Translation of the diabetes prevention program lifestyle intervention for promoting postpartum weight loss among low-income women

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ABSTRACT

The Women Infants and Children (WIC) program is a promising venue in which to implement weight loss interventions for low-income postpartum women. The goals of this study were to describe formative steps to translate the DPP lifestyle intervention to be delivered to diverse low-income postpartum women who are served by the WIC program, and to present the results of a pilot trial of the intervention. The steps of intervention translation involved were the following: (1) building partnerships, (2) understanding the target setting, (3) understanding the target population, (4) re-designing the intervention, and (5) refining the intervention. The pilot trial was a single group pre/post test comparison among 27 overweight/obese postpartum WIC clients. The intervention resulted in an average weight loss of 4.6lb at a 4-month follow-up ($p=0.004$). A dose–response association between intervention attendance and weight loss was observed. This translation of the DPP for diverse low-income postpartum women has potential for widespread implementation.

KEYWORDS

Weight loss, Health disparities, Intervention, Translational research

The postpartum period is a critical time for targeting weight loss, as on average, women retain approximately 3 kg per pregnancy over the life course [1]. Low SES and minority women are at greatest risk of postpartum weight retention, and these populations also experience significant weight gain after the first few postpartum weeks [2]. The Women Infants and Children (WIC) program is a promising setting in which to implement evidence-based weight loss interventions for low SES women. WIC is a federal- and state-funded program with a mission to promote health of low-income women, infants, and children up to age 5 who are at nutritional risk. WIC serves approximately 18 million individuals a year via 9,000 clinics across the country. The program does not systematically provide weight loss services per se, but addressing weight loss among its participants is within the mission of WIC.

Implications

Practice: Evidence-based weight loss interventions, adapted to meet the needs of at-risk populations and the organizations that serve them, can be implemented in real world settings by real world practitioners.

Policy: Federally funded programs such as WIC have tremendous potential for intervening for enhancing postpartum weight loss among at-risk women.

Research: Future research is needed to understand factors and processes that can facilitate successful implementation and sustainability of Fresh Start within WIC settings.

Only a few interventions have aimed to promote postpartum weight loss among WIC clients and have had minimal or no success [2–4]. These interventions have not used or translated existing evidence-based programs or strategies [5, 6] (i.e., limited focus on creating an energy deficit; non-systematic use of self-monitoring, goal-setting and problem-solving, and limited hands-on opportunities and support to develop healthy cooking skills and physical activity behaviors). In addition, studies reported poor attendance and high attrition rates.

Despite the promise of efficacious weight loss interventions such as the Diabetes Prevention Program (DPP) Lifestyle Intervention [5, 7], to date only a few studies have demonstrated a positive effect of using the DPP intervention in real world settings and populations [8]. There are sizeable barriers to widespread implementation and dissemination of efficacious weight loss interventions like the DPP to real world settings and populations, such as WIC clinics and the low SES postpartum women they serve [9]. These barriers include the high intensity and cost of efficacy interventions, use of highly skilled interventionists, selection of educated and motivated participants, and lack of consideration of the context of real world settings that could potentially implement and sustain the intervention

over extended periods of time. Translational research will thus require that efficacious weight loss interventions be adapted to meet the characteristics of the populations targeted and the needs and resources of the settings that serve them. The purpose of this study is to describe the translation and pilot test of a DPP-like intervention among postpartum WIC program participants.

METHODS

This study was guided by the intervention translation framework depicted in Fig. 1. Using social cognitive theory [10] and the social ecological model [11, 12] as a guide, the framework emphasizes that the successful translation of evidence-based behavioral interventions requires understanding factors specific to the real world settings and populations to which they are being translated. Population characteristics, which include knowledge, attitudes, and behavioral practices as well as surface (observable behavior) and deep (shared belief system) cultural structures [13], guide message framing, and intervention format. Setting specific factors, which include organizational structure, capacity, and resources, guide implementation. The study was approved by the Board of Directors of the Massachusetts Department of Public Health WIC program, the Oversight Board of Family Health Services of Worcester, and the University of Massachusetts Medical School Institutional Review Board.

