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## Design and Outcomes of a *Mothers In Motion* Behavioral Intervention Pilot Study

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### INTRODUCTION

Overweight and obese women of childbearing age, especially those with low-income, are at a risk of major weight gain in the U.S.<sup>1, 2</sup> Nearly three quarters (73.7%) of African American and almost half (45.6%) of white women 20–39 years old are overweight or obese.<sup>3</sup> Overweight and obesity are associated with weight retention and weight gain during the postpartum period.<sup>1, 4</sup> For example, overweight and obese low-income women in New York state were found to retain about 5 pounds more of the weight that they gained during pregnancy than lower income women with normal or low BMI.<sup>5</sup> A Texas study reported that loss of excess weight gained during pregnancy reached an early plateau (2–3 weeks postpartum) in an ethnically and racially mixed group of 26 low-income women who were mostly overweight or obese.<sup>6</sup>

Low-income women's high rates of overweight and weight gain have been strongly associated with poor diet and physical inactivity,<sup>7–9</sup> which may both be exacerbated by stress.<sup>10</sup> During periods of high stress in daily lives, these mothers experienced the most difficulty in following nutrition and physical activity recommendations.<sup>10–13</sup> To cope with stress, some women engage in emotional eating and increase their intakes of energy-dense foods, e.g., candy and potato chips.<sup>10, 14, 15</sup> Therefore, health promotion programs aimed to prevention of further weight gain of low-income women at childbearing age should incorporate stress management. The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is an important community-based setting for this type of intervention. WIC is a federally funded program that provides nutrition consultation and other services to low-income pregnant women, new mothers, and young children (< 5years). In 2004, more than 8.5 million low-income women and young children received benefits from WIC.<sup>16</sup>

Researchers have used interactive CD-ROM to deliver nutrition education and physical activity to WIC mothers in WIC clinics<sup>17–20</sup> and individuals with diabetes.<sup>21</sup> Studies using a single dose of an intervention have found significant improvement in nutrition knowledge,<sup>18–20</sup>

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attitudes,<sup>19, 20</sup> and self-efficacy,<sup>18</sup> but not dietary intake behavior changes in WIC mothers. However, a study using a combination of interactive CD-ROM and individual telephone consultation found significantly reduced dietary fat intake, increased fruit and vegetable intake, and increased physical activity.<sup>21</sup> These studies suggest that repeated contact and a combination of these modes might be needed to be effectively change behaviors. However, repeated contact with interactive CD-ROM in WIC clinics is not feasible.<sup>18</sup> An alternative is to view a DVD with equipment (a television and a DVD player) at participants' home, given the fact that most American households have television (99%) and use a DVD player (80%).<sup>22</sup>

Interventions that utilize peer support group teleconferences (PSGTs) have resulted in significant gains in coping, support satisfaction, perceived support and information,<sup>23–25</sup> and decreased feelings of isolation and loneliness.<sup>24, 26</sup> The teleconference environment is comfortable and convenient, provides privacy, is readily accessible without transportation, and can increase participation.<sup>27, 28</sup> Also, group intervention can be effective because it provides empathy, social support, and a healthy dose of competition.<sup>29</sup> However, the implementation of PSGT has not been documented in low-income overweight and obese mothers or similar populations for healthy eating or physical activity interventions.

Based on literature review and our previous formative research with the target audience (described later), we chose to deliver intervention messages via a DVD and PSGTs. Since the feasibility of combining these modes of intervention has not been documented for this target audience, we piloted the intervention. This paper describes design and results of the pilot *Mothers In Motion (P-MIM)* program. Also, this paper discusses challenges and lessons learned to developing culturally sensitive DVD that featured peers who were trained in healthy lifestyle behavioral changes from the target audience.

## METHODS

### Overview of the P-MIM Program

The *MIM* aims to preventing weight gain in low-income overweight and obese mothers 18–34 years old by promoting healthy eating (decreased fat intake and increased fruit and vegetable intake), physical activity, and stress management. This P-MIM was a 2-year community-based randomized control trial. This intervention integrated cultural preferences of overweight and obese African American and white WIC mothers and contextual issues identified through our formative research<sup>10</sup> with principles of Social Cognitive Theory (SCT).<sup>30</sup> The 10-week intervention delivered theory-based culturally sensitive intervention messages via a series of 5 chapters in a DVD (10–15 minutes/chapter) complemented by 5 PSGTs (30-minute/PSGT) at alternative weeks. Intervention participants viewed the DVD that featured peers from the target audience at home and called in PSGTs at convenience locations that were led by WIC educators.

