 2016).

For this report, we focus on the 9-month weight loss–maintenance phase of PILI@Work. Specifically, we compare here the weight loss–maintenance outcomes of the second phase of the PILI@Work Program delivered via DVD versus face-to-face in a group (FFG) setting by a peer educator. Additionally, we examined factors from baseline (i.e., prior to starting the PILI@Work intervention) and the 3-month assessment (i.e., post 3-month weight loss phase but prior to randomization to the DVD or FFG maintenance) as predictors of continued weight loss at the 12-month assessment (i.e., post 9-month weight loss–maintenance phase).

We hypothesized that delivery methods would be similar in their effects on employees' continued weight loss or weight loss maintenance. Additionally, we hypothesized that retention in the DVD group would be higher than in the face-to-face group.

Materials and Method

Worksites and Participants

We compared the weight loss–maintenance effectiveness of two delivery methods (i.e., DVD vs. FFG) of the PILI@Work Program weight loss–maintenance phase with employees of NHSOs (i.e., organizations with an expressed mission to serving Native Hawaiians) in Hawai'i. NHSO were targeted because they employ large numbers of NHOPI. However, this study was open to all employees of the NHSO regardless of ethnicity.

Fifteen worksites participated in our study: seven on O'ahu, one each on Maui and Lāna'i, and two each on Moloka'i, Kaua'i, and Hawai'i Island. These NHSO worksites included social service organizations (six worksites, eight employee cohorts), health centers (four worksites, six employee cohorts), Native Hawaiian Health Care Systems (three worksites, three employee cohorts), and academic institutions (two worksites, five employee cohorts). A total of 22-employee cohorts were obtained. All participants who completed 3-month assessment were eligible for participation in this study. In total, 217 employees completed the 3-month weight loss phase and were eligible to enter the 9-month weight loss–maintenance phase (Townsend et al., 2016). Inclusion criteria for the first phase were as follow: adults (≥ 18 years of age), with overweight or obese (body mass index [BMI] ≥ 25 kg/m²; BMI ≥ 23 kg/m² for Filipinos and Asians), willing and able to engage in moderate physical activity and modification of dietary pattern.

Study Design

We used a two-arm RCT design embedded in a community-based participatory research (CBPR) approach (Townsend et al., 2016). An intervention steering committee (ISC), which included managerial/executive worksite representatives as community investigators and academic investigators, agreed on the research project's mission and guiding CBPR principles. The ISC was involved in all decision-making processes and research phases. An employee at each participating NHSO assisted with participant recruitment and intervention implementation. Academic researchers conducted participant assessments. Institutional review boards at the University of Hawai'i, the Native Hawaiian Health Care Systems, and the Queen's Health Systems approved this study.

At the conclusion of the 3-month, weight loss phase, participants completed a 3-month assessment. Participants were then randomized by worksite cohort to receive the weight loss–maintenance phase delivered either (1) in a group setting via trained peer facilitators (12 FFG cohorts with 112 participants) or (2) via DVD technology (10 DVD cohorts with 105 participants). To avoid cross-contamination, cohorts that ran concurrently within a single worksite were randomized together. The content, materials, and delivery schedule, described below, were the same for both arms. A CONSORT (Consolidated Standards of Reporting Trials) diagram of the study is presented in Figure 1.

The intervention for both DVD and FFG arms was delivered at the participating worksites. Most facilitators were worksite employees tasked with delivering the PILI@Work intervention ($n = 15$) while others ($n = 7$) were contracted by a worksite or provided by the ISC for the sole purpose of delivering the intervention. Prior to PILI@Work implementation, facilitators received training on program content, delivery methods, behavioral change principles from the social cognitive theory (e.g., self-regulation, self-efficacy, modeling, outcome expectations), and motivational interviewing, (Bandura, 1998). The meetings mainly occurred during an extended lunch hour or immediately after work hours.