Step 1: build partnerships

The first step of this translation effort involved establishing a partnership with the target organization at the local (Worcester WIC program) and state (Massachusetts Department of Public Health WIC office) levels. Contact was initiated by the investigators with the goal of identifying common interests and unique strengths of the parties and exploring the potential for working together toward the implementation of a weight loss program to be delivered as part of WIC. Through our initial

meetings, it was clearly established that overweight and obesity are prevalent among WIC participants and promoting healthy weight among postpartum women was a priority for the WIC program in Massachusetts, although the focus of WIC at the time did not include structured weight loss assistance. The WIC leadership expressed interest in developing an applied research program that could lead to a better understanding of how WIC might incorporate programming aimed at weight loss among their postpartum participants.

Once this was established, a series of in-service meetings were held with WIC staff members, predominantly nutritionists, to solicit their ideas for a postpartum weight loss program. The newly configured team agreed to move forward.

Step 2: understand the target setting

The second step had as a goal to improve the understanding of the setting organizational structure, staffing and resources that could impact the likelihood of the intervention being adopted by WIC after the research ended and their perspectives on how an intervention might be implemented into routine practice. Accordingly, the researchers held a series of meetings with program directors and lead nutritionists at four WIC programs in Massachusetts. These discussions were documented, and the results were analyzed by two investigators to identify common themes.

These meetings clarified program characteristics (i.e., format, intensity, staff training and skills, and other resources) and opportunities for intervention. It was determined that it was infeasible to incorporate a weight loss intervention within the context of routine clinical visits as these visits were brief and spaced in time. The clinics had successful experiences with after-hour group-based programs targeting breastfeeding that were co-led by WIC nutritionists and peer counselors. This was viewed as a model that a weight loss program could follow. The meetings identified the need for specialized knowledge in weight loss and motivational counseling among the WIC staff. It also was determined

Fig 1 | Intervention translation framework

that space limitations and lack of a kitchen at the WIC program offices required the intervention be held in a community location.

Step 3: understand the target population

The goal of this third step was to gain insights regarding knowledge, attitudes, and experiences related to weight and weight loss as well as contextual (family, social, cultural, and physical environment) barriers to and facilitators of weight loss among diverse postpartum women served by WIC. This knowledge allows for the framing of intervention messages to target common aspects of surface and deep cultural structures in a manner that resonates with this population [13]. To accomplish this, we conducted key informant interviews with both WIC staff members and with WIC clients.

Key informant interviews with WIC program directors and senior nutritionists targeted four WIC programs in Massachusetts. Interviews were guided by a semi-structured protocol that assessed perceptions of WIC participants' knowledge, attitudes, and behaviors related to weight loss. It also assessed perceptions of their participants' core values and life circumstances that may serve as barriers or facilitators of weight loss and perceptions of program strategies and formats that the target population might be receptive to. These discussions were documented via notes from two investigators and compared and contrasted for completeness. A thematic analysis was conducted. A codebook of identified themes and sub-themes was developed, and findings were summarized in table format by theme and sub-themes.

Key informant interviews were conducted with 21 WIC participants. Interviews used a semi-structured protocol designed to provide greater understanding of women's values and priorities, knowledge of evidence-based weight loss strategies, intervention preferences, and specific needs, perceived challenges, and contextual issues. Participants were overweight and obese, English-speaking women, between 6 weeks and 6 months postpartum, consecutively screened by their WIC provider. Women gave written consent. A trained interviewer contacted participants by phone and implemented a telephone-administered interview which lasted 45 min on average. Data from participants' interviews were tape recorded and transcribed. A codebook of identified themes and sub-themes was developed, and findings were summarized in table format by theme and sub-themes. Findings from both methods were compared by the investigators and triangulated to come to consensus on common themes.

