Results from the Dissemination of an Evidence-Based Telephone-Delivered Intervention for Healthy Lifestyle and Weight Loss: The Optimal Health Program

Abstract

Background: Despite proven efficacy, there are few published evaluations of telephone-delivered interventions targeting physical activity, healthy eating and weight loss in community dissemination contexts.

Purpose: To evaluate participant and program outcomes from the Optimal Health Program, a telephone-delivered healthy lifestyle and weight loss program provided by a primary health care organization.

Methods: Dissemination study using a single-group, repeated measures design; outcomes assessed at 6-(mid-program; n=166) and 12-months (end-of-program; n=88) using paired analyses.

Results: The program reached a representative sample of at-risk, primary care patients, with 56% withdrawing before program completion. Among completers, a statistically significant improvement between baseline and end-of program was observed for weight [mean change (SE) -5.4 (7.0)kg] and waist circumference [-4.8 (9.7)cm], underpinned by significant physical activity and dietary change.

Conclusion: Findings suggest that telephone-delivered weight loss and healthy lifestyle programs can provide an effective model for use in primary care settings, but participant retention remains a challenge.

Key words: dissemination, telephone, weight loss, physical activity, diet, intervention

Introduction

Despite well-known health benefits of physical activity and healthy eating [1-3], the majority of adults in economically developed countries fail to meet minimal public health recommendations [4,5]. Related to this are increasing rates of overweight and obesity, and lifestyle-related diseases [6-8]. Thus, effective and broad reaching interventions to promote regular physical activity and healthy eating, as well as modest weight loss are required. Mediated (non face-to-face) intervention delivery in the form of print, Internet and telephone [9-11], offers a potentially flexible, convenient and cost-effective means of providing the repeated contacts necessary to achieve and maintain behavior change [12]. Telephone-delivery is the most widely researched of these modalities to date and remains the most accessible [9,12]. Such interventions are distinctly promising given their potential to be adopted by health organizations that operate telephone information and support centers [12,13].

A strong randomized trials evidence base supports the efficacy of telephone-delivered interventions targeting physical activity and/or dietary change and weight loss in a range of settings and target populations [9,10,14-19]. In order to achieve their potential public health impact, such interventions need to be implemented and evaluated in diverse community practice settings [20-23]. To date, only three large scale dissemination studies have reported on the outcomes of telephone-delivered lifestyle interventions, two targeting physical activity only [24-26], and one targeting modest weight loss via physical activity and diet [27]. Findings from these telephone-delivered dissemination studies suggest that evidence-based interventions can be delivered successfully to achieve results comparable to those observed in controlled research settings, and in so doing, may even reach more diverse samples [24-26,28].

The Logan Healthy Living Program is an evidence-based telephone-delivered 12-month intervention targeting physical activity and healthy eating [29,30]. Its recent uptake by a primary health care organization provided the opportunity to evaluate participant and program outcomes within an applied practice setting. Detailed study methods and outcomes from the randomized controlled trial of the Logan Healthy Living Program have been described [29-31]. In brief, the trial, which targeted adults with type 2 diabetes and/or hypertension, demonstrated significant between-group improvement, favoring the intervention group, for all dietary outcomes, including total and saturated fat, vegetable, fruit

and fiber intake. Significant within-group improvement was observed for physical activity for both intervention and usual care groups [30]. Diet and physical activity improvements were largely maintained at a 6-month post-intervention follow-up [32] and the intervention was shown to be cost-effective [33].

The adaptations and supports that were necessary to facilitate adoption and implementation of the program, now known as the Optimal Health Program (OHP), in a community setting have also been described; the adaptations include broadening the program focus to include modest weight loss (i.e. -5 to 10% of initial body weight), in addition to promotion of physical activity and healthy eating [34], for overweight patients without chronic illness. This was done to avoid duplication of services as the adopting organization offers a range of program and support initatives around self-management of chronic illness including diabetes and heart disease. This paper describes the evaluation of the OHP. Given the dissemination context, indicators of both internal and external validity are addressed [35-37] via reporting on both program (i.e. adoption; reach; characteristics of participants vs. non-participants, and completers vs. dropouts; implementation) and participant outcomes (i.e. weight, waist circumference, HDL-, LDL- and total cholesterol, systolic and diastolic blood pressure, fruit and vegetable intake, total time for moderate-to-vigorous physical activity and total screen time).

Methods

Study Design

Given that the effectiveness of the telephone-delivered intervention had previously been established in a randomized trial, and that the primary research question in this study was about outcomes that could be achieved in an applied practice setting (i.e. dissemination context), a single group, pre-post design was used, as is common for dissemination research [24,25,38-40]. As the OHP program is ongoing, data presented here come from a 'snap shot' of participant and program outcomes after approximately 2.5 years of the program becoming fully operational, with a censure date of April 15, 2012. OHP participants were assessed at baseline and at 6-months (mid-program and end of the more intensive phase of telephone contacts) and 12-months (end-of-program). The study protocol was approved by the School of Population Health Research and Ethics Committee, The University of Queensland, Australia.

Setting

The OHP was taken up for delivery by the Greater Metro South Medicare Local. The Greater Metro South Medicare Local is a state- and federally-funded organization that provides administrative, technical, professional development and educational support to primary medical care practices within the Logan area south of Brisbane, Queensland. Australia. The Logan area (population 277,000) is a large, ethnically diverse community characterized by higher levels of social disadvantage compared to Brisbane (the state Capital) and Queensland, including a greater percentage of single-parent families, unemployment and residents born overseas [41]. At the time the program was initated, the area was supported by 80 primary care practices with 304 General Practitioners.

Practice and Patient Recruitment

The OHP began recruitment of general practices within the Logan area primarily through notices within general practice newsletters. Practices were also invited to participate through expression of interest at committee meetings, promotional events and conferences. Once an expression of interest was received, OHP staff completed a practice visit with General Practitioners and/or practice nurses. During these visits, practices were provided with information kits detailing the program including eligibility criteria for participants, program brochures, referral forms and participant outcome reporting forms. General Practitioners screened potentially eligible patients for OHP referral. To be eligible for participation, patients needed to be at least 18 years of age, have a BMI equal or greater than 25 kg/m^2 and have no chronic disease (other than hypertension, arthritis, osteoporosis, dyslipidemia, depression, or anxiety). Patients were excluded if they were unable to participate in telephone counseling (e.g. no telephone, unreachable by phone for extended periods), and if the doctor determined that participation in unsupervised moderate-intensity physical activity or strength training was contraindicated. Once referrals were received by the Medicare Local, an additional screening call (to double check eligibility) was conducted by the OHP counselors before recruitment into the program. During this call verbal informed consent was obtained for the collection of data for evaluation purposes.