Intervention

The PILI@Work 9-month, 11-lesson, weight loss–maintenance intervention was adapted from an 18-month, 17-lesson, community-based, weight loss–maintenance intervention. The 18-month intervention was developed using a CBPR approach with NHOPI communities. The 11 PILI@Work weight loss–maintenance lessons were selected using the 18-month intervention by the ISC for perceived relevance to their employees. Additional modifications were made to language (e.g., emphasizing friends and coworkers) and examples (e.g., healthy eating at work, activities with coworkers). The intervention built on the strategies and content used in the weight loss phase. Topics in the weight loss–maintenance phase included strategies for staying motivated, problem solving, and continuing a healthy lifestyle during holidays and vacations (Table 1).

Both the DVD and FFG received the same intervention materials (i.e., participant workbooks and handouts) on the same delivery schedule for 11 lessons; the first 4 delivered every other week for 2 months and the remaining seven lessons delivered monthly for a total of 9 months. Those cohorts randomized to FFG attended group meetings led by peer-facilitators. Those cohorts randomized to DVD were provided with the DVD lessons and accompanying workbooks at their worksites on the intervention delivery schedule. DVD participants had several viewing options: (1) as a group, at a set time and location (e.g., private conference room) or (2) individually or in smaller groups at times and places convenient to them. Worksites randomized to DVD were provided with a large screen LCD television, a DVD player, and four copies of each DVD lesson.

The DVDs were filmed and edited by research assistants with expertise in audiovisual production. The first three DVDs featured Native Hawaiian researchers as peer facilitators talking directly to the camera and participants viewing the DVD. The subsequent lessons featured audio narration with text graphics, local pictures, and short videos to provide illustration of the ideas presented and to maintain audience interest. DVDs followed the participant workbooks, which were the same as those for the FFG, and prompted participants to pause the DVD to complete any worksheets and action plans.

Assessment Instruments

The assessment procedures followed a standardized protocol as previously detailed (Kaholokula et al., 2013). Briefly, measures were selected for their validity indices, sensitivity to change, literacy level, ease of administration, and cultural appropriateness

(Kaholokula et al., 2014; Mau et al., 2010; Townsend et al., 2016). Study investigators conducted the assessments in private locations at the worksites to ensure confidentiality.

Clinical Measures—Weight was measured in kilograms (kg) using an electronic scale (Tanita BWB800AS). Participants were asked to remove their shoes and empty their pockets prior to weights being taken. Height was measured in centimeters using a Seca 222 stadiometer. Blood pressure was measured in mmHg through an electronic blood pressure device (HEM-907XL IntelliSense). Each clinical measure was collected twice and averaged for the final measurement. BMI was calculated as weight in kg divided by height in meters squared.

Sociodemographics—Collected were age, sex, marital status (never married, currently married, or interrupted, i.e., divorced, separated, widow/widower), education level (high school diploma/GED or less, some college/technical training, college degree, or graduate/professional degree), and race/ethnicity (i.e., Native Hawaiian [NH], Other Pacific Islander [OPI, including Filipino], Asian, Caucasian, and “other”).

Physical Functioning—Physical functioning was assessed using the 6-minute walk test (6MWT). 6MWT instructions were read aloud to participants using a standardized script based on established test guidelines (“American Thoracic Society Statement,” 2002). Participants were instructed to walk, without running, around a 60-foot course for 6 minutes. They were informed they could stop or take breaks as needed. This measure was scored by total distance walked in feet within 6 minutes.

Exercise Frequency—A two-item Physical Activity Questionnaire assessed frequency of moderate physical activity (from 1 = *4 times a week* to 5 = *rarely or never*) and frequency of vigorous activity (from 1 = *4 times a week* to 5 = *rarely or never*; Marshall, Smith, Bauman, & Kaur, 2005). The average of the two items was used to measure overall exercise frequency, with lower scores indicating greater frequency.