Briefly, findings revealed that multiple factors impact postpartum WIC participants' efforts to lose weight including knowledge/perceptual factors (i.e., limited recognition of overweight status, mixed feelings regarding body satisfaction and importance of weight, misconceptions regarding breastfeeding caloric requirements, misinformation of healthy

weight loss strategies, and low weight loss self-efficacy), behavior-specific factors (i.e., overeating or "continued eating for two," fast food and sugar-sweetened beverage consumption, limited cooking skills, difficulty navigating social situations that involve food, limited access to/fear of exercise facilities, lack of knowledge regarding home-based physical activity, cold weather as a barrier for outdoor activity), and life context factors (i.e., scarce resources, childcare and other responsibilities, limited time, multiple stressors, limited partner and social support overall and weight loss specific, and negative moods such as boredom and depressed feelings). Interviews also identified potential motivators and preferences for weight loss intervention. WIC staff perceived participants as being strongly motivated to be "good mothers." The staff made suggestions for tailoring the program that included focus on practical skills (e.g., cooking quick, healthy meals), teaching fun, simple activities that involve children, including peer models among the intervention staff, using group-based programs that incorporate social support from family/friends, increasing awareness of community resources, providing transportation and child care for older children, allowing infants in sessions, including evening hours, conducting the program at a location accessible by public transportation, and providing behavioral incentives.

Step 4: re-designing the intervention

The goal of step 4 was to re-design the original intervention (DPP) in a manner that integrated its core evidence-based principles and strategies with information gathered in steps 2 and 3 in order to enhance their relevance to the population and enhanced self-management skills. Accordingly, the DPP topics and curriculum that most closely addressed issues uncovered were selected, organized and modified, and new messages and activities specific to the context of new mothers' day-to-day lives were created. This step involved an interactive process with ongoing discussion and input from the WIC team. Principles of social cognitive theory [10] and the social ecological model [11, 12] were used to guide intervention re-design.

The intervention included eight group sessions that were 2 1/2 h in duration followed by two telephone contacts. The session titles/topics were as follows: (1) exploring motivators for weight loss/getting started being active, (2) making wise food and beverage choices, (3) be strategic: three ways to reduce your calories in, (4) reading nutrition labels/food substitutions, tasting new foods, (5) cutting the budget while cutting calories, (6) taking charge of what's around you, (7) taking charge of what's within you (talking back to negative thoughts), and (8) dealing with slips and staying motivated. Only eight sessions that focused on critical topics to the target population (as opposed to all 16 sessions in

the DPP) were included because of challenges to committing to a longer program on the part of WIC participants, as evidenced in our developmental work and literature [4]. Group sessions, as opposed to individual sessions, were also perceived to have greater potential for sustainability among WIC staff members.

Like the DPP, the program had clear weight and behavioral goals. Participants were encouraged to lose 1–2 lb per week by working toward an ultimate goal of 1,500 cal and 10,000 walking steps (or equivalent) per day. Weight loss knowledge, self-efficacy and outcome expectations, and self-management skills were targeted through instruction, group modeling, and mastery experiences which included personalized goals, problem-solving of potential and encountered challenges, and reinforcing and building on participants' successes no matter how small, all while maintaining high standards and expectations.

Group sessions were led by a WIC nutritionist and co-led by a peer who had been a WIC participant and were held at a community site that was easily accessible to participants. This delivery approach took into consideration data gathered from participants during the formative steps and was modeled after a successful breastfeeding program implemented by WIC. The nutritionists and peers were trained in the delivery of patient-centered counseling and use of motivational interviewing strategies. Special emphasis was placed on strategies to manage anticipated ambivalence and resistance among participants, including empathic messages, amplification of discrepancies, avoiding arguing, and rolling with resistance, and reinforcing change talk and behavior change, using motivational interviewing strategies. Interventionists were provided with opportunities to role play and practice the implementation of the intervention protocol and received feedback on their performance.

Prior to the formal start of each group session, approximately 15 min was allocated for start up. During this time period, participants took turns to have their weight measured by the WIC peer, who recorded this information on a tracking sheet. As a group, women were encouraged to walk with their pedometers around the Youth Center and interact with other participants during this period. Next, the nutritionist led a group discussion that began with the review of the participants' progress toward achieving individual goals established at the previous session and successes and challenges to goal achievement, followed by a review of the previous session. Each session introduced a new topic, described above, that was relevant to postpartum women and weight loss. Sessions included group activities to promote group cohesiveness and support among participants. All sessions concluded with a goal-setting segment where participants were encouraged to state a goal that they wanted to accomplish during the following week and write

down an action plan for accomplishing the goal, including anticipation of potential challenges and strategies to manage those challenges.