Intervention – The Optimal Health Program

The OHP intervention protocol closely followed the original Logan Healthy Living Program [29]; given the change in target group it also included evidence-based weight loss protocols [42]. It involved delivery of a total of 18 intervention calls, delivered weekly for the first four

weeks, then fortnightly until four months, and then monthly for the remaining eight months. Although the ideal frequency of calls was specified based on the Logan Healthy Living Program protocol [29,30], flexibility in the timing of calls was allowed, consistent with the norms of the clinical practice-based approach being used. (For example, participants may have received an extra call during the monthly phase if required). Program calls were intended to last approximately 20-30 minutes. Program protocol allotted up to five call attempts before a participant was withdrawn from the program.

Participants were mailed a workbook, pedometer, stretch band, tape measure, calorie (fat and fiber) counter, community lifestyle directory with details of subsidized physical activity programs within the local area and off-the-shelf brochures on diet and physical activity guidelines. In addition to sections on physical activity, diet and weight loss, the workbook addressed behavior change strategies consistent with Social Cognitive Theory [43], including goal setting, problem-solving, self-rewards, social support, positive self-talk, and relapse prevention [29]. Telephone counselors regularly referred to the workbook during the 12-month program, emphasizing the development and ongoing review of achievable physical activity, diet and weight loss goals. A patient-centered motivational interviewing approach [44] to the telephone counseling was used.

Targets for diet and physical activity were consistent with national guidelines [45-49]. Drawing on newer evidence on the importance of reducing sitting time [50], participants were encouraged to limit non-work-related screen time to no more than two hours per day. Consistent with the evidence on weight loss for chronic disease prevention, participants were encouraged to lose 5-10% of their body weight over the 12-month program and weight loss protocols followed evidence-based guidelines [51,52].

Staff training

Telephone counselors were accredited practicing dieticians, all with bachelor's level training in nutrition and dietetics. Counselors initially received an intensive 5-day in-house training program conducted by research staff on intervention procedures, recruitment, screening and assessment methods, follow-up protocols, data entry and motivational interviewing strategies [44]. Additionally, a half-day training workshop with an exercise physiologist was provided to ensure adequate skills related to physical activity promotion (specifically around strength training). Regular phone and email contact, and monthly to bi-monthly face-to-face meetings with research staff supported implementation and addressed quality control of program

delivery (via case conferences) and data collection (via regular checks for accuracy of entry); however, only call delivery and duration were systematically tracked and recorded. A total of 2.2 full-time equivalents were devoted to OHP program delivery by three counselors.

Outcomes

Program Outcomes

Participant baseline socio-demographic variables (i.e. age, sex, marital status, highest education attainment, employment status and income) were collected via telephone by OHP counselors in order to be able to describe the characteristics of participants versus non-participants and OHP completers versus dropouts. Data related to program delivery (i.e. number and duration of calls completed) were tracked by OHP counselors. At both the mid- and end-of-program assessments, participants were asked by counselors to rate how helpful they found the program overall on a 10 point likert scale, from 1 'not helpful at all' to 10 'extremely helpful'.

Participant Outcomes

Participant outcomes included objectively-measured clinical (weight, waist circumference, HDL-, LDL- and total cholesterol, systolic and diastolic blood pressure) and self-reported behavioral outcomes [fruit and vegetable intake, total time for moderate-to-vigorous physical activity (MVPA), and total screen time]. For all participant outcomes, mid- and end-of-program assessments were scheduled at approximately 4-6 months and 12-months, allowing more flexibility with the scheduling than in a controlled research study in view of the constraints of conducting program evaluation in a community setting with rolling recruitment.

Clinical outcomes were collected via General Practitioner or practice nurse at baseline, and each follow-up time point. Behavioral outcomes were collected via telephone by OHP counselors and included: the same validated measures used in the original randomized controlled trial [29,30], as well as demographic data at baseline. Servings of fruit and vegetables were assessed using two items from the validated Australian National Nutrition Survey [53,54]. Self-reported physical activity was measured using the Active Australia Survey [4]. Total weekly minutes of MVPA was calculated from the sum of walking, moderate and 2 × vigorous minutes, first truncating each activity at 840 minutes/week and truncating total MVPA at 1680 minutes/week [4]. Four items were used to assess total time

spent sitting in the last week across two domains – 1) watching television, videos or playing electronic games and 2) leisure-time computer use [55]. Adverse outcomes were assessed by asking participants if they had any new health problems since the previous assessment.

Data Analysis

The 'snap shot' evaluation utilized data from participants enrolled in the program from its inception until mid-April 2012. Analyses that required data from mid- or end-of-program assessments excluded those participants who had not been enrolled in the program long enough to have reached those assessment time points.

Data analyses were conducted in SPSS for Windows (version 18). Statistical significance was set at $p<0.05$, two-tailed. Baseline characteristics of participants versus non participants, as well as those who completed the mid- (6-months), and those who completed end-of program (12-months) assessments (completers) versus those who withdrew before each assessment point (drop-outs) were compared using independent sample t-tests, Wilcoxon signed rank tests (for variables not normally distributed) and chi-square tests statistics. Similarly, changes in program outcomes from baseline to 6 months were also compared between those who completed the 12 month assessment and those who withdrew between mid- and end-of-program assessments. Statistically significant and meaningful differences are noted (the latter defined as ≥10% absolute difference for categorical variables or ≥10% difference in means for continuous variables).

Effectiveness of the program was assessed by examining whether participants who completed the program assessments changed significantly from baseline to mid- or end-of-program in their clinical and behavioral outcomes, using paired t-tests and Wilcoxon signed rank tests. Program outcomes are presented as means (standard deviations) for Normally distributed outcomes and medians (minimum and maximum values) for outcomes that did not follow a Normal distribution.

Results

Program Outcomes

Adoption, Reach and Characteristics of Participants versus Non-Participants

After approximately two and a half years of being fully operational, the OHP had been adopted by 23/80 General Practices (29%) and had received 377 referrals, with 317

participants consenting to participate and completing the baseline assessment. Recruitment and retention of participants are shown in Figure 1.

INSERT FIGURE 1 HERE

Participant characteristics at baseline are presented in Table 1. At time of entry into the program, the age range of participants was 18 to77 years [mean (sd) = 46.4 (11.8) years] and body mass index ranged from 25.3 to 76.8 kg/m^2 [mean (sd) = 37.0 (7.7) kg/m^2]; with 48.5% having a BMI of greater than or equal 35kg/m^2. Participants were predominantly female, Caucasian, and married. However, the sample also included a notable percentage of ethnic minorities, including Aboriginal/Torres Strait Islander and Pacific Islander populations (7%), those unemployed (11%) and with low educational attainment - Junior High School or less (41%). According to referral data (gender, age, BMI, weight, waist circumference), there was no statistically significant or meaningful difference between those who consented versus those who declined to participate (data not shown).