Fat Intake—The 39-item Eating Habits Questionnaire estimated fat consumption in the past month based on four categories: meat consumption, avoidance of fat, modification/substitution of fatty foods, and replacing fatty foods with vegetables (Kristal, Beresford, & Lazovich, 1994). Participants are asked whether or not they consumed red meat, fish, chicken, and pasta (six items), milk and cheese products (three items), fruits, vegetables, and salads (six items), and bread, rolls, muffins, and cereals (one item) and if they prepared food (two items). For affirmative responses, participants were asked to rate the frequency with which they used various preparation methods (e.g., frying vs. baking or broiling, with vs. without butter, regular vs. low-fat cheese, dressing or milk) using a 4-point Likert-type scale ranging from 1 (*always*) to 4 (*never*). A mean of the category means was used as the final score, with scores ≥ 2.5 indicating greater than 30% fat in diet. The questionnaire was found to have acceptable reliability ($\alpha = .73$).

Family and Community Support—The Family Support Scale (six items) and Community Support Scale (five items) assessed perceived family and community support to achieve and maintain healthier lifestyles through healthy eating and exercise (Gruber, 2008).

Example items include, “my family encourages me to lose weight” (Family Support Scale) and “my community is safe for me to walk around or exercise in.” Items are rated on a 5-point Likert-type scale from 1 (*never*) to 5 (*very often*), with higher scores indicating greater perceived family or community support.

Locus of Weight Control—The four-item Weight Locus of Control Scale assessed a person’s perceptions of how their weight is controlled—internally (two items; e.g., “whether I gain, lose, or maintain my weight is entirely up to me”) or externally (two items; e.g., “being the right weight is largely a matter of good fortune”; Saltzer, 1982). Each item is scored on a Likert-type scale from 1 (*strongly disagree*) to 5 (*strongly agree*) and totaled. Total scores range from 4 (*extreme external locus*) of control to 20 (*extreme internal locus of control*). Cronbach’s alpha for this scale, .56, was comparable to that found in initial testing, .58 (Saltzer, 1982).

Exercise and Eating Self-Efficacy—The nine-item Self-Efficacy Exercise Scale (SEE) assessed participants’ confidence to engage in exercise despite specific barriers (e.g., “I had to exercise alone”) from 1 (*not sure at all*) to 5 (*completely sure*; Resnick, Luisi, Vogel, & Junaleepa, 2004). The final score is the average of the item scores, with higher scores indicating greater self-efficacy. The nine-item Eating Self-Efficacy Scale (ESE) was adapted from the 20-item Weight Efficacy Life-Style Questionnaire. The ESE was shortened to decrease participant burden and minor wording changes were made (i.e., from “I can resist eating” to “I can control eating”) to improve the scales relevance to a Hawai‘i-based sample. The ESE assessed participants’ confidence to control eating and engage in healthy eating behaviors in potentially difficult situations. (e.g., “I can control my eating on the weekends”) from 1 (*not sure at all*) to 5 (*completely sure*) (Clark, Abrams, Niaura, Eaton, & Rossi, 1991). The final score was an average of the item scores, with higher scores indicating greater self-efficacy. Cronbach’s alphas for the SEE and ESE were high, .89 and .91, respectively.

Data Reductions and Statistical Analysis

Participant characteristics were summarized by descriptive statistics: mean and standard deviation (*SD*) for continuous variables and frequency and percentage for categorical variables. Two-sample *t* tests for continuous variables and chi-square tests or Fisher’s exact tests for categorical variables were used to compare intervention groups. The retention rate, defined as the percentage of subjects who participated at the beginning and remained at the end of their respective interventions, was compared using chi-square test. Changes in outcome measures were computed as participants’ assessment at the end of weight loss–maintenance phase (12-month assessment) minus the assessment at the beginning of weight loss–maintenance phase (3-month assessment). Both a complete case and intent-to-treat analyses were done. Two-sample *t* tests were performed to compare the changes in weight and weight-related outcomes by intervention group. For the analysis of weight maintenance, dropouts were assumed to have regained 0.3 kg per month (Wadden, Berkowitz, Sarwer, Prus-Wisniewski, & Steinberg, 2001; Wing, Tate, Gorin, Raynor, & Fava, 2006). Successful weight maintenance was defined as participants’ 12-month postintervention weight change remaining ≤3% of their 3-month weight (Kaholokula et al., 2012). Logistic regression was

used to compute the relative indifference ratio (RIR) defined as the odds for weight maintenance, adjusted for sex and worksite type (Cook, 2002). The null hypothesis that RIR equaled unity was tested via a likelihood ratio test. Logistic regression, adjusted for potential participant characteristics, was used to calculate the odds ratio (*OR*) for weight maintenance. All statistical analyses were performed using SAS software Version 9.4 (SAS Institute Inc., Cary, NC). A *p* value <.05 was regarded as statistically significant.