### Community Partnership

Partnerships for the P-MIM program were developed over a 2-year period. With assistance from the State of Michigan WIC, we contacted 11 local WIC programs that are within 85 miles of Michigan State University. Six programs collaborated in formative research and 3 WIC programs participated in this pilot. These 3 collaborating WIC programs comprise predominantly African Americans and whites and are located in urban and suburban areas.

### Community advisory group

A WIC coordinator from each of 3 participating counties and a nutrition consultant from the State of Michigan WIC served on the community advisory group. The purposes of the

community advisory group were to 1) select, plan, and review components and topics of intervention, 2) collaborate to plan and implement recruitment, intervention, and data collection, and 3) support and maintain progress of the intervention program by teleconference as often as necessary. This group also reviewed the first and second rough-cuts DVD and provided suggestions for revision to ensure that the DVD was culturally sensitive to the target audience.

### Peer advisory group

The peer advisory group consisted of 9 overweight and obese WIC mothers 18–34 years old (5 African Americans and 4 whites). They were recruited from one of our collaborating WIC programs via personal invitation. A predetermined set of screening questions was used to screen potential members for necessary attributes such as verbal articulation skills. The peer advisors reviewed the first and second rough-cuts DVD and gave suggestions for revision to ensure that the DVD was culturally sensitive to the target audience.

### Intervention Development

**Formative research**—Formative research was conducted prior to the development of the P-MIM to 1) explore barriers to and motivating factors for prevention of weight gain, 2) identify key concepts for the DVD, 3) identify culturally sensitive ways to make the intervention and messages relevant and appropriate for the target audience, and 4) to identify facilitators of recruitment and active participation. Participants were overweight and obese African American and white WIC mothers 18–35 years old. Design, sampling, formative research procedures, and results of the first objective have been published elsewhere.<sup>10</sup>

The focus group participants said that they favored a DVD that could be viewed at home as a conduit for educational messages. The most frequently requested topics included healthy eating, physical activity, and stress management. Suggested subtopics included meal planning, grocery shopping/food label reading, meal preparation, enjoyable home exercise/activities with children, stress management skills and ways to avoid emotional eating. They recommended simple, brief, entertaining and concrete messages that are easily applied in their daily lives. People who appeared in the DVD should be mothers and their children wearing casual clothing. Participants preferred to see and hear other overweight and obese WIC mothers who would share real-life experiences, both positive and negative, in making behavioral and weight changes. The DVD should include a variety of settings, e.g., home, grocery store, and neighborhood. Each chapter should be brief (10–15 minutes) and fun to watch. The participants also suggested a way of answering questions at the end of each chapter to verify that they had viewed each chapter in the DVD. Also, participants indicated that PSGTs would motivate them to participate actively, modify lifestyle behavior, and prevent weight gain. When asked how to motivate them to participate in the PSGTs, they indicated that the group members must be mothers to whom they could relate to, e.g., women with similar body size, age, and number of children.

When asked how to recruit and retain participants, women suggested that we should tell the potential participants exactly what our program is about. Monetary incentives were suggested, especially cash, grocery coupons, and gift certificates for diapers and clothing. Providing a weekly calendar was suggested. Telephone and postcard reminders were also recommended. Participants also suggested the name of the intervention program, e.g., *Mothers In Motion*.

**Culturally tailored components**—The P-MIM program components were designed in a manner that incorporated ethnic/cultural characteristics, beliefs, norms, values, and behavior patterns of the target population, and relevant social, historical, and environmental forces. Cultural sensitivity can be conceptualized in terms of 2 primary dimensions: *deep structure*

and surface structure. *Deep structure* reflects how cultural, social, psychological, historical, and environmental factors influence health behaviors differently across racial populations.<sup>31, 32</sup> The *deep structure* requires understanding how the target audience perceives the cause, course, and treatment of illnesses (e.g., overweight and obesity) and how these perceptions influence specific health behaviors (e.g., healthy eating).<sup>33</sup> The *surface structure* is addressed by matching the intervention materials and messages to the social and behavioral characteristics of a target population, such as selecting an appropriate channel of intervention and using people, clothing, language, foods, music, and locations that are familiar to and preferred by the target audience.<sup>32</sup>

In addition to using principles from our formative research, we addressed “*deep structure*” in our P-MIM intervention by 1) using presentation styles that conveyed authenticity and respect, 2) providing peer role models,<sup>34</sup> 3) helping mothers understand that taking care of oneself would help meet the needs of her children, 4) directly addressing the common barriers of psychosocial stress, emotional eating, negative mood, low self-esteem, lack of social support, and unsuccessful weight loss history, and 5) using peer testimonials to model and explain specific ways to make healthy lifestyle behavioral changes. We tailored elements of “*surface structure*” by 1) using the combination of information channels: DVD and PSGT, 2) featuring overweight and obese WIC mothers and their children wearing casual clothing in the DVD, 3) providing personal testimonials from peers regarding improvement of dietary intake, physical activity, and stress management, 4) using the typically foods eaten by the target audience for demonstration of meal planning, grocery shopping, and meal preparation, 5) using the background music in the DVD that was selected by the target audience, and 6) videotaping done at familiar locations (e.g., homes, neighborhood, local grocery store, and work).