INSERT TABLE 1 HERE

Attrition and Characteristics of Completers vs. Drop-outs

As of the census date, of the 279 participants enrolled in the program long enough to complete the mid-program assessment, 166 completed it; 107 withdrew from the program; and 6 had not withdrawn, but had assessments outstanding. Approximately one-third of those who dropped out before the mid-program assessment did so after completing only one counseling call. Of those who completed the mid-program assessments, 136 had also been in the program for long enough to complete their end-of-program assessment; 88 completed it, 39 withdrew and 9 remained outstanding. The withdrawal rates were 38% (107/279) up to the mid- program assessment and 29% (39/136) between mid- and end-of-program assessments. In total, approximately 44% of participants who commenced the OHP completed the program and 12-month assessment.

Table 2 shows the demographic and baseline variables of those who completed the mid-program assessment (completers; n=166) and those who withdrew before completion (drop-outs; n=107). A comparison of the two groups revealed that completers were significantly more likely to be older than those who withdrew. There was a non-significant but meaningful difference in physical activity, with completers reporting higher levels of MVPA per week at baseline than drop-outs.

Table 2 also shows the demographic and baseline variables for those who completed the end-of-program assessment (completers; n=88) and those who withdrew between the mid- and end-of-program assessments (drop-outs; n=39). A comparison of the two groups indicates that completers and drop-outs at the end-of-program time point varied on similar indicators as was observed for the mid-program assessment time point; except that non-Caucasians were more likely to complete end-of-program assessments, as were those with lower incomes, and lower fruit intake at baseline. Compared to those who completed the end-of-program assessment, those who withdrew between mid and end-of-program assessments achieved smaller adiposity changes from baseline to the mid-program assessment [weight: mean change (sd) = -3.7 (5.5)kg vs. -1.3 (5.9) kg, p = 0.1; waist circumference: -4.2 (6.9) vs. -1.9 (5.5) cm, p = 0.3, respectively], but reported larger behavioral changes [including MVPA: 63.7 (215.8) mins/wk vs. 153.5 (201.8) mins/wk, p = 0.03; and fruit intake: 0.4 (1.2) vs. 0.2 (1.2), p = 0.3].

INSERT TABLE 2 HERE

Reasons for attrition are listed in Figure 1. Most commonly, for the mid-program assessment participants were unable to be contacted (n=51). Participants who actively withdrew from the program before completing the mid-program assessment most commonly cited family or health reasons (n=21) or that they had become too busy or no longer needed support (n=28). Similarly, participants who did not complete the end-of-program assessment were most commonly unable to be contacted (n=16).

Implementation

For those remaining in the program at 6 months (n= 166), the median number of calls received was 10 out of approximately 12 recommended calls (range = 1to15). For those who had completed the entire 12-month program (n=88), the median number of calls received was 16 of approximately 18 recommended calls (range=7 to 23). Call duration ranged from 6 to 55 minutes, with an average duration of 29 minutes. On a scale of 1 to 10, with 10 being ‘extremely helpful’, 69/78 (86%) rated the program an ‘8’ or above at end-of-program.

Participant Outcomes

Change from baseline to mid-program

As shown in Table 3, for those completing the mid-program assessment, there was a statistically significant improvement between baseline and 6-months, for all clinical outcomes (i.e. BMI, weight, waist circumference, total cholesterol, systolic and diastolic blood pressure), except HDL cholesterol. Mean weight loss of 3.3 % (±5.6) of initial body weight [mean change (SD): -3.3 (5.7) kg] was observed at 6 months.

There were statistically significant improvements for all self-reported behavioral outcomes, including physical activity [+105 (231) total MVPA minutes/week] and dietary behavior [fruit: +0.4 (1.1) serves/day; vegetables: +0.9 (1.5) serves/day] between baseline and mid-program for those completing the 6-month assessment. No adverse outcomes as a result of participating in the program were reported at the mid-program assessment.

INSERT TABLE 3 HERE

Change from baseline to end-of-program

As shown in Table 4, for those completing the end-of-program assessments, there were improvements between baseline and 12-months for all clinical outcomes, with these reaching statistical significance for BMI, weight, waist circumference and diastolic blood pressure. Mean weight loss of 5.5 % (±6.8) initial body weight [mean change (SD):-5.4 (7.0) kg] was observed for those completing the 12- month assessment, with 48% (28/59) of participants having met or exceeded the 5% weight loss goal of the program.

INSERT TABLE 4 HERE

As shown in Table 4, participants who completed the end-of-program assessment reported statistically significant improvements in self-reported behavioral outcomes including physical activity [+83 (249.7) minutes/week] and vegetable intake [+1.0 (1.7) serves/day], but not fruit, with median intake remaining at the recommended two serves per day. No adverse outcomes were reported at the end-of-program.

Discussion

There have been numerous calls for increased efforts to disseminate effective chronic disease prevention and management interventions [22,25,35,37,56], with more recent attention to their translation into 'real-world' settings [57,58]. The Optimal Health Program is unique to our knowledge, as it represents the first effort to translate and evaluate a telephone-delivered lifestyle intervention targeting weight loss within an applied primary health care setting.

Overall, participant outcomes from the 'snap shot' evaluation indicate promising effectiveness for weight loss and other clinical outcomes, underpinned by dietary and physical activity change. Those who completed the end-of-program assessment showed clinically meaningful improvement, losing on average 5.5% of their body weight from baseline. Almost half of participants who completed the program achieved at least 5% weight loss, although it is important to note this was based on a small number of participants, given 44% retention at 12-months. This magnitude of weight loss has been associated with beneficial health outcomes and is meaningful in terms of both individual and population health [59-61].

An Australian telephone-delivered lifestyle program [offered as a state-wide government health-department funded service – the Get Healthy Information and Coaching Service (GHS)] provides the most comparable source of data for OHP outcomes [62]. Similar to the OHP, the GHS targeted physical activity and diet as well as modest weight loss, but with all outcomes collected via self-report. In contrast to the OHP, the GHS involved six months of telephone coaching, and broadly targeted the general adult population, mainly based on self-referrals following ongoing media campaigns [27,28], with a smaller number of participants coming from secondary referral sources which included health practitioner referrals [28]. From a snap shot of 1440 participants, the GHS reported statistically significant improvements in weight [-3.9kg (5.1)] and waist circumference [-5.0cm (6.0)], remarkably similar to the corresponding objectively-measured anthropometric outcomes seen in the mid-program assessment of the OHP.

