An After-School Obesity Prevention Program for African-American Girls: The Minnesota GEMS Pilot Study

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Objective: This paper describes the development of an after-school obesity-prevention program for African-American girls, and presents findings from a 12-week pilot trial conducted by the University of Minnesota. This study was part of the GEMS project, created to test interventions designed to reduce excess weight gain in African-American girls.

Design: Two-arm parallel group, randomized controlled trial. Measures were taken at baseline and at 12 weeks follow up.

Setting: An after-school community program.

Participants: Fifty-four African-American girls, 8- to 10-years of age, and their parents/caregivers.

Intervention: The after-school intervention was conducted twice a week for 12 weeks, and focused on increasing physical activity and healthy eating. A family component was also included. Girls in the control group received a program over 12 weeks unrelated to nutrition and physical activity.

Outcomes: Measures included height and weight (body mass index), percent body fat (DEXA), physical activity, assessed using a CSA accelerometer and self-report, two 24-hour dietary recalls, and psycho-social and demographic variables. Parental data included demographic and psycho-social characteristics, and dietary measures. Additionally, process evaluation data on the intervention were collected.

Results: Recruitment goals were met. After adjustment for baseline level, follow-up BMI did not differ between the treatment groups, an expected finding, given that this was a pilot study. At 12 weeks follow up, differences between the intervention and control groups were in the hypothesized direction of change for most variables, among both the girls and their parents. Process evaluation results demonstrated that the program was well attended, and well received, by girls and parents.

Conclusions: An after-school obesity prevention program for low-income African-American girls is a promising model for future efforts. (*Ethn Dis*. 2003;13[suppl1]:S1-54–S1-64)

Key Words: Obesity, African-American, Primary Prevention, Adolescents, Female, Food Intake, Exercise

Introduction

Obesity and its associated health problems are prevalent among African-American women.[1] According to data from the NHANES III survey (1988–1994), 69% of Black women were overweight or obese (Body Mass Index [BMI]>25), compared to 47% of White women.[1] Similar disparities exist among Black girls. Data from NHANES III show that 17% of African-American girls, aged 6–17 years, are overweight (BMI>95th percentile for age and gender), compared to 11% of White girls of the same age.[2] The high prevalence of obesity in African-American women may be a contributing factor to their higher prevalence rates of cardiovascular disease mortality, type 2 diabetes, and hypertension.[3] Although obesity-associated morbidities occur most frequently in adults, consequences of excess weight, such as type 2 diabetes, are now occurring with greater frequency among obese adolescents.[4] Because of the health risks associated with adult and child obesity, and since overweight children and adolescents are more likely to become overweight or obese adults, the health community has paid greater attention to the need for obesity prevention efforts directed at high-risk population groups, such as African-American girls. Programs to prevent obesity during adolescence are particularly critical, since this is a high-risk period for excessive weight gain.[5,6]

While there is a need for culturally appropriate obesity-prevention programs for African-American girls, few such programs have been developed.[7] Moreover, few obesity-prevention studies in children have been conducted, irrespective of race and ethnicity. Little information is available regarding what types of interventions, delivery channels and settings, and intervention messages would be most effective. Because few prevention-oriented interventions for obesity have been developed or evaluated, developmental research to support pilot projects is required. The Girls health Enrichment Multi-site Studies (GEMS) was a National Heart, Lung, and Blood Institute-sponsored multicenter research program created to develop and test 4 interventions that were designed to prevent excess weight gain in 8- to 10-year-old African-American girls. Each of 4 field centers independently developed and tested their own interventions, but shared common eligibility criteria and key measurements. The purpose of this paper is to describe the development of an after-school intervention program, explain the evaluation measures used, and present findings from the 12-week, randomized controlled pilot trial at the University of Minnesota field center. This information may be useful to others interested in developing and evaluating obesity interventions for children, especially in high-risk populations.

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METHODS

Study Design

Fifty-four participants completed baseline measures, and were then randomized into either an intervention or control group for the 12-week pilot study. Participants were recruited from 3 schools that also served as intervention sites for the program. Details about recruitment procedures are provided in the paper in this supplement by Story et al. Eligibility criteria included the following: 1) being an 8- to 10-year-old African-American girl; 2) having a BMI ≥25th percentile for age and sex[8]; 3) being able to participate in physical education classes at school; 4) girl and having a primary caregiver fluent in English; and 5) not having been held back more than one grade in school. Girls with a medical condition affecting growth, or who were taking a medication affecting growth, were excluded from the study. The study was approved by the Institutional Review Board of the University of Minnesota, and all participants and their parents/caregivers signed informed assent/consent statements. The evaluation of the pilot study was primarily based on intervention process measures and trends in key measurements, including BMI, diet, physical activity, and psycho-social measures. Due to its small sample size and short duration, the pilot study did not have sufficient power to test for between-group differences in changes in either BMI, which would be a primary outcome in a larger scale trial, or in other key outcome measurements.

THE GIRLFRIENDS FOR KEEPS INTERVENTION

Intervention Program

Girls randomized into the intervention group participated in a 12-week after-school program called "Girlfriends for KEEPS," where KEEPS stood for Keys to Eating, Exercising, Playing, and Sharing. Intervention meetings, designed in a "club meeting" format, were held twice a week, for one hour after school, at each of the 3 elementary schools. The intervention also included a family component designed to reinforce and support the healthy eating and physical activity messages delivered in the after-school program. The intervention was based on social cognitive theory,[9] and targeted key constructs from the following 3 domains: 1) environmental factors: peer support, opportunities, and role models; 2) personal factors: knowledge, values, and self-efficacy; and 3) behavioral factors: practice, goal setting, and social reinforcement. A youth development, resiliency based approach was also employed, which acknowledged the importance of building on individual and family strengths.[10] Formative research, comprising qualitative and quantitative methodology, was used to help develop the intervention, and to assess the acceptability of the evaluation measures (see article by Kumanyika et al in this issue).