**Conceptual framework**—Topics and educational strategies were selected for this project based on the SCT and the research team’s prior findings with the target audience.<sup>10, 35, 36</sup> The SCT systematically addresses personal and environmental factors<sup>30</sup> to promote healthy lifestyle behaviors (healthy eating, physical activity, and stress management). Personal factors include outcome expectancies (motivation and benefits to perform a behavior), self-efficacy (one’s confidence to perform a specific behavior in varying conditions and situations), and emotional coping response (strategies used to manage stress). The environmental factors include physical (factors external to the person, e.g., availability of foods), social environments (social support), and situations (barriers and person’s concept of the environment).<sup>30</sup>

**Examples of application of SCT concepts to intervention**—*Outcome expectancies.* We presented personal testimonies and real-life examples about the processes, motivation, and benefits of adopting healthy lifestyle behaviors. *Self efficacy.* We helped mothers recognize their existing skills and make changes in the form of small steps. *Emotional coping response.* We defined and identified emotional eating, triggers of emotional eating, and strategies to interrupt the emotional eating cycle. *Physical environment.* We provided examples of triggers in the environment and external factors related to eating, being active, and managing stress. *Social support.* We explained how to select positive social support persons and elicit their support. *Situations.* We helped identify barriers to making healthy lifestyle behavioral changes and we corrected misconceptions.

## Development of the MIM DVD

**Recruitment and training of featured mothers**—In this paper, we refer overweight and obese WIC mothers who appeared in the DVD as “featured mothers.” The featured mothers (2 African Americans and 2 whites) were representatives of the target audience who met the inclusion and exclusion criteria for the study. These featured mothers were identified by collaborating with Michigan State University Extension educators serving low-income

populations, such as WIC mothers. A pre-determined set of interview questions was used to gather data on demographics and communication skills of the potential featured mothers. These mothers were selected to represent the body size, age, education, postpartum, employment, and marital status of the target audience.

The intervention curriculum that was developed based on the *deep* and *surface structures* and SCT concepts was used to train the featured mothers at a variety of familiar settings in 15 sessions (3 sessions/per chapter) that were tailored to the needs of each featured mother. Each featured mother was asked to attend 3 individualized weekly trainings before being videotaped for the DVD. Each training session included demonstration, role-playing, problem solving, goal setting, and debriefing. The trainer (the first author) called the featured mothers twice a week to monitor their progress and answer questions. The initial training (week #1) focused on knowledge and skill-building and practice. The featured mothers applied learned cognitive and behavioral skills to their daily lives within the following 7 days and used a weekly worksheet to self-monitor progress based on their short-and long-term goals. For week #2, the trainer used a checklist to assess and optimize the degree to which the featured mothers understood and demonstrated knowledge of and ability to apply the learned skills to their daily lives. Also, strategies for problem solving were discussed. To ensure that the featured mothers could talk naturally without a script, the trainer observed and evaluated them using a checklist during rehearsal (week #3). After meeting the rehearsal checklist criteria, the featured mothers and their children were videotaped at a variety of settings, e.g., home, neighborhood, and grocery store. The trainer was present during videotaping, using a checklist to ensure that the topics were covered.

**Components of the culturally sensitive DVD**—Each chapter had 3 components as the following sequence: interactive information (1–2 minutes), culturally sensitive narratives (7–10 minutes), and goal setting (2–3 minutes). At the end of each chapter, 3 quiz questions were included. *Interactive information.* The interactive information was designed to correct misconceptions and promote healthful lifestyle norms by asking viewers to evaluate a series of written statements. The DVD showed featured mothers' written statements on presentation boards that were accompanied by narrators' voice-over. After the DVD displayed a mother's statement, the DVD would then pause and ask the learner to hit "Yes" or "No", after which the DVD showed a correct statement, regardless of the learner's response. *Culturally sensitive narratives.* The featured mothers demonstrated and talked about their own positive and negative experiences in applying effective strategies in their daily lives and the impact on their family members and children. Their testimonials focused on reinforcing motivation and increasing self-efficacy and problem solving for improvement of dietary intake, physical activity, and stress management.