Overall, weight loss achieved within the OHP compares favorably to evidence from the broader array of studies that have attempted to translate the intensive Diabetes Prevention Program into delivery in a range of community and clinical settings. A review of 16 such studies found that weight loss ranged from -1.0 to -8.6 kg, with the percentage of participants meeting the 5% weight loss goal ranging from 11 % to 64% [57]. However, studies included in the review were predominantly group-based/face-to-face, with only one including some telephone contact [63]. The magnitude of physical activity and dietary improvements observed in the OHP is broadly comparable to other telephone-delivered dissemination studies [24,26,64], as well as the original trial upon which it was based [30].

In addition to reporting on participant (effectiveness) outcomes, a number of factors related to external validity that are important to informing the broader evidence around dissemination

(i.e. adoption, reach and retention), were also assessed as part of the OHP evaluation. At the practice level, initial adoption of the program was moderate, with just over one quarter of potentially eligible practices taking up the program to date. This is in line with the practice recruitment rate (i.e. 27.8%) observed in the original Logan Healthy Living Program trial [29], as well as other primary care based trials [65,66]. Encouragingly, all adopting practices of the OHP continue to refer patients into the program and expressions of interest from other practices remain forthcoming. Ongoing resources in the form of additional practice visits and follow-up telephone calls, as well as regular mailed feedback to General Practitioners concerning patient outcomes have been key strategies for sustaining referrals.

Importantly, the OHP appears to be successfully targeting overweight/obese primary care patients from lower socioeconomic backgrounds who are often difficult to reach and engage in behavior change programs [67]. Participants and non-participants were similar across demographic variables, indicating that the program was successful in recruiting a representative sample, including a notable percentage from ethnic minority groups, a finding also reported in the GHS [28]. However, as in the GHS (82%) [28]; notably more females took part in the OHP. A recent systematic review also found that the majority of participants in diabetes translation programs were female (i.e. 74%), with this rate being higher than in the original Diabetes Prevention Program research trial (68% female) [57]. Similarly, the number of females taking part is slightly higher for the OHP: 74%, than the Logan Healthy Living Program: 61% [30]. For the OHP, the over selection of women occurred during the referral process when potential participants presented at primary care practices, as 73% of referrals were for female patients. It may be that men are opting out of the program at this point and thus never being referred, or General Practitioners are simply referring more women, given that women are more likely to present for preventive care [68].

High withdrawal rates observed in the OHP (38% attrition at 6 months) are reflective of the 'real world' context and are in line with other dissemination studies [24,25,57], including the GHS, which reported 74% attrition at the end of the 6 month intervention [64]. It may be that participants in dissemination studies with interventions delivered in applied settings do not perceive themselves as making the same level of commitment to complete a program as those who formally consent to participate in a controlled research study, especially when the program is offered free of charge. Further, non-research organizations, which often emphasize service delivery over evaluation, may be less likely to follow-up participants as extensively and systematically (due to staffing and budgeting constraints) as is typical in

controlled research trials [69]. This was the case in the current study, where OHP participant follow-up protocols were much less stringent than in the precursor trial.

A recent review of attrition in weight loss trials showed that there were no consistent demographic, weight, or heath behavior profiles that were associated with program drop-out [70]. In the OHP, those who completed the program versus those who dropped out were largely similar, except that younger and heavier participants were more likely to withdraw. Interestingly, those who withdrew after the 6-month assessment achieved less weight loss, but self-reported larger behavioral changes from the start of the program to the mid-program assessment, compared to those who remained in the program until the end-of-program assessment. Further clarification is needed to understand this finding. In any instance, promoting regular self-monitoring by participants of both weight and behaviors can improve consistency between perceptions of changes made and actual behavioral and weight change progress [71].

Evaluation of OHP implementation, including the number and duration of calls completed, shows that the primary-care organization largely followed evidence-based program delivery protocols, demonstrating that the program was able to be implemented with fidelity in the *'real* world'. Although it is important to note that resource constraints did not allow for more detailed quality assurance procedures (eg, audiotaping and coding call content). Higher drop-out rates in the beginning of the program indicate that the ability to implement the full 12-month intervention to all participants was challenging. This is an important issue given evidence from two recent systematic reviews of telephone-delivered physical activity and/or dietary behavior change interventions which indicates that delivery of longer term interventions (i.e. of at least six months duration) is associated with improved outcomes [9,14]. It suggests that other modalities for providing ongoing intervention contacts should be evaluated [72].

Although non-randomized, single-group pre-post designs are common in dissemination studies [24,25,40], the lack of a comparison group is a limitation in this study. However, evidence from Australian population based prospective studies indicates an overall population trend to gain weight, with an average gain of 1.8kg over five years in adults aged18-65 years [8]. Further, there is evidence that those who are overweight/obese are more likely to continue to gain weight over a five year period [73]. Thus, it is a reasonable assumption that in the absence of the OHP, participants would have continued to gain weight.

Another limitation of the study is that behavioral outcomes were self-reported and collected by staff delivering the OHP, as was participant satisfaction data. This limitation is mitigated to some extent by corroborative objective data from General Practitioner-measured clinical outcomes. In our dissemination context, the complete standardization of data collection procedures was not feasible. However, all clinical outcomes (i.e. weight, waist circumference, blood pressure and cholesterol) were collected at baseline and follow-up time points by the same GP or practice nurse for each participant. It was not feasible to have a standardised method (such as type of weight scale) across practices for collecting these outcomes. Within person change was our primary outcome of interest, therefore any error engendered by data collection procedures was likely to be consistent within individuals and thus not likely to threaten validity of outcomes obtained. It is also important to consider that this study reports on a completers analysis of a small number of participants , with our analyses showing that those who dropped out experienced poorer weight loss outcomes.

Summary and implications

Although small by dissemination study standards, findings from the OHP provide further support to a small but growing body of research which demonstrates that evidence-based lifestyle/weight loss interventions can be translated into practice and achieve outcomes, perhaps even with more representative samples, consistent with those observed in the original randomized trials. As previously described [34] strong and ongoing partnerships between the academic/research and primary care/community entities remains a key to both successful program implementation and the type of rigorous evaluation reported here. Future studies need to consider costs to deliver and cost-effectiveness to further the evidence needed to inform future uptake into practice.

Acknowledgements

We thank the participating general practices in the Logan area and their patients, as well as the staff of the Greater Metro South Brisbane Medicare Local. In particular, we would like to acknowledge the dedicated work of the accredited dietician telephone-counselors, Jana Husak, Sarah Gruber, Natalie Cross and Ashleigh Davidson and the support provided by Sherron Madden and Amada Adams. The authors declare no conflicts of interest.