The peers cooked and served dinner to participants and their children, gave a brief presentation about the preparation method, and handed out the recipe at each session's conclusion. Transportation and child care for older children were provided to those who required it, and infants were allowed in the group sessions. Participants who did not attend the group sessions received a telephone call by the nutritionist that briefly reviewed new content and discussed reasons for not coming with a goal of problem-solving barriers to attendance.

Print materials were newly developed for this intervention, and included content and graphics relevant to new mothers. A workbook that included a range of materials designed to educate and solicit motivations and barriers was created. These included illustrations depicting the concept of energy balance, a checklist of motivators for wanting to lose weight specific to new mothers to highlight benefits of weight loss and reinforce engagement, a weekly menu with shopping list, and a physical activity/exercise menu. Two versions of a food (intake) and activity (expenditure) guide were created to provide input on calories associated with consumption of specific foods and participation in specific activities. One version included calorie information and the other one used a calorie-based point system to simplify counting calories. Self-monitoring sheets were created to track daily weight and energy intake and expenditure. In addition to the print materials, the participants were provided with a pedometer, resistance bands, measuring cups, and a scale. To further support physical activity efforts, the program provided a free institutional membership to the local YWCA and encouraged participants to attend.

Step 5: refine the intervention

Upon completion of intervention re-design, protocols and materials were pre-tested in two phases. First, focus groups were conducted to assess clarity, acceptability, and perceived usefulness of materials and to obtain input from the target population on a name for the program. Subsequently, the intervention implementation protocol was pre-tested in its entirety among a sample of WIC participants. This process also intended to provide intervention implementation experiences for the interventionists and obtain their additional input on the program. Participants were recruited following the same process as in step 3.

A total of nine consecutive women attended two focus groups led by the study investigators using a structured interview guide. Briefly, the guide prompted the introduction of selected study materials to participants, queried their understanding of the materials, and encouraged them to provide input regarding clarity and appeal and suggest ideas on

how the materials could be improved. The discussions were tape recorded, and the investigators took detailed notes of specific suggestions and comments. The identified suggestions and comments were summarized and reviewed by the investigators. This approach was taken in lieu of traditional thematic analysis given the specific purpose of materials refinement. The investigators then came to consensus on how to incorporate suggestions into the materials.

The second phase, pre-test of the entire 8-week protocol, included 30 women. Sessions were implemented weekly as per the initial protocol described above, were observed by the investigators to determine intervention fidelity, and were immediately followed by debriefings between the investigators and the WIC providers.

Overall, the materials were well-received and perceived to be clear and useful by WIC staff members and clients. Three substantial refinements were made based on the two phases of step 5. First, *Fresh Start* was suggested as a possible name for the program by the WIC clients in the first focus group and endorsed by the second group. Second, WIC client participants demonstrated preference for a food tracking system that used calories rather than a point system. Third, both WIC clients and staff members made suggestions that indicated that ability and self-efficacy to engage in physical activity were low and that exercise demonstrations and practice opportunities were needed. Two specific suggestions that were incorporated into the intervention included on-site exercise demonstrations by WIC nutritionists focusing on counting steps with pedometers and the use of resistance bands at the start up of the group sessions, and an orientation session at the YWCA that provided a tour of the facility and instruction in how to use equipment, which was facilitated by the peer leader. Additional refinements included minor edits to wording and layout.

Pilot test

The finalized intervention was pilot tested in collaboration with the Worcester WIC program, the YWCA and the Worcester Youth Center (site for the group sessions) in 2010, using a single group pre/post-design with assessments conducted at baseline and at 4 months post-baseline. Sources of data included anthropometric measures, interviewer-administered surveys and a participant tracking system.