**Goal setting:** The DVD presented concrete examples of short- and long-term goals and plans to achieve these goals. The emphasis was on small, practical steps that would move the participants in the direction of lowering dietary fat intake and increasing fruit and vegetable intake, physical activity, and stress management skills. The featured mothers demonstrated how to set up specific, realistic, and measurable personal goals and self-monitor progress for each personal goal. They also encouraged participants to try to achieve their personal goal(s) for just 1 week and to evaluate and identify barriers and facilitators for behavioral changes. *Quizzes.* Quizzes with narrators' voice-over were used to monitor compliance of viewing each chapter in the DVD and to increase learners' engagement with materials. The quiz questions were related to the content of the DVD, thus participants were highly unlikely to gain information from other resources to answer the quiz.

**Evaluation of the cultural sensitivity DVD**—To ensure that the DVD was culturally sensitive to the target audience and delivered key topics effectively, the community and peer



advisory groups critically reviewed the first and second rough-cuts of the DVD. A DVD producer and one of the research team members met with peer advisory group several time to show them chapters in the DVD. Then the peer advisory group answered a series of questions on the chapter sequence, SCT concepts, presentation, application of learned skills to daily life, and time flow. Also, they evaluated the appropriateness of quiz questions.

The peer advisory group provided suggestions for content revision and suggested sequence of each chapter for intervention: 1) stress management/ways to avoid eating foods for comfort, 2) enjoyable exercise with children at home, 3) meal planning, 4) grocery shopping/food label reading, and 5) meal preparation. They also suggested providing supplemental pamphlets to reinforce key concepts for each chapter and using the term “hotline” instead of “PSGT” to encourage participation. The DVD was revised and finalized based on feedback from the community and peer advisory groups. As suggested by the peer advisory group, we worked with the featured mothers to develop 5 pamphlets supplemented the DVD by summarizing key points of each chapter in the DVD.

**Development of PSGTs’ Scripts and Training of WIC Educators**—The scripts for leading the PSGTs were developed based on SCT concepts and contents in the DVD. Three WIC educators attended 1-day training on leading PSGTs. The training included didactic instruction, demonstration, role-playing, and a practice exercise. The PSGT procedure and content were pre-tested with members of the peer advisory group.

**Setting and Participants**—A detailed description of recruitment strategies, inclusion and exclusion criteria, and sample representation is described elsewhere.<sup>37</sup> Study participants were recruited from 3 WIC programs in southern Michigan. Briefly, every woman coming to the WIC clinics during the data collection dates was personally invited by trained recruiters. Study participants were non-pregnant women 18–34 years old, understood and spoke English, were African Americans or non-Hispanic whites, were at least 6 weeks postpartum, had a measured body mass index (BMI) between 25.0 and 39.9 kg/m<sup>2</sup>, and had fasting blood glucose less than 126 mg/dl or random (non fasting) blood glucose less than 200 mg/dl (through finger stick). Study participants signed consent forms prior to participation. The study procedure was approved by the Institute of Review Board at Michigan State University.

### **Stratified Randomization and Intervention**

**Stratified randomization**—A detailed description of stratified randomization and intervention is described elsewhere.<sup>37</sup> In brief, participants were randomly assigned to an intervention or control group after completion of the baseline phone interview. WIC staff at collaborating counties were blinded to the study participants’ assignment.

**Intervention**—An intervention package was sent via certified mail (signature required) to intervention participants’ homes. Intervention participants viewed a designated chapter in the DVD biweekly in their homes. After viewing the assigned chapter, participants answered 3 quiz questions and set 1–2 personal goal(s) for healthy behavioral changes and used a weekly worksheet to self-monitor progress for 1 week. Then, they mailed the quiz and weekly worksheet to the study office. They also joined a PSGT call on alternate weeks for 10 weeks. Intervention participants were grouped based on their BMI categories and ages of their children. Each teleconference had the 10–15 assigned participants, a moderator who was a WIC educator from a different collaborating county than the participants where they were recruited, and an assistant moderator. Hereafter, we refer WIC educators who led the PSGTs as “interventionists.”

The interventionists used a theory-based protocol to lead the group discussion and the assistant moderator was responsible for taking notes, keeping time, and keeping track who called in. Each PSGT lasted 30-minutes, a length of time suggested by the community advisory group, and had a specific topic corresponding to the content of the DVD chapter from the previous week. For example, participants viewed the meal planning chapter followed by a PSGT that focused on their experience in applying meal planning recommendations from the DVD. To monitor treatment fidelity, a research team member called in each PSGT and used a checklist to ensure the contents that were covered. At the end of each session, the researcher debriefed with the interventionist to discuss reasons for variation in approach and to maintain standardization, integrity of implementation, and reliability among interventionists.