Results

Participant Characteristics at Randomization

A total of 15 worksites participated with 22 cohorts yielding 217 participants. Participant characteristics (Table 2) at randomization into the two arms of the weight loss–maintenance phase differed significantly in worksite type; more participants from academic institutions were in the FFG and more participants from the other worksite types were in the DVD group ($p < .001$). There were more Other Pacific Islanders in the DVD group and more Asians in the FFG ($p = .011$). On average, the participants in the DVD group were 4.5 years younger ($p = .003$) and were more likely to be female ($p = .008$) than those in the FFG. There were no significant differences on any of the clinical or behavioral measures between intervention groups. Face-to-face participants' mean weight was 84.6 kg compared with 86.3 kg in DVD participants ($p = .58$).

Retention

The overall retention rate was 71.9%. There was no significant difference between DVD and FFG weight loss–maintenance groups in terms of participant retention from 3- to 12-month assessments. In the FFG, 83 participants were retained at 12 months (74.1%) compared with 73 participants (69.5%) in the DVD group ($p = .46$).

Weight Loss Outcomes

Overall, participants mean weight loss was $M = -0.26$ kg, which was not statistically significant. Statistically significant changes ($p < .05$) included an increase in systolic ($M = 2.29$ mmHg) and diastolic blood pressure ($M = 1.64$ mmHg), and decrease in exercise frequency ($M = 0.22$) and a more internal locus of weight control ($M = 0.31$). The DVD group lost slightly more weight ($M = -0.48$ kg) than the FFG ($M = -0.07$ kg); however, this difference was not significant either within or between groups. There was a significant change within each intervention arm on several variables, including exercise frequency scores ($M = 0.24$, $p = .021$) in the DVD group, signaling a decrease in exercise frequency, and locus of weight control scores ($M = 0.46$, $p = .045$) in the FFG, signaling greater internality (Table 3). There was no significant difference between intervention arms in change of any variables except family support scores, with FFG having greater perceived family support (FFG $M = 0.45$, DVD $M = -0.49$, $p = .047$). The intent-to-treat analysis showed similar results; a decrease in exercise frequency (DVD $M = 0.17$), an increase in internal locus of weight control (FFG $M = 0.35$), and an increase in family support scores were significantly different between groups (FFG $M = 0.34$, DVD $M = -0.33$, $p = .047$).

Weight Loss Maintenance

Table 4 summarizes the proportion of participants who had lost 3% of their weight during the 3-month weight loss phase and who successfully maintained this weight loss at 12-month assessment (i.e., gained 3% of their body weight) by intervention arm. Overall, 59.6% ($n = 31$) of all participants successfully maintained their weight loss at 12-month assessment. A larger proportion of participants in the DVD group, 20 of 31 (64.5%), successfully maintained their weight loss, compared with the FFG, 11 of 21 (52.4%), although this difference was not statistically significant.

Predictors of Correlates of Continued Weight Loss

Table 5 presents the results of a multivariate linear model predicting the percent of weight loss from 3- to 12-month assessments. The variables included in this model were those with a significant bivariate association with percent weight loss at 12-month assessment including number of lessons attended during the 3-month weight loss phase ($r = 0.186$, $p = .019$), systolic blood pressure at baseline ($r = -0.174$, $p = .030$), and 6MWT at baseline ($r = 0.197$, $p = .014$). Sociodemographic variables (i.e., age, sex, and ethnicity), intervention group, and worksite type were not included in the model as none of these variables had a significant bivariate correlation with percent weight loss from 3 to 12 months. As shown in Table 5, the number of lessons attended in Phase 1 of the intervention was a significant predictor of percent weight loss at 12 months: $\beta = 0.358$, $t(1) = 2.310$, $p = .022$. Additionally, systolic blood pressure at baseline, $\beta = -0.038$, $t(1) = -2.000$, $p = .048$, predicted percent weight loss at 12 months. The model explained 8% of the variance in percent weight loss from 3- to 12-month assessment: $R^2 = .081$, $F(3, 140) = 4.10$, $p = .008$.