Participants and recruitment—Participants were recruited as a cohort. Eligibility criteria included 6 weeks to 6 months postpartum, BMI > 27, English-speaking, not pregnant, not taking steroid medications, and having approval from their health care provider to participate in a weight loss program. WIC providers were trained in implementing an algorithm for identifying their participants who were potentially eligible to participate. WIC providers completed a form that listed de-

identified eligibility and background information for each postpartum woman they saw during the study period. Providers checked off criteria met by each woman, and a fact sheet about the study was handed out to the women. The provider then asked the women about their interest in being contacted by the study staff if they were found eligible, and those who expressed interest in being contacted were asked to sign a form consenting to be contacted and to provide their contact information. Study staff determined potential eligibility and contacted participants by telephone to reassess eligibility. Participants provided their primary care provider information so that their approval could be sought. Upon receipt of provider approval, the participants were scheduled for an assessment visit which was conducted at WIC by study staff unrelated to the intervention activities.

In all, 69% (116 of 169 postpartum women approached by their WIC providers) were eligible to participate in the program and 62% ($n=72$) of eligible women agreed to be contacted. Of these 30 women enrolled in the study (ineligible=1, declined=3, unable to reach=25, no show at baseline assessment=6, unable to attend scheduled time=7). Overall, 26% of all eligible women completed the baseline assessment. Among the 30 enrollees, 3 became ineligible during the course of the intervention (pregnant=1, on steroids=2). Twenty-three (85%) of the remaining 27 enrollees completed the 4-month follow-up.

Outcome measures—The primary outcomes of interest were change in weight, percentage change in weight, and BMI from baseline to 4 month follow-up. Weight change was measured in pounds using a digital scale, with participants wearing light clothing and no shoes, and height was measured to the nearest 1/10th inch using a portable stadiometer.

We also assessed physical activity and eating behaviors. The Pregnancy Physical Activity Frequency Questionnaire [14], modified for the postpartum period, is a measure that assesses total number of MET minutes per week expended, and also includes sub-scales of activity intensity (sedentary, low, moderate, and intensive) and activity domain (recreational, occupational, household). Fat intake behavior was assessed by the fat summary score of the Fat- and Fiber-Related Behavior Questionnaire [15, 16]. This 26-item measures ask participants about food choices in 5 sub-scales: avoiding fat as a flavoring, modifying meat to be lower in fat, substituting manufactured low-fat foods, replacing high fat foods with fruits and vegetables, and replacing high fat meals with fruits and vegetables. Responses are rated on a 4-point scale, ranging from usually or always to rarely or never. Each sub-scale is scored as the average of its items. The summary score is the average of the sub-scales, with higher scores equating unhealthier behaviors. The revised 21-item Three Factor Eating Questionnaire (TFEQ-R21), which was developed specifically for obese persons, measured cognitive and behavioral eating components in three areas: cognitive restraint (6 items, score range 6–24), uncontrolled eating (9 items,

score range 9–36), and emotional eating (6 items, score range 6–24) [17]. Each item is measured on a 4-point response scale that ranges from mostly false to mostly true and sub-scales are summed. Higher scores indicate more problematic behavior.

Consistent with our theoretical framework, self-efficacy for exercise and diet were assessed by The Self-Efficacy and Eating Habits Survey and Self-Efficacy and Exercise Habits Survey consist of 20 and 12 items, respectively. Respondents rate their confidence to perform healthy behaviors in a range of situations on a 5-point scale (I know I cannot to I know I can) [18]. The dietary scale was modified to assess self-efficacy for eating a low calorie diet, rather than for a low-fat diet. In addition, because our developmental work indicated high levels of stress and potentially depressive symptoms among our participants, we assessed these constructs. Stress was assessed by the 10-item Perceived Stress Scale [19]. Each item is rated on a 5-point scale (0–4) and summed. Scores range from 0 to 40, with higher scores indicating greater stress. Depressive symptoms were assessed by the Edinburgh Postnatal Depression survey [20], which includes ten items that assesses emotional well-being in the past 7 days. Each item has a 4-point response option (0–3), and items are summed with higher scores indicating greater symptoms.