### Usual WIC Care

Regardless of her group assignment, each participant received WIC nutrition education for approximately 20 minutes every 6 months during the re-certification appointment for her young child(ren).

### Measurement

Height, weight, and blood glucose via finger stick were measured at the collaborating WIC clinics. Survey data were collected via telephone interviews. These data were collected at 3 time points: baseline, 2- and 8-months following the 10-week intervention.

#### Primary outcomes

**Height and weight:** Height was collected for the purpose of calculating BMI (weight [kg]/height [m]<sup>2</sup>) that was used to screen and randomize participants. Height was measured to the nearest 0.1 cm using a wall-mounted stadiometer, with participants wearing no shoes. Weight was measured to the nearest 0.1 kg on an electronic scale with the participants wearing light clothing and no shoes.

**Blood glucose:** Blood glucose was measured via finger stick using one-touch (Milpitas, California). Participants were asked if they ate or drank, except water, within the last 8 hours (yes/no) to determine whether fasting or random blood glucose parameters were applicable.

#### Secondary outcomes

**Fat, Fruit, and Vegetable Intake:** The National Cancer Institute (NCI) Fat Screener with established predictive validity was used to measure percent of calories from fat. This instrument contains 15 items (food groups) predictive of percent of calories from fat.<sup>38, 39</sup> The NCI fruit and vegetable Short Assessment Form that contains 19 items with predictive validity was used to measure fruit and vegetable intake.<sup>40</sup>

**Physical Activity:** The Godin Leisure Time Exercise Questionnaire was used to measure moderate physical activity (6 items).<sup>41</sup> Participants were asked how frequently and for how long they participated in moderate physical activity in the last 7 days (i.e., walking, jogging, biking, aerobic exercise, dancing, and play active activities with children).

**Perceived Stress:** The Perceived Stress Scale (9 items) was used to measure stress. Responses to each item were rated on a 4-point scale ranging from 1 (rarely or never) to 4 (usually or always).<sup>42</sup>

**Feelings:** Feelings were measured because they are prevalent and relevant outcome of stress. 10-<sup>43</sup> The Positive Affect and Negative Affect Scale (PANAS) was used to measure feelings

which is emotional stress response (18 items). Responses to each item were rated on a 5-point scale ranging from 1 (very slightly or not at all) to 5 (extremely).<sup>44</sup>

## Data Analysis

Demographic and compliance data were analyzed using descriptive statistics, chi-squared (for categorical variables), and t-tests (for continuous variables) via SAS (Statistical Analysis System version 9.2). To assess treatment effects, general linear mixed model<sup>45</sup> was applied to 2- and 8-month post intervention data. Covariates included baseline data of each primary and secondary outcome variable. Pattern mixture modeling was performed to examine the differentiation pattern of drop out on treatment effect.<sup>46-47</sup> Pattern was defined as completers (those completed 3 time points of data collections) versus non-completers (those completed 1 or 2 time points of data collections or partial respondents). As a follow-up, we performed a profile analysis using the general linear mixed model and reported *d* family effect size.

## RESULTS

### Demographic

A total of 129 participants were enrolled and randomly assigned to intervention (n = 64) and control (n = 65) groups (Table 1). Compared to the control participants, a higher proportion of the intervention participants had a high school or less education ( $p < 0.05$ ). Also, there were differences in employment status ( $p < 0.05$ ). While the control group had more students and part-time employees, the intervention group had more unemployed and homemakers.

### Baseline Data

No significant differences were found between the intervention and control groups in primary and secondary outcome variables (Table 2). Of the study sample, only about one-third or less met the recommendation of eating 35% or less of total calories from fat (30.8%) or eating at least five cups of fruit and vegetable a day (28.7%) as assessed using NCI dietary surveys.

### Compliance of Intervention

Of 64 intervention packages mailed out via certified mail (signature required), we received 60 signed receipts. Of the 60 participants who received the intervention package, 65.5% provided worksheets and quiz responses showing that they had viewed 1 or more of the 5 chapters in the DVD (mean = 3.2 chapters, SD = 1.6). On average, participants reported reviewing each chapter 2.5 times within the last 6 months. About 48% of intervention participants called in to participate in 1 or more of the 5 assigned PSGT sessions (mean = 2.17 sessions, SD = 1.33).