References

1. Eyre H, Kahn R, Robertson RM, et al. Preventing cancer, cardiovascular disease, and diabetes: a common agenda for the American Cancer Society, the American Diabetes Association, and the American Heart Association. *Circulation.* 2004;109(25):3244-3255.
2. Mathers CD, Vos ET, Stevenson CE, Begg SJ. The Australian Burden of Disease Study: measuring the loss of health from diseases, injuries and risk factors. *Med J Aust.* 2000;172(12):592-596.
3. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. *JAMA.* 2004;291(10):1238-1245.
4. Australian Institute of Health and Welfare. *The Active Australia Survey: A Guide and Manual for Implementation, Analysis and Reporting.* Canberra: AIHW; 2003.
5. World Health Organization. *Global strategy on diet, physical activity and health: Report by the Secretariat.* Geneva: WHO; 2004.
6. Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA.* 2006;295(13):1549-1555.
7. Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM. Prevalence of overweight and obesity among US children, adolescents, and adults, 1999-2002. *JAMA.* 2004;291(23):2847-2850.
8. Barr E, Magliano D, Zimmet P, et al. *AusDiab 2005, The Australian Diabetes, Obesity and Lifestyle Study: Tracking the accelerating epidemic, its causes and outcomes.* Melbourne: International Diabetes Institute; 2006.

9. Eakin EG, Lawler SP, Vandelanotte C, Owen N. Telephone interventions for physical activity and dietary behavior change: a systematic review. *Am J Prev Med.* 2007;32(5):419-434.
10. Kroeze W, Werkman A, Brug J. A systematic review of randomized trials on the effectiveness of computer-tailored education on physical activity and dietary behaviors. *Ann Behav Med.* 2006;31(3):205-223.
11. Vandelanotte C, Spathonis KM, Eakin EG, Owen N. Website-delivered physical activity interventions: A systematic review. *Am J Prev Med.* 2007;33(1):54-64.
12. Castro CM, King AC. Telephone-assisted counseling for physical activity. *Exerc Sport Sci Rev.* 2002;30(2):64-68.
13. Marcus AC, Heimendinger J, Wolfe P, et al. A randomized trial of a brief intervention to increase fruit and vegetable intake: a replication study among callers to the CIS. *Prev Med.* 2001;33(3):204-216.
14. Goode AD, Reeves MM, Eakin EG. Telephone-delivered interventions for physical activity and dietary behavior change: an updated systematic review. *Am J Prev Med.* 2012;42(1):81-88.
15. Perri MG, Limacher MC, Durning PE, et al. Extended-care programs for weight management in rural communities: the treatment of obesity in underserved rural settings (TOURS) randomized trial. *Arch Intern Med.* 2008;168(21):2347-2354.
16. Digenio AG, Mancuso JP, Gerber RA, Dvorak RV. Comparison of methods for delivering a lifestyle modification program for obese patients: a randomized trial. *Ann Intern Med.* 2009;150(4):255-262.
17. Donnelly JE, Smith BK, Dunn L, et al. Comparison of a phone vs clinic approach to achieve 10% weight loss. *Int J Obes (Lond).* 2007;31(8):1270-1276.
18. Akers JD, Estabrooks PA, Davy BM. Translational research: bridging the gap between long-term weight loss maintenance research and practice. *J Am Diet Assoc.* 2010;110(10):1511-1522e3.
19. Pignone MP, Ammerman A, Fernandez L, et al. Counseling to promote a healthy diet in adults: A summary of the evidence for the U.S. Preventive Services Task Force. *Am J Prev Med.* 2003;24(1):75-92.
20. Owen N, Glanz K, Sallis JF, Kelder SH. Evidence-based approaches to dissemination and diffusion of physical activity interventions. *Am J Prev Med.* 2006;31(4 Suppl):S35-44.

21. Brownson RC, Jones E. Bridging the gap: Translating research into policy and practice. *Prev Med.* 2009;49(4):313-315.
22. Dzewaltowski DA, Estabrooks PA, Klesges LM, Bull S, Glasgow RE. Behavior change intervention research in community settings: how generalizable are the results? *Health Promot Int.* 2004;19(2):235-245.
23. Owen N, Goode A, Fjeldsoe B, Sugiyama T, Eakin E. Designing for the Dissemination of Environmental and Policy Initiatives and Programs for High-Risk Groups. In: Brownson R, Colditz, G., & Proctor, E ed. *Dissemination and Implementation Research in Health: Translating Science to Practice*: Oxford University Press; 2012:114-127.
24. Hooker SP, Seavey W, Weidmer CE, et al. The California Active Aging Community Grant Program: Translating Science Into Practice to Promote Physical Activity in Older Adults. *Ann Behav Med.* 2005;29(3):155-165.
25. Wilcox S, Dowda M, Griffin SF, et al. Results of the first year of active for life: translation of 2 evidence-based physical activity programs for older adults into community settings. *Am J Public Health.* 2006;96(7):1201-1209.
26. Wilcox S, Dowda M, Leviton LC, et al. Active for life: final results from the translation of two physical activity programs. *Am J Prev Med.* 2008;35(4):340-351.
27. O'Hara BJ, Bauman AE, King EL, Phongsavan P. Process evaluation of the advertising campaign for the NSW Get Healthy Information and Coaching Service. *Health Promot J Austr.* 2011;22(1):68-71.
28. O'Hara BJ, Phongsavan P, Venugopal K, Bauman AE. Characteristics of participants in Australia's Get Healthy telephone-based lifestyle information and coaching service: reaching disadvantaged communities and those most at need. *Health Educ Res.* 2011;26(6):1097-1106.
29. Eakin EG, Reeves MM, Lawler SP, et al. The Logan Healthy Living Program: a cluster randomized trial of a telephone-delivered physical activity and dietary behavior intervention for primary care patients with type 2 diabetes or hypertension from a socially disadvantaged community--rationale, design and recruitment. *Contemp Clin Trials.* 2008;29(3):439-454.
30. Eakin E, Reeves M, Lawler S, et al. Telephone counselling for physical activity & diet in primary care patients. *Am J Prev Med.* 2009;36(2):142-149.