Discussion

We examined the weight loss–maintenance outcomes of a healthy lifestyle intervention called the PILI@Work Program delivered in NHSOs. The PILI@Work Program is composed of a 3-month, DPP-LI–translated phase to initiate weight loss efforts and a 9-month phase to continue or maintain weight loss. This article presented the results of the 9-month, weight loss–maintenance phase delivered via two methods—DVD and FFG. Sixty percent of the participants who entered the 9-month weight loss–maintenance phase having lost 3% of their initial body weight maintained their weight loss at the conclusion of the intervention.

Based on an overall intervention retention rate of 71.9%, the PILI@Work Program was well received by the participating NHSO. While not statistically significant, the DVD group's retention rate was about 5% lower than that of the FFG, contrary to our hypothesis. These retention rates are comparable to rates reported in a systematic review of other worksite weight loss/maintenance studies, which range from 82% to 42% (Ni Mhurchu, Aston, & Jebb, 2010). In a similar 6-month, structured weight loss–maintenance program, retention was 48% (Salinardi et al., 2013). Researchers have speculated that smaller, localized programs may improve retention compared with large-scale programs (Cawley & Price, 2013). The fact that PILI@Work is a culturally informed, localized program, delivered by employees to employees, may have contributed to our ability to retain participants.

Overall, there was no significant reduction in weight during the 9-month intervention. Looking at the intervention arms separately, the participants in the face-to-face arm significantly internalized their locus of weight control to perceive themselves and their actions as influencing their weight, while the DVD participants did not. The only significant difference found between intervention arms was that the FFG's perception of their families' support improved while the that of the DVD groups declined. While previous studies have found a positive association between social support and locus of weight control and weight loss or weight loss maintenance, our study does not support this conclusion (Anastasiou, Fappa, Karfopoulou, Gkza, & Yannakoulia, 2015; Kiernan et al., 2012).

Most participant weight loss occurred during Phase 1 of the intervention, however this initial weight loss did not predict long-term weight loss or maintenance. The number of lessons attended in Phase 1 and baseline systolic blood pressure were the only two predictors of percent weight loss during Phase 2. Every additional lesson attended resulted in a 0.36% decrease in body weight at 12 months, suggesting that initial intervention participation and engagement results in improved long-term weight loss. Also, a lower baseline systolic blood pressure predicted a greater percent weight loss from 3 to 12 months. This suggests that greater physical functioning, as reflected by lower systolic blood pressure at baseline, may improve a participant's weight loss and weight loss–maintenance success. Greater engagement during the first phase of the intervention may be an indicator of participants' mental and physical readiness for initial and for continued behavior change. Previous studies have shown that participant baseline characteristics can predict participant success in weight loss interventions (Delahanty et al., 2013; Harwell, Vanderwood, Hall, Butcher, & Helgersen, 2011; Teixeira et al., 2004).

We did not find a significant difference between face-to-face and DVD delivery methods in weight loss maintenance, and these results are similar to previous research (Kramer et al., 2010). This is encouraging, as the dissemination, implementation, and sustainability of DVD-delivered weight loss–maintenance interventions are easier and less expensive than the same interventions delivered via live, trained facilitators. This has significant practice implications with the accessibility of mediums such as YouTube or mobile apps. Compared with face-to-face interventions, technology-based interventions may obtain comparable employee weight loss at potentially lower costs to the organization (Ma et al., 2013; Xiao et al., 2013). Though not statistically significant, we found a slightly lower retention rate for the DVD intervention. Future online interventions could be more personalized in an attempt to increase retention.