### Post Intervention Data

Significant fixed effects were found in blood glucose (time effect), fruit and vegetable intake (group [treatment] effect and treatment by time effect) and perceived stress (time effect). No significant treatment, time, and treatment by time effects were found in body weight, fat intake, physical activity, positive feelings, and negative feelings (Table 3). Results of pattern mixture modeling revealed a significant higher dropout rate in the treatment than the control group ( $p < 0.05$ ). However, the pattern of dropout did not bias treatment effect ( $p > 0.05$ ). Detailed descriptions of dropout have been published.<sup>37</sup> Table 4 presents differences in adjusted means between the intervention and control groups at the 2 post-intervention time points. After adjusting for baseline body weight, there was an apparent trend for the intervention group to weigh less than the control group at 2 months (3.19 lbs) and 8 months (0.3 lbs) post intervention, but no significant effect size was detected. At 2- and 8-month post intervention, no significant effect sizes were found in blood glucose, fat intake, fruit and vegetable intake, physical activity, perceived stress, positive feelings, and negative feelings after adjusting for baseline data of



each primary and secondary variable. However, all variables had trends consistent with study's hypotheses at both post intervention time points, except fat, fruit, and vegetable intakes.

## DISCUSSION

The *P-MIM* is the first study utilizing a combination of theory-based culturally sensitive DVD and PSGTs to deliver educational messages about healthy eating, physical activity, and stress management to help overweight and obese WIC mothers prevent weight gain. Our experience in developing the *P-MIM* underscored the importance and value of a strong theoretical base, community involvement, and a thorough understanding of the specific target audience.

There were many challenges to develop the culturally sensitive DVD. First, it took us nearly 3 months to recruit mothers to be characters in the DVD. After initial screenings and pre-training sessions, 8 WIC mothers were selected for these roles. During the first 3 weeks of training, 4 of the 8 women were disqualified because they were unwilling to make positive lifestyle behavioral changes or were unable to attend scheduled training sessions.

Patience, respect, and attentive listening were important for establishing rapport and trust between the featured mothers and the *P-MIM* staff. Still, training the featured mothers took much longer than we anticipated, due to numerous challenges and interruptions. As suggested by our previous focus group research, mothers tended to be more concerned with their children's eating patterns than their own.<sup>10</sup> Preparing featured mothers to talk without a script required step-by-step coaching. Gaining access for videotaping at grocery stores was complicated and time-consuming. Safety issues needed to be addressed when training featured mothers at their homes and neighborhoods because they lived in unsafe areas.

Nevertheless, many positive lessons were learned from the development of the culturally sensitive DVD. Close collaborations among the *P-MIM* development team and its community and peer advisory groups and featured mothers were essential. We also learned the importance of addressing stress management issues early in this type of intervention. Our featured mothers and our peer advisory group agreed and said that overweight and obese mothers need to learn how to manage their stress before they can eat more healthfully and be more physically active. Bringing fruits and vegetables to share with featured mothers' young children was a successful strategy to help both featured mothers and their young children learn to eat more fruits and vegetables. Featured mothers said that their children started to ask for more fruits after the trainer brought fruits to their homes. Discussing and demonstrating ways to modify the home environment was another successful strategy to encourage positive lifestyle behavioral changes. Because most training took place at featured mothers' homes, the trainer was able to observe and discuss ways to modify the home environment, e.g., leaving fresh apples instead of chips or cookies on the kitchen counter. We found that the featured mothers enjoyed making plans with their children for healthy lifestyle behavior changes. Therefore, this type of intervention should demonstrate and reinforce the importance of mothers and young children making changes together. Moreover, correcting misconceptions needs to target common beliefs that are specific to the target audience. We found that such beliefs tend to vary from group to group and change over time.

The theory-based culturally sensitive intervention showed promise for preventing weight gain in low-income overweight and obese African American and white mothers. The lack of significant effect size of primary and secondary outcome variables is most likely due to the small sample size and short duration (10 weeks) of the intervention. However, most of the apparent data trends for our outcome variables were consistent with the study objectives, with the exception of fat and fruit and vegetable intakes. The findings that are inconsistent with study's hypotheses may be partially attributable to the use of imprecise measurements.

Although, the NCI fat, fruit and vegetable intake surveys have been used successfully to track year-to-year change in national surveys<sup>48–50</sup> and intervention trials,<sup>51–52</sup> recent studies which were published after our data collection questioned the validity of this instrument.<sup>53</sup>

There are several limitations to this pilot feasibility study. First, the randomized control design was implemented with a convenience sample of our target population. This approach may have introduced a selection bias that limits external validity, but it mimics the process that would be likely to occur in community-based programs such as WIC. The small sample size, demographic variations between groups, and lack of data from dropouts may have affected our findings. Study participants were limited to low-income African American and white mothers 18–34 years old with BMI between 25.0–39.9 kg/m<sup>2</sup>. A higher proportion of intervention participants dropped out than the control group. However, this did not influence the treatment effect. Fasting and random blood glucose values were obtained via finger stick. The intervention group had a higher blood glucose value than the control group at 8 months post intervention. We were not able to assure that all blood glucose values were collected in the fasting state (< 126 mg/dl defined as none diabetic) rather than non fasting blood glucose (< 200 mg/dl define as none diabetic). It is possible that we collected more none fasting blood glucose values from our intervention participants than the controls. Finally, results of this study are not generalizable to low-income women resident in different geographic locations.