31. Lawler SP, Winkler E, Reeves MM, Owen N, Graves N, Eakin EG. Multiple health behavior changes and co-variation in a telephone counseling trial. *Ann Behav Med.* 2010;39(3):250-257.
32. Eakin E, Reeves M, Winkler E, Lawler S, Owen N. Maintenance of physical activity and dietary change following a telephone-delivered intervention. *Health Psychol.* 2010;29(6):566-573.
33. Graves N, Barnett AG, Halton KA, et al. Cost-effectiveness of a telephone-delivered intervention for physical activity and diet. *PLoS One.* 2009;4(9):e7135.
34. Goode AD, Owen N, Reeves MM, Eakin EG. Translation from research to practice: community dissemination of a telephone-delivered physical activity and dietary behavior change intervention. *Am J Health Promot.* 2012;26(4):253-259.
35. Glasgow RE, Lichtenstein E, Marcus AC. Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to-effectiveness transition. *Am J Public Health.* 2003;93(8):1261-1267.
36. Dunton GF, Lagloire R, Robertson T. Using the RE-AIM framework to evaluate the statewide dissemination of a school-based physical activity and nutrition curriculum: "Exercise Your Options". *Am J Health Promot.* 2009;23(4):229-232.
37. Klesges LM, Estabrooks PA, Dzewaltowski DA, Bull SS, Glasgow RE. Beginning with the application in mind: Designing and planning health behavior change interventions to enhance dissemination. *Ann Behav Med.* 2005;29(2):66-75.
38. Estabrooks PA, Gyurcsik NC. Evaluating the impact of behavioral interventions that target physical activity: Issues of generalizability and public health. *Psychol Sport Exerc.* 2003;4(1):41-55.
39. Campbell M, Fitzpatrick R, Haines A, et al. Framework for design and evaluation of complex interventions to improve health. *Br Med J (Clin Res Ed).* 2000;321(7262):694-696.
40. Rychetnik L, Frommer M, Hawe P, Shiell A. Criteria for evaluating evidence on public health interventions. *J Epidemiol Community Health.* 2002;56(2):119-127.
41. Harper C, Cardona M, Bright M, et al. *Health Determinants Queensland 2004 Public Health Services, Queensland Health. Brisbane 2004.* Brisbane: Public Health Services, Queensland Health; 2004.
42. Eakin EG, Reeves MM, Marshall AL, et al. Living Well with Diabetes: a randomized controlled trial of a telephone-delivered intervention for maintenance of weight loss,

physical activity and glycaemic control in adults with type 2 diabetes. *BMC Public Health.* 2010;10:452.

43. Bandura A. *Social foundations of thought and action: A social cognitive theory.* N.J.: Prentice Hall; 1986.
44. Hecht J, Borrelli B, Breger RK, DeFrancesco C, Ernst D, Resnicow K. Motivational interviewing in community-based research: Experiences from the field. *Ann Behav Med.* 2005;29(2):29-34.
45. Australian Government Department of Health and Ageing, National Health and Medical Research Council, New Zealand Ministry of Health. *Nutrient reference values for Australia and New Zealand: Executive summary.* Canberra: National Health and Medical Research Council; 2006.
46. National Health and Medical Research Council. *Dietary Guidelines for Australian Adults.* Canberra: Commonwealth of Australia; 2003.
47. WHO Global InfoBase team. *The SuRF Report 2. Surveillance of chronic disease Risk Factors: Country-level data and comparable estimates.* Geneva: World Health Organization; 2005.
48. Australian Government Department of Health and Ageing, National Health and Medical Research Council. *Food for health: Dietary guidelines for Australians, a guide to health eating.* Canberra: Australian Government Department of Health and Ageing; 2005.
49. National Heart Foundation Australia. *Summary of Evidence: Dietary fats and dietary cholesterol for cardiovascular health.* National Health Foundation Australia; 2009.
50. Owen N, Sugiyama T, Eakin EE, Gardiner PA, Tremblay MS, Sallis JF. Adults' sedentary behavior determinants and interventions. *Am J Prev Med.* 2011;41(2):189-196.
51. National Health and Medical Research Council. *Clinical Practice Guidelines for the Management of Overweight and Obesity in Adults.* Canberra: Commonwealth of Australia; 2003.
52. North American Association for the Study of Obesity & the National Heart, Lung, and Blood Institute. *The practical guide: identification, evaluation and treatment of overweight and obesity in adults.* National Heart, Lung, and Blood Institute; 2000.
53. Rutishauser IHE, Webb K, Abraham B, Allsopp R. *Evaluation of short dietary questions from the 1995 National Nutrition Survey.* Canberra: Australian Food and Nutrition Monitoring Unit; 2001.

54. Coyne T, Ibiebele TI, McNaughton S, et al. Evaluation of brief dietary questions to estimate vegetable and fruit consumption using serum carotenoids and red-cell folate. *Public Health Nutr.* 2007;8(3):298-308.
55. Marshall AL, Miller YD, Burton NW, Brown WJ. Measuring total and domain-specific sitting: a study of reliability and validity. *Med Sci Sports Exerc.* 2010;42(6):1094-1102.
56. Green LW. From research to 'best practices' in other settings and populations. *Am J Health Behav.* 2001;25(3):165-178.
57. Whittemore R. A systematic review of the translational research on the Diabetes Prevention Program. *Transl Behav Med.* 2011;1(3):480-491.
58. Cardona-Morrell M, Rychetnik L, Morrell SL, Espinel PT, Bauman A. Reduction of diabetes risk in routine clinical practice: are physical activity and nutrition interventions feasible and are the outcomes from reference trials replicable? A systematic review and meta-analysis. *BMC Public Health.* 2010;10:653.
59. Wing RR, Lang W, Wadden TA, et al. Benefits of modest weight loss in improving cardiovascular risk factors in overweight and obese individuals with type 2 diabetes. *Diabetes Care.* 2011;34(7):1481-1486.
60. 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(6):393-403.
61. Tuomilehto J, Lindstrom J, Eriksson JG, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med.* 2001;344(18):1343-1350.
62. O'Hara BJ, Bauman AE, Eakin EG, et al. Evaluation framework for translational research: Case study of Australia's Get Healthy Information and Coaching Service. *Health Promot Pract.* In press.
63. Whittemore R, Melkus G, Wagner J, Northrup V, Dzuria J, Grey M. Translating the Diabetes Prevention Program to primary care: A pilot study. *Nurs Res.* 2009;58(1):2-12.
64. O'Hara BJ, Phongsavan P, Venugopal K, et al. Effectiveness of Australia's Get Healthy Information and Coaching Service®: Translational research with population wide impact. *Prev Med.* In press.