We also found that the majority of participant weight loss occurred in Phase 1. Our findings suggest that individuals in traditional weight loss programs who have not lost weight within the first 3 months are not likely to respond to the program later. This suggests that weight loss programs should be geared toward increasing initial weight loss rather than continuing long-term treatment for individuals who do not respond. A possible method for increasing initial weight loss is through worksite-based financial incentives. One study found that a deposit contract incentive with repayment improved weight loss by 25% compared with a weight loss program alone (Benedict & Arterburn, 2008).

Future research should focus on identifying strategies to increase initial participant engagement to facilitate long-term weight loss and its maintenance. The finding that participants with better physical functioning (i.e., lower systolic blood pressure) prior to intervention were more likely to maintain weight loss suggests that strategies to improve function (e.g., starting with increased physical activity before specifically addressing weight loss) may improve outcomes. Research on strategies to increase initial participant engagement may also result in greater long-term weight loss and maintenance. Future studies are needed to more fully identify the predictors of early weight loss and elucidate methods for improving initial weight loss as a means to improve long-term weight loss maintenance (Astrup & Rössner, 2000). Additional research is also needed to determine how to best meet the needs of “nonresponders,” that is, those who do not lose weight within the first 3 months. Finally, more research is needed to determine if the relative effectiveness of the DVD delivery method would extend to Phase 1 of the intervention.

It is important to note the limitations of this study. This study did not examine worksite characteristics, which may have affected intervention effectiveness (i.e., support from administration, employee cohesion, other worksite wellness programs and policies). Future studies should account for such characteristics in their design. The researchers should have required those facilitators of the DVD groups to record whether participants watched the DVD, rather than simply received it. Thus, this study is limited by our inability to control for attendance during the 9-month weight loss–maintenance phase (i.e., DVD viewing).

Support for worksite wellness programs has increased under the 2010 Patient Protection and Affordable Care Act, which resulted in a dramatic increase in the number of work-site wellness programs, from 19% of large employers (those with 200 employees) in 2006 to 94% in 2012. Sixty-five percent of large employers offered weight loss programs specifically (Kaiser Family Foundation and Health Research & Educational Trust, 2012). With the variety of interventions available and emergence of employee wellness programs, it is important to identify the most effective interventions, as well as ways to disseminate and sustain these programs. The findings of our study suggest that technology-based delivery methods for worksite wellness programs may be as effective as facilitator-delivered interventions and, thus, may help reduce obesity and obesity disparities.

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Figure 1. CONSORT (Consolidated Standards of Reporting Trials) flow diagram of Partnership for Improving Lifestyle Intervention at Work (PILI@Work) participation.

Table 1

Summary of the 9-Month PILI@Work Weight Loss–Maintenance Phase.

Lessons	Topic
Lesson 1 (Month 4)	Introduction to the PILI Lifestyle Maintenance Intervention <ul style="list-style-type: none"> • Importance of a support person • Ways to stay motivated • Why is it important to monitor your weight? • What is the weight chart? What is it used for?
Lesson 2 (Month 4)	What We Know About Weight Loss/Maintenance? <ul style="list-style-type: none"> • Share success stories • How's and why's of successful weight loss • Ways family and community resources can be helpful
Lesson 3 (Month 5)	The Four Phases of Change in Successful Losers <ul style="list-style-type: none"> • Stopping the vicious cycle and starting the positive spiral • Dealing with success • Maintenance (emphasis) • Create/identify the needed home and community environment
Lesson 4 (Month 5)	Continue to Be Active <ul style="list-style-type: none"> • Reasons for family and friends to be active together • How to make being active a way of life • Strategies to exercise safely • Identify and plan family activities
Lesson 5 (Month 6)	Take Charge of Challenging Social Situations <ul style="list-style-type: none"> • Eating and physical activity triggers and habits • Challenging day-to-day situations • Ways your family and friends can help support you
Lesson 6 (Month 7)	Make Eating Healthy, Easy, and Fun <ul style="list-style-type: none"> • Ways to eat healthier by adopting healthy habits and benefits of healthy eating • Review the plate method • Understanding nutrition labels • Counting calories and finding hidden fat
Lesson 7 (Month 8)	Social Situations and Cultural Beliefs <ul style="list-style-type: none"> • Ways you and your family and friends can eat healthy at social events • Cultural beliefs that relate to eating • Ways to increase social support in the community
Lesson 8 (Month 9)	Manage Your Stress <ul style="list-style-type: none"> • What is stress and how it affects people • Signs and symptoms of stress