## IMPLICATIONS FOR RESEARCH AND PRACTICE

A larger experimental randomized controlled trial is needed to test the effectiveness of the intervention that delivers culturally sensitive intervention messages via DVD featuring peers from the target audience and PSGT led by community health care providers.

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**Table 1**

## Baseline Demographics of Study Participants

Demographic	Intervention (N = 64)		Control (N = 65)	
	M	SD	M	SD
Age (years)	25.53	3.94	25.12	4.10
Postpartum (years)	1.15	0.81	1.11	0.83
	N	%	N	%
Race				
African American	35	54.69	32	49.23
White	29	45.31	33	50.77
Education*				
Some high school or less	16	25.0	6	9.23
High school	19	29.69	10	15.38
Some college or technical school	25	39.06	38	58.46
College degree or higher	4	6.25	11	16.92
Smoking status				
Never smoked	33	51.56	31	47.69
Smoke but quit	18	28.13	17	26.15
Smokers	13	20.31	17	26.15
Employment Status*				
Full time	12	18.75	16	24.62
Part time	8	12.50	16	24.62
Homemaker	17	26.56	9	13.85
Self-employed	2	3.12	2	3.08
Unemployed	19	29.69	9	13.85
Students	4	6.25	10	15.38
Other	2	3.12	3	4.62

\* P &lt; 0.05.

**Table 2**

Baseline P-MIM Data \*

Variables	Intervention (n = 64)		Control (n = 65)	
	M	SD	M	SD
<b>Primary outcomes</b>				
Body weight (lbs)	181.5	34.01	199.5	34.95
Blood glucose (mg/dl) <sup>1</sup>	91.04	11.56	97.77	17.36
<b>Secondary outcomes</b>				
Fat intake behaviors (% of total calories from fat)	33.14	5.03	34.50	8.43
Fruit and vegetable intake behaviors (cups/day) <sup>2</sup>	4.87	4.41	4.25	2.91
Physical activity (MET)	29.76	26.74	27.28	29.85
Perceived stress	2.22	0.26	2.21	0.34
Positive feelings	3.35	0.70	3.36	0.73
Negative feelings	3.60	0.61	3.64	0.70
	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>
Fat intake (percent consuming < 35% of total calories from fat)	22	34.4	24	36.9
Fruit and vegetable intake (≥ 5 cups/day)	17	26.6	20	30.8

\* Lower scores are more desirable in the shaded rows.

<sup>1</sup> Fasting and none fasting (random) blood glucose via finger stick.

<sup>2</sup> Median 4.49 cups/day for the control group, 4.98 cups/day for the intervention group, and 4.83 cups/day for the study sample.

**Table 3**

Fixed Effects for Primary and Secondary Outcome Variables

Outcome variables	Intercept	Baseline covariate <sup>a</sup>	Group	Time	Group X Time
<b>Primary outcomes</b>					
Body weight (lbs)	196.8 <sup>b</sup> (187.4, 206.2)	0.96 <sup>b</sup> (0.89, 1.04)	-6.00 (-21.7, 9.72)	-4.68 (-10.8, 1.45)	2.81 (-8.0, 13.6)
Blood glucose (mg/dl) <sup>f</sup>	106.3 <sup>b</sup> (95.3, 117.2)	0.31 <sup>b</sup> (0.05, 0.57)	-15.96 (-34.3, 2.3)	-8.11 <sup>b</sup> (-15.3, -0.90)	10.06 (-2.5, 22.7)
<b>Secondary outcomes</b>					
Fat intake (% of total calories from fat)	32.38 <sup>b</sup> (27.9, 36.7)	0.54 <sup>b</sup> (0.36, 0.72)	-2.47 (-9.6, 4.7)	0.22 (-2.8, 3.2)	2.16 (-3.0, 7.3)
Fruit and vegetable intake (cups/day)	3.99 <sup>b</sup> (1.4, 6.4)	0.26 <sup>b</sup> (0.12, 0.40)	4.90 <sup>b</sup> (0.85, 8.9)	0.83 (-0.80, 2.4)	-3.30 <sup>b</sup> (-6.0, -0.55)
Physical activity (MET)	29.96 <sup>b</sup> (8.8, 51.0)	0.54 <sup>b</sup> (0.35, 0.74)	-2.01 (-36.5, 32.5)	2.51 (-11.2, 16.3)	9.59 (-13.7, 32.9)
Perceived stress	1.70 <sup>b</sup> (1.4, 1.9)	0.42 <sup>b</sup> (0.14, 0.69)	-0.14 (-0.61, 0.32)	0.53 <sup>b</sup> (0.33, 0.71)	0.07 (-0.25, 0.39)
Positive feelings	3.33 <sup>b</sup> (2.8, 3.7)	0.45 <sup>b</sup> (0.28, 0.61)	-0.05 (-0.78, 0.68)	0.05 (-0.24, 0.35)	0.11 (-0.38, 0.61)
Negative feelings	3.87 <sup>b</sup> (3.4, 4.3)	0.55 <sup>b</sup> (0.37, 0.73)	-0.21 (-0.98, 0.55)	-0.07 (-0.39, 0.23)	0.07 (-0.44, 0.59)