Intervention dose—The dose was assessed in two ways. A categorical indicator of total number of sessions attended was classified as less than or equal to two sessions, three to five sessions, and greater than or equal to six sessions, based on the frequency distribution of this variable. A second indicator compared those who attended all of the first three sessions to those who did not. This was assessed because the first three sessions provided the essential concepts and strategies of self-management for weight loss, while the topics covered in the remaining eight sessions reinforced these concepts.

Process evaluation measures—The intervention dose received was assessed by tracking attendance in group sessions. Intervention fidelity was assessed using a standardized check list during group sessions and all interventionists were given feedback on their implementation of the protocol after each session. A 20-min telephone-based qualitative interview was conducted by an interviewer not previously involved in the study to assess participant experiences with the intervention at the 4-month follow-up. A protocol of open-ended questions guided the interview and inquired about facilitators and challenges to attendance.

Statistical analysis—Descriptive statistics were used to describe sample characteristics. Paired *t* tests were used to assess pre/post-change in weight, behavioral, and theoretical variables. Baseline value carried forward for participants lost to follow-up. Secondary analysis assessed the association of dose received with weight changes. Paired *t* tests were computed to assess change within category of each dose variable, and independent sample *t* tests were computed to

compare change across categories. Analysis was conducted using Stata version 12. Qualitative research techniques were used to summarize patient experiences in the program and followed a qualitative methods protocol as described in step 4.

RESULTS

Table 1 describes the study sample. Table 2 presents a baseline description of each study outcome measure and the change in outcomes from baseline to 4 month follow-up. Overall, a significant weight change of -4.6 lb ($SD=8.2$, $P=0.04$), -2.7% of total weight ($SD=4.4$, $P=0.04$), and -0.88 BMI units ($SD=1.4$, $P=0.006$) was observed. Overall, 35% lost 6.6 lb or more, which is considered the average amount of weight retained per pregnancy (3 kg) [1], and 32% lost 5% or more of their baseline body weight, which is considered to be clinically significant for health improvement [5].

In all, 48% of women who enrolled in the program attended greater than or equal to three out of eight sessions. Attendance varied over time with 65% and 64% of the sample attending the first session and second sessions and attendance decreasing to approximately a third in the last three sessions. Twenty-six percent of the participants

Table 1 | Baseline description of study sample (n=27)

Variable	Mean or <i>N</i>	Standard deviation (SD) or percentage (%)
Client age, mean (SD)	27.8	5.1
Number of weeks postpartum, mean (SD)	14.4	2.5
Race/ethnicity, <i>n</i> (%)		
Latino	8	29.6
Non-Latino Black	6	22.2
Non-Latino White	12	44.4
Asian	1	3.7
Education, <i>n</i> (%)		
High school degree or less	15	55.6
Some post-high school education	6	22.2
College degree	6	22.2
Marital status, <i>n</i> (%)		
Married/living as married	21	77.8
Divorced	1	3.70
Never been married	5	18.50
Total number of children, <i>n</i> (%)		
1	11	40.7
2	5	18.5
3+	11	40.7
Breastfeeding status, <i>n</i> (%)		
Never	4	14.8
Previously, but not currently	11	40.7
Currently	12	44.5

Table 2 | Baseline description of outcomes and change from baseline to 4 months follow-up

	Baseline mean (SD)	Change from baseline mean (SD)	P value
Weight in pounds	185 (28.3)	−4.6 (8.2)	0.04
Percent weight loss	—	−2.7 (4.4)	0.04
BMI	32.0 (3.6)	−0.88 (1.4)	0.006
Total activity	432.4 (137.6)	70 (177.0)	0.05
Sedentary activity	73.0 (34.9)	−17.5 (41.5)	0.12
Light-intensity activity	181.3 (64.2)	28.9 (80.1)	0.12
Moderate-intensity activity	151.6 (87.5)	45.4 (176.7)	0.08
Vigorous-intensity activity	25.8 (38.4)	7.4 (41.8)	0.12
FFB fat summary score	2.4 (.36)	−0.31 (0.46)	0.03
TFEQ-R21 cognitive restraint score	17.1 (2.3)	0.78 (2.4)	0.36
TFEQ-R21 uncontrolled eating score	23.9 (4.3)	−1.4 (3.8)	0.38
TFEQ-R21 emotional eating score	9.9 (3.5)	−1.3 (5.1)	0.05
Edinburgh postnatal depression scale score	8.6 (5.7)	−2.3 (5.5)	0.03
Perceived stress scale score	17.5 (7.0)	−3.1 (3.2)	0.02
Self-efficacy for exercise	14.5 (3.5)	0.64 (4.0)	0.99
Self-efficacy for diet	22.2 (4.1)	1.7 (4.7)	0.19