Lessons	Topic
	<ul style="list-style-type: none"> Ways you can manage stress
Lesson 9 (Month 10)	Make Time for a Healthy Lifestyle <ul style="list-style-type: none"> Ways you can better manage your time How you can fit healthy eating and physical activity into your life
Flexible Lesson (Month during major holidays)	Get Ready for the Holidays/Vacations/Managing Binges <ul style="list-style-type: none"> What are the special difficulties during this time of the year/on vacations? General problem-solving strategies for the holidays or vacations What's most important during the holidays and vacations?
Lesson 11 (Month 12)	Stay Healthy for Life! <ul style="list-style-type: none"> What comes next in your healthy lifestyle plan? How to keep going when the going gets tough Stay motivated

Note. PILI@Work = Partnership for Improving Lifestyle Intervention at Work.

Table 2

Characteristics of the Study Participants by Intervention Group at Baseline Assessment.

Characteristics	FFG (<i>n</i> = 112), <i>n</i> (%)	DVD (<i>n</i> = 105), <i>n</i> (%)	<i>p</i> value
Worksite			<.001
AI	51 (45.5)	0	
HC	24 (21.4)	40 (38.1)	
NHHCS	10 (8.9)	21 (20.0)	
SS	27 (24.1)	44 (41.9)	
Facilitator, internal	78 (69.6)	62 (59.1)	.11
Island, O'ahu	66 (58.9)	70 (66.7)	.24
Ethnicity			.011
Asian	32 (28.6)	14 (13.3)	
Caucasian	13 (11.6)	17 (16.2)	
Native Hawaiian	42 (37.5)	41 (39.1)	
Other Pacific Islander	15 (13.4)	31 (29.5)	
Other	2 (1.8)	2 (1.9)	
Age, years, <i>M</i> (<i>SD</i>)	48.2 (11.6)	43.7 (10.8)	.003
Females	91 (81.3)	98 (93.3)	.008
Education level			.11
High school diploma/GED	6 (5.4)	7 (6.7)	
Some college/technical training	20 (17.9)	29 (27.6)	
College degree	34 (30.4)	41 (39.1)	
Graduate/professional degree	42 (37.5)	26 (24.8)	
Marital status			.99
Never married	23 (20.5)	23 (21.9)	
Currently married	63 (56.3)	63 (60.0)	
Interrupted marital status	16 (14.3)	17 (16.2)	
Height, cm, <i>M</i> (<i>SD</i>)	162.2 (8.8)	161.5 (7.8)	.58
Weight, kg, <i>M</i> (<i>SD</i>)	84.6 (22.8)	86.3 (20.5)	.58
Body mass index, kg/m ² , <i>M</i> (<i>SD</i>)	31.9 (6.7)	33.0 (7.2)	.25
Systolic blood pressure, mmHg, <i>M</i> (<i>SD</i>)	123.6 (13.8)	121.0 (14.4)	.17
Diastolic blood pressure, mmHg, <i>M</i> (<i>SD</i>)	77.8 (10.4)	77.1 (10.5)	.62
6-Minute walk test, feet, <i>M</i> (<i>SD</i>)	1492 (186)	1543 (210)	.15
Exercise frequency, <i>M</i> (<i>SD</i>)	3.0 (1.1)	2.9 (1.1)	.25
Fat in diet score, <i>M</i> (<i>SD</i>)	2.6 (0.4)	2.6 (0.4)	.69
Family Support Scale, <i>M</i> (<i>SD</i>)	22.3 (3.6)	22.2 (4.1)	.84
Community Support Scale, <i>M</i> (<i>SD</i>)	20.3 (3.4)	19.9 (3.8)	.41
Locus of weight control, <i>M</i> (<i>SD</i>)	16.9 (2.1)	16.8 (2.3)	.67
Self-efficacy for exercise, <i>M</i> (<i>SD</i>)	3.2 (1.0)	3.1 (1.0)	.53
Eating self-efficacy, <i>M</i> (<i>SD</i>)	3.2 (0.9)	3.3 (0.9)	.65