<sup>a</sup> Baseline covariate centered on grand mean.

<sup>b</sup>  $p < 0.05$ . Values of 95% confidence interval are in the parentheses.

\* Lower scores are more favorable in the shaded rows.

<sup>f</sup> Fasting and random blood glucose via finger stick.

Table 4

Differences in Adjusted Mean between the Intervention and Control Groups\*

2- month post-intervention Outcome variables	Intervention group Mean (SD)	Control group Mean (SD)	Effect size	95% CI effect size	
				Lower	Upper
<b>Primary outcomes<sup>1</sup></b>					
Body weight (lbs)	189.66 (12.24)	192.85 (12.24)	-0.26 <sup>a</sup>	-0.79	0.28
Blood glucose (mg/dl) <sup>#</sup>	91.56 (14.16)	97.46 (14.13)	-0.40 <sup>a</sup>	-0.95	0.13
<b>Secondary outcomes<sup>2</sup></b>					
Fat intake (% of total calories from fat)	31.81 (5.81)	32.12 (5.75)	-0.05 <sup>a</sup>	-0.54	0.44
Fruit and vegetable intake (cups/day)	6.33 (3.42)	4.73 (3.41)	0.46 <sup>a</sup>	-0.03	0.96
Physical activity (MET)	41.09 (29.87)	33.51 (29.34)	0.25 <sup>a</sup>	-0.24	0.74
Perceived stress	2.15 (0.36)	2.23 (0.37)	-0.21	-0.70	0.28
Positive feelings	3.46 (0.62)	3.39 (0.56)	0.11 <sup>a</sup>	-0.37	0.61
Negative feelings	3.71 (0.62)	3.85 (0.63)	-0.22	-0.71	0.27
<b>8-month post-intervention Primary outcomes<sup>3</sup></b>					
Body weight (lbs)	187.79 (12.43)	188.17 (12.22)	-0.03 <sup>a</sup>	-0.73	0.67
Blood glucose (mg/dl) <sup>#</sup>	93.51 (14.16)	89.35 (14.39)	0.28	-0.42	0.98
<b>Secondary outcomes<sup>4</sup></b>					
Fat intake (% of total calories from fat)	34.20 (7.16)	32.34 (7.01)	0.26	-0.34	0.86
Fruit and vegetable intake (cups/day)	3.87 (3.52)	5.56 (3.50)	-0.47	-1.08	0.13
Physical activity (MET)	53.20 (30.24)	36.02 (29.30)	0.57 <sup>a</sup>	-0.04	1.18
Perceived stress	2.75 (0.40)	2.76 (0.39)	-0.02	-0.62	0.58
Positive feelings	3.62 (0.64)	3.45 (0.62)	0.27 <sup>a</sup>	-0.34	0.87
Negative feelings	3.70 (0.64)	3.77 (0.62)	-0.11	-0.71	0.49

\* Adjusted each baseline primary and secondary outcome variable.

<sup>a</sup>Effect in hypothesized direction. Lower scores are more favorable in the shaded rows.

<sup>#</sup>Fasting and non fasting (random) blood glucose via finger stick.

<sup>1</sup>Data collected from 57/129 participants (intervention = 22, control = 35).

<sup>2</sup>Data collected from 70/129 participants (intervention = 28, control = 42).

<sup>3</sup>Data collected from 38/129 participants (intervention = 12, control = 26).

<sup>4</sup>Data collected from 48/129 participants (intervention = 16, control = 32). Reasons for high dropped out are described elsewhere.<sup>36</sup>