65. Harris MF, Hobbs C, Powell Davies G, Simpson S, Bernard D, Stubbs A. Implementation of a SNAP intervention in two divisions of general practice: a feasibility study. *Med J Aust.* 2005;183(10 Suppl):S54-58.
66. Lazovich D, Curry SJ, Beresford SA, Kristal AR, Wagner EH. Implementing a dietary intervention in primary care practice: a process evaluation. *Am J Health Promot.* 2000;15(2):118-125.
67. Eakin EG, Bull SS, Glasgow RE, Mason M. Reaching those most in need: A review of diabetes self-managment interventions in disadvantaged populations. *Diabetes Metab Res Rev.* 2002;18(1):26-35.
68. Brett KM, Burt CW. Utilization of ambulatory medical care by women: United States, 1997-98. *Vital Health Stat 13.* 2001;149:1-46.
69. Estabrooks PA, Smith-Ray R, Almeida FA, et al. Move More: Translating an efficacious group dynamics physical activity intervention into effective clinical practice. *Int J Sport Exerc Psychol.* 2011;9(1):4-18.
70. Moroshko I, Brennan L, O'Brien P. Predictors of dropout in weight loss interventions: a systematic review of the literature. *Obes Rev.* 2011;12(11):912-934.
71. Abraham C, Michie S. A taxonomy of behavior change techniques used in interventions. *Health Psychol.* 2008;27(3):379-387.
72. Fjeldsoe B, Neuhaus M, Winkler E, Eakin E. Systematic review of maintenance of behavior change following physical activity and dietary interventions. *Health Psychol.* 2011;30(1):99-109.
73. Brown WJ, Williams L, Ford JH, Ball K, Dobson AJ. Identifying the energy gap: magnitude and determinants of 5-year weight gain in midage women. *Obes Res.* 2005;13(8):1431-1441.

Figure 1. Flow chart of participant recruitment

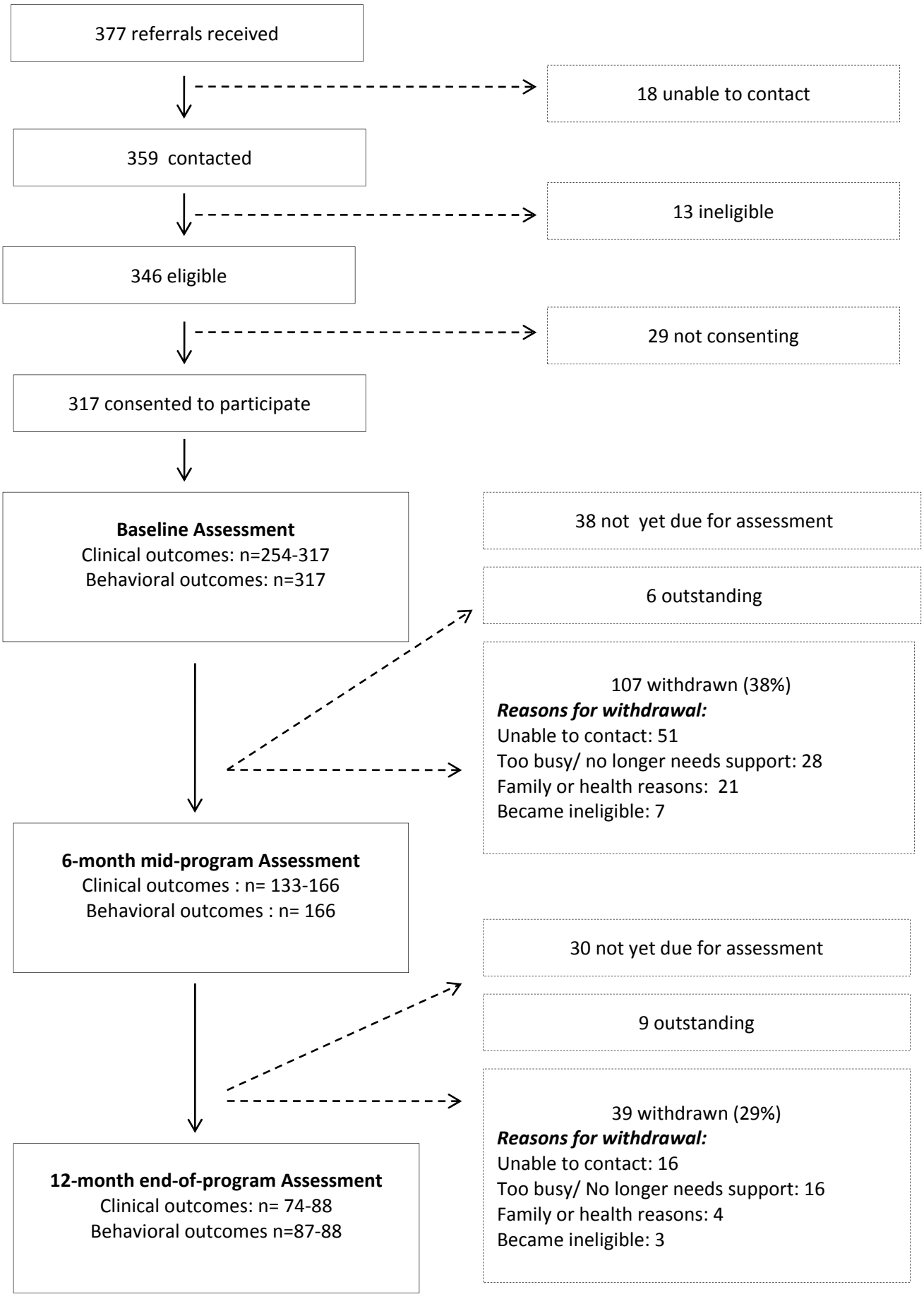

Table 1. Baseline characteristics of participants

Baseline Characteristic	**Mean (sd) or % N=317[+]**
Female	74%
Age (years)	46 (12)
BMI(kg/m^2)	37.0 (7.7)
Obesity Class I	34%
Class II	27%
Class III	25%
Weight (kg)	103.1 (23)
Waist circumference (cm)	112.1 (16.8)
Total cholesterol (mmol/L)	5.3 (1.0)
HDL Cholesterol (mmol/L)	3.3 (0.9)
LDL Cholesterol (mmol/L)	1.3 (0.4)
Systolic BP (mmHg)	128.1 (17.4)
Diastolic BP (mmHg)	80.8 (10.7)
Ethnicity	
Caucasian	88%
Marital status	
Married/ living together	73%
Education	
≤High School	41%
Completed High School	43%
Tertiary qualification (trade/diploma/ university degree)	16%
Employment	
Employed (FT, PT, casual)	61%
Retired/ home duties	21%
Unemployed/ student/other	18%
Household Income	
≤ $999 /wk	30%
≥$1000/wk	59%
Declined to answer/don't know	11%

+ weight & BMI n = 315; waist circumference n = 297; cholesterol n = 306; HDL & LDL cholesterol n = 254; diastolic 7 systolic BP n = 304; for income n = 312.