Note. AI = Academic Institution; FFG = face-to-face in a group; HC = health center; NHHCS = Native Hawaiian Health Care System; SS = Social Service. All values are expressed as *n* (%) unless indicated otherwise. The total percentages are not equal to 100 due to the missing values or rounding. Boldfaced *p* values indicate statistical significance (*p* < .05).

Table 3

Change in Outcome Measurements by Intervention From 3-Month to 12-Month Assessment.

Outcome measure	FFG, <i>M (SD)</i>	DVD, <i>M (SD)</i>	<i>p</i> value	Total (<i>N</i> = 156), <i>M (SD)</i>
Weight (kg)	−0.07 (3.61)	−0.48 (3.15)	.46	−0.26 (3.40)
Body mass index (kg/m ²)	−0.05 (1.36)	−0.19 (1.20)	.51	−0.11 (1.29)
Systolic blood pressure (mmHg)	2.79 (13.81)	1.70 (11.35)	.60	2.29 (12.71) *
Diastolic blood pressure (mmHg)	1.45 (8.66)	1.85 (7.94)	.77	1.64 (8.31) *
6-Minute walk test (feet)	−4.54 (125.74)	22.78 (112.63)	.17	8.32 (120.14)
Exercise frequency	0.21 (1.16)	0.24 (0.87) *	.86	0.22 (1.03) *
Fat in diet score	−0.02 (0.34)	0.01 (0.32)	.61	−0.01 (0.33)
Family Support Scale	0.45 (2.60)	−0.49 (2.92)	.047	−0.04 (2.77)
Community Support Scale	0.35 (2.76)	−0.05 (2.85)	.41	0.17 (2.80)
Locus of weight control	0.46 (1.97) *	0.13 (1.50)	.27	0.31 (1.77) *
Self-efficacy for exercise	0.12 (1.05)	0.10 (1.10)	.93	0.11 (1.07)
Eating self-efficacy	0.12 (0.73)	0.10 (0.84)	.89	0.11 (0.78)

Note. FFG = face-to-face in a group. The change was computed as 12-month assessment value (end of weight loss–maintenance phase) minus 3-month assessment value (at randomization into maintenance intervention group). This analysis was limited to those eligible participants with both 3- and 12-month assessment data. Because of missing data, the sample size ranges were: FFG *n* = 76–83 and DVD *n* = 61–73.

* Within-group change is significant at *p* < .05.

Table 4

Participants Who Maintained Initial 3-Month Weight Loss at 12-Month Assessment by Intervention Group.

Arm	FFG (<i>n</i> = 21), <i>n</i> (%)	DVD (<i>n</i> = 31), <i>n</i> (%)	Total (<i>n</i> = 52), <i>n</i> (%)
Successful weight maintenance	11 (52.4)	20 (64.5)	31 (59.6)
Unsuccessful weight maintenance	10 (47.6)	11 (35.5)	21 (40.4)
Adjusted RIR = 0.50 (0.04, 5.86) <i>p</i> = .58			

Note. FFG = Face-to-face in a group; RIR = relative indifference ratio.

Table 5

General Linear Regression Model Predicting Percent Weight Loss From 3-Month Assessment to 12-Month Assessment.

Variable	Estimate	Standard error	<i>t</i> value	<i>p</i> > <i>t</i>
Number of lessons	0.358	0.155	2.310	.022
Systolic blood pressure	−0.038	0.019	−2.000	.048
6-Minute walk test	0.003	0.002	1.530	.129
Overall model fit, $R^2 = .081$, $F(3, 140) = 4.10$, $p = .008$				