attended the first three sessions. A dose–response relationship was observed between weight loss and session attendance. Weight loss was −5.8 (SD=9.4, $P=0.07$) and −9.2 (SD=6.7, $P=0.005$) lb for women who attended between three and five sessions and greater than or equal to six sessions, respectively, compared to women who attended less than or equal to two sessions whose weight change was −1.8 (SD=5.7; $P=0.43$; P for between group differences=0.04). Women who attended the first three sessions lost an average of −11.1 lb (SD=4.9; $P=0.001$), compared with −2.1 lb (SD=8.0; $P=0.034$; P for between group differences=0.006).

Qualitative interviews—A total of 20 women participated in the qualitative interviews. The rate of intervention participation among these 20 women (average 4.6 sessions) was significantly higher than that of the 5 women who did not participate in the interviews (average 2.0 sessions; $P=0.04$). Overall, women overwhelmingly had positive experiences in the program and we observed a theme of improved confidence and empowerment. Facilitators of attendance included group support (mentioned by more than half of the women), interest in the content and materials (half of the women), convenience (i.e., childcare and transportation), weight loss (“program was working for me”), family support, knowledgeable providers, and feeling accountable to their commitment to attend. Reminder calls and calls from the nutritionist following missed sessions were perceived as helpful (“it feels as if someone really cares about what’s going on”). Women found the program materials helpful and most reported referring to them at least once per week during the program. Obstacles to attendance included child illness (mentioned by half), bad weather, transportation problems (despite transportation being provided by the program), conflicting work or school schedule, and being too busy or tired to attend. Women recommended that systematic activities to build accountability among the participants be included in the program (e.g.,

create a buddy system for women to contact each other for support, remind each other to attend sessions). Women also suggested the inclusion of guest speakers “to avoid repetitiveness.”

DISCUSSION

Postpartum women are at substantial risk for overweight and obesity due to pregnancy weight retention and weight gain after childbirth [2]. Efforts to reduce weight disparities among diverse disadvantaged women require attention to the postpartum period. Furthermore, targeting postpartum weight loss has the potential to improve the health of the entire family.

Overall, the current weight loss intervention efficacy literature has been of limited use in real world settings and ineffective at achieving public health impact [21]. Reducing the obesity epidemic will require that efficacious interventions like the DPP be translated to promote weight loss in settings and populations that bear the greatest burden of obesity, such as women enrolled in the WIC program. Efficacy studies are designed with the goal of addressing an epidemiologic question. For example, the DPP was designed to address the question “Does weight loss result in decreased diabetes risk?” As such, the DPP lifestyle intervention was designed to maximize weight loss, with little consideration of cost or context, to ensure that the research could answer the question at hand. Consequently, the DPP intervention was highly intensive, costly, and provided abundant weight loss resources to participants. This included highly specialized intervention staff trained to deliver state-of-the-art behavioral counseling, continuous monitoring, and other resources. In addition, the DPP study screened a sample of highly motivated individuals who received incentives to stay in the trial. In contrast, real world populations and the settings that serve

them represent a large array of characteristics and are influenced by a multitude of factors that impact adherence to behavioral interventions (i.e., psychological, interpersonal, contextual) and the settings' capacity to deliver evidence-based interventions (i.e., limited resources, staff that may not have specialized skills). It is the demonstrated effectiveness of DPP-like interventions used in real world settings and their populations, particularly vulnerable populations, and those facing health disparities that will determine their true public health impact [22].