Obesity Class I = BMI 30.0-34.9 kg/m^2; Class II= 35.0-39.9 kg/m^2; Class III ≥40.0 kg/m^2

Table 2. Baseline characteristics of those who completed vs. those who withdrew before completion of 6 month assessment and those who completed vs. those who withdrew between 6 and 12 month assessment

	6 MONTH ASSESSMENT		12 MONTH ASSESSMENT	
Baseline Characteristics	**Completers N=166[a]** mean (sd) or median [min, max]	**Drop outs N=107[b]** mean (sd) or median [min, max]	**Completers N=88[c]** mean (sd) or median [min, max]	**Drop outs N=39[d]** mean (sd) or median [min, max]
Demographics				
% Female	77%	75%	74%	80%
% Caucasian	87%	90%	90%	74%*
% Married	75%	69%	75%	77%
Senior High School or greater	61%	57%	58%	62%
Employed (FT,PT Casual)	61%	63%	59%	62%
% income >$1000/wk	57%	61%	50%	72%
Age (years)	47.3 (12.1)	44.0 (11.1)*	49.3 (12.0)	45.9 (10.3)
Clinical outcomes				
BMI (kg/m2)	36.7 (7.2)	37.3 (8.8)	36.0 (7.1)	37.0 (6.8)
Weight (kg)	102.0 (22.1)	104.0 (25.0)	102.0 (23.4)	100.0 (19.7)
Waist circumference (cm)	110.7 (17.1)	112.6 (15.9)	110.0 (17.1)	113.0 (19.2)
Total cholesterol (mmol/L)	5.3 (1.0)	5.5 (1.1)	5.3 (0.1)	5.3 (0.9)
HDL Cholesterol (mmol/L)	1.3 (0.3)	1.3 (0.3)	1.3 (0.3)	1.3 (0.3)
LDL Cholesterol (mmol/L)	3.2 (0.9)	3.4 (0.8)	3.2 (0.9)	3.1 (0.9)
Systolic BP (mmHg)	129.2 (17.3)	126.0 (18.6)	128.4 (16.2)	130.3 (20.1)
Diastolic BP (mmHg)	81.3 (10.2)	80.0 (11.8)	81.1 (9.70	81.7 (11.0)
Behavioral outcomes				
Vegetables (serves/day)	2.0 [0-10]	2.0 [0-8]	2.0 [0-10]	2.0 [0-8]
Fruit (serves/day)	1.0 [0-4]	1.0 [0-4]	1.5 [0-4]	1.0 [0-4]*
MVPA (mins/wk)	77.5 [0-1260]	60.0 [0-954]	95.0 [0-820]	60.0 [0-1260]
Screen time (mins/day)	183.2 [14.3- 900]	192.0 [0-613.0]	197.1 [47.1- 900]	167.1 [14.-557.1]

* $p \leq 0.05$ ** $p \leq 0.01$ ***$p \leq 0.001$ MVPA = moderate-to vigorous physical activity

[a] income n= 164; cholesterol, diastolic & systolic BP n= 161; waist circumference n= 157 HDL & LDL n= 133
[b] weight & BMI n= 106; waist circumference, cholesterol, income n= 104; systolic and diastolic BP n= 101 HDL & LDL n= 84.
[c] income n= 86; waist circumference n= 85; cholesterol, diastolic & systolic BP n= 84; HDL & LDL n= 74.
[d] waist circumference & cholesterol n= 38; HDL & LDL n= 34.

Table 3. Mid-program outcomes for participants who completed the 6-month assessment

Outcomes	N	**Baseline** mean (sd) or median [min, max]	**6 months** mean (sd) or median [min, max]	***p* value[a]**
Clinical				
BMI (m/kg^2)	118	36.3 (6.0)	35.1 (6.8)	< 0.001
Weight (kg)	118	99.9 (20.8)	96.6 (20.4)	< 0.001
Waist circumference (cm)	101	108.7 (14.3)	104.5 (15.4)	< 0.001
Total cholesterol (mmol/L)	114	5.4 (1.0)	5.1 (1.0)	< 0.001
HDL Cholesterol (mmol/L)	91	1.30 (0.3)	1.34 (0.5)	0.279
LDL Cholesterol (mmol/L)	90	3.28 (0.8)	3.12 (0.9)	0.023
Systolic BP (mmHg)	106	130.0 (17.1)	126.7 (13.0)	0.019
Diastolic BP(mmHg)	105	81.2 (10.4)	78.8 (8.6)	0.004
Behavioral				
Vegetables (serves/day)	166	2 [0-10]	3 [0-10]	< 0.001
Fruit (serves/day)	166	1 [0-4]	2 [0-4]	< 0.001
MVPA (mins/wk)	165	75 [0-1260]	200 [0-1080]	< 0.001
Screen time (mins/day)	166	183.2 [14.3-900]	138.5 [0-849]	< 0.001

[a]*p* for paired t-tests (normal data) or Wilcoxon signed ranks test (non normal) MVPA = moderate-to-vigorous physical activity

Table 4. End-of-program outcomes for participants who completed the 12 month assessment

Outcomes	N	**Baseline** mean (sd) or median [min, max]	**12months** mean (sd) or median [min, max]	***p* value**[a]
Clinical				
BMI (m/kg^2)	59	35.2 (6.0)	33.3 (6.1)	< 0.001
Weight (kg)	59	97.4 (2.1)	92.0 (20.9)	< 0.001
Waist circumference (cm)	53	106.9 (15.2)	102.2 (17.2)	0.001
Total cholesterol (mmol/L)	56	5.3 (0.9)	5.1 (1.0)	0.144
HDL Cholesterol (mmol/L)	46	1.27 (0.4)	1.35 (0.4)	0.072
LDL Cholesterol (mmol/L)	46	3.13 (0.9)	3.00 (0.8)	0.292
Systolic BP (mmHg)	53	127.3 (13.2)	125.7 (15.4)	0.350
Diastolic BP(mmHg)	53	80.6 (10.5)	76.4 (8.1)	0.004
Behavioral				
Vegetables (serves/day)	88	2 [0-10]	4 [0-10]	< 0.001
Fruit (serves/day)	88	1.5 [0-4]	2 [0-3]	0.312
MVPA (mins/wk)	87	95 [0-820]	170 [0-1180]	0.004
Screen time (mins/day)	87	191.1 [49.3-900]	150 [0-810]	< 0.001

[a]*p* for paired t-tests (normal data) or Wilcoxon signed ranks test (non normal) MVPA = moderate-to-vigorous physical activity