This study illustrated a five-step framework to translate the DPP to be delivered to diverse low-income postpartum women enrolled in the WIC program, a population vulnerable to postpartum weight retention and also postpartum weight gain [2]. Our intervention demonstrated significant, yet modest, weight loss and changes in diet and physical activity among low-income, postpartum women. The intervention also led to significant improvements in perceived stress, depressive symptoms, and emotional eating. Lack of significant improvements in self-efficacy were unexpected and may be associated with the adapted measure as the qualitative interviews suggested that participants felt empowered by the intervention. We attribute the intervention success to the methodological process by which it was adapted, taking into consideration key characteristics of the population and the WIC setting.

Despite these promising findings, two challenges to intervention implementation are worth noting. First, intervention attendance among the participants was lower than desirable, although greater than in prior studies. For example, Krummel and colleagues [4] and Chang and colleagues [3] reported that 57% and 52% of their participants, respectively, never attended a group discussion, compared with 15% in this study. Less than ideal attendance rates reflect the reality of many health centers serving low-income populations, i.e., typically high cancellation and no show rates. The future implementation of the program could incorporate attendance incentives, a strategy already used by the WIC program where women receive food vouchers upon attending appointments. Group support and calls from the nutritionists or peers (i.e., reminder calls and calls subsequent to missed sessions) appeared to enhance engagement among participants in the intervention, and thus in-between session contact with participants and among participants should be explored in future studies. In addition, future research should explore the reach and effectiveness of alternate intervention formats, including phone-based and technology-based interventions. Second, nutritionists' intervention fidelity needed oversight and additional training during the implementation of the program. In particular, nutritionists struggled with using a motivational interviewing style, instead reverting to a didactic approach typically used in clinical encounters. Future program implementation will require a longer training phase that incorporates extended opportunities for

counseling skill building or, alternatively, strategies that support the group leader to "stay with" the protocol (i.e., intervention activities that provide increased structure).

Average weight loss in this study, 4.6 lb, was less than that achieved in the DPP efficacy trial [21]. This is common among interventions that translate efficacy findings into real world settings and populations, and should be expected when moving from resource intensive clinical settings to resource scarce community settings. Smaller net weight loss, however, is still a worthwhile achievement among populations that otherwise are on a trajectory of continued weight gain. No consensus exists on a threshold for what constitutes a clinically significant weight loss among obese individuals and at-risk groups such as the low-income postpartum women. From a public health perspective, small changes and modest weight loss such as that achieved through this study can have profound health benefits across the population [23]. A limitation of this study is lack of a comparison group, which precludes our ability to determine the absolute difference in weight change impacted by the intervention compared to a usual care condition which presumably gained weight during the postpartum period [2]. In addition, qualitative evaluation participants attended greater sessions than non-participants and thus their responses may overestimate positive reactions to the intervention.

The use of the intervention translation framework took into consideration individual and contextual characteristics of the population (i.e., demographics, beliefs, family/social factors, culture), which facilitated its perceived relevance and appeal among the target population. The partnership approach with WIC program leaders and staff contributed to perceived intervention relevance among these stakeholders and to the successful implementation of the study. This greater emphasis on external validity is critical to changes in practice, dissemination, and policy that are needed to improve the population's health and decrease health disparities [21]. The above factors represent strengths that will facilitate future adoption of the Fresh Start intervention by WIC at the state level. This pilot program was implemented locally and ended with the conclusion of this study. Our research team currently in discussions with the state Department of Public Health, which administers WIC, regarding implementing the intervention in routine practice. We anticipate that full-scale implementation of the Fresh Start intervention will require considerable more time and relationship development. Such implementation will require considerable technical assistance (i.e., training, oversight, and support), changes in administrative systems (i.e., screening of eligible WIC participants, referral process), and resource allocation by the State WIC office. Given the current fiscal climate of massive budgetary cuts, the latter is expected to be the greatest barrier to implementation in routine practice. Building attendance incentives and establishing a process for staff

training within the current WIC program systems represent important steps to adoption and sustainability. Eventually, continued monitoring of program implementation, weight loss effectiveness, and cost-effectiveness will provide important data for its long-term sustainability.

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