The physical activity intervention goals were for girls to: 1) increase frequency of participation in sustained, moderate-to-vigorous intensity activities; 2) decrease time spent in sedentary activities; and 3) experience feelings of enjoyment, physical competence, and self confidence, in performing a range of physical activities. The dietary change intervention goals were for girls to: 1) decrease consumption of high-fat foods; 2) increase consumption of fruits and vegetables; 3) decrease consumption of sweetened beverages; and 4) adopt healthy weight-related eating practices (eg, portion-size awareness, eating only when hungry, etc). The goals for the family component were to help familiarize families with the objectives, eating behaviors, and physical activity behaviors central to the intervention, and to help families create an environment that reinforces and supports regular, enjoyable physical activity and healthy eating. This latter goal included increasing the availability of healthy foods in the home, and decreasing physical inactivity.

After-School Program

The intervention was taught by trained African-American GEMS staff. The training focused on the need for, and purpose of, the intervention, and included modeling and active rehearsal of many of the activities. Club meetings consisted of fun, culturally appropriate, interactive, hands-on activities, emphasizing skill building and practice of the particular health behavior message for that week. A healthful snack, sometimes prepared by the girls, and chilled bottled water, was offered at each club meeting. Messages included information about the benefits of drinking water more often than soda pop, increasing the consumption of fruits and vegetables, drinking low-fat milk, selecting low-fat foods for snacks, eating smaller portions of snacks, choosing smaller-sized, and lower-fat, entrees in fast food restaurants, increasing physical activity, watching less television, and enhancing self esteem. An example of selected intervention messages and activities is shown in Table 1.

A major component of the after-school intervention was increasing physical activity levels with a variety and choice of activities, such as dancing (ethnic, hip hop, aerobic), double-dutch jump rope, relay races, active African-American games, tag, and step aerobics. To keep girls' interest and participation, incentives were built into the program for attendance, setting short-term goals, and completing activities. These included attendance beads that made a bracelet when put together at the end of the intervention, water bottles, pedometers, jump ropes, and t-shirts. Transportation home was provided by the schools' regular buses.

Family Involvement

The after-school intervention messages were reinforced by family activities, including weekly family packets

Table 1. Examples of selected intervention messages and club activities

Selected Intervention Messages	Selected Club Activities
Sweetened beverages:	
Drink less soda pop and other sweetened beverages Drink water when you are thirsty	■ Measure amount of sugar in different size containers of soda pop. ■ Drink chilled bottle of water given out after Exercise Break at every club meeting. ■ Act out an active rap that emphasizes drinking water. ■ Set a personal goal to drink more water than soda pop or other sweetened beverage.
Snack foods:	
Choose lower-fat snacks (5 g or less/serving) Determine portion size and try to eat only one serving Choose smaller sized items when eating fast food	■ Play label-reading game to determine serving sizes and amount of fat/serving. ■ Measure amount of fat in different sized servings of snacks and fast food items. ■ Set a goal to choose ''Star Snacks'' (snacks with 5 g or less/serving) rather than higher-fat snacks. ■ Prepare and taste test lower-fat snacks at every club meeting (ie, sliced peaches topped with low-fat granola, pretzels dipped in sweet mustard, low-fat yogurt topped with fruit, raw vegetables dipped in non-fat dressing or salsa, fruit kabobs, cereal with low-fat milk).
Physical activity:	
Do some physical activity every day Have fun doing different physical activities Encourage family members to play active games and do physical activity together Watch less TV	■ Participate in moderate-to-vigorous physical activity (ie, dancing, relay races, jump rope, tag games) ■ Practice favorite physical activities and learn new ones (ie, double-dutch jump rope, hula hoops, African-American active games). ■ Brainstorm activities that are fun to do instead of watching TV. ■ Demonstrate active games that are alternatives to watching TV. ■ Set a personal goal to watch less TV and try to get family to participate in an active game or activity together instead of watching TV. ■ Receive a jump rope, hula hoop, and pedometer to encourage and chart daily physical activity.

sent home to the parents; family night events; phone calls by GEMS staff to parents, to encourage them, and to check their progress on their family goals they set; and organized neighborhood walks. Each week, girls took home packets for their parents ("take home packs"), which contained user-friendly materials, including practical suggestions about each week's healthful eating and exercise topic formatted on a refrigerator magnet, a "Fridge Facts" card, and colorful tip sheets. Every other week the family packet also included family-sized packets of ingredients for the low-fat snack prepared by the girls during that day's club meeting (eg, baby carrots and non-fat ranch dressing, or canned peaches with low-fat granola topping). The girls were encouraged to make the snack for family members.

Two family nights were held during the 2nd and 9th weeks of the intervention. Families participated in interactive booths, performing such tasks as measuring out the sugar in soda pop, determining the amount of fat in whole milk, compared with low-fat milk, label reading, and lower-fat cooking techniques. Family members participated in active games, danced, and had jump rope contests. A tasty, low-fat meal was served. An integral part of both family nights was a family goal-setting activity. At the conclusion of each night's activities, parents were asked to choose one nutrition, and one physical activity goal that their family would try to achieve during the next few weeks. The nutrition goals included drinking more water instead of soda pop, eating more fruit, eating more vegetables, and drinking 1% or skim milk, instead of 2% or whole milk. The physical activity choices were watching less TV and getting more physical activity. The families were given practical tip sheets to help them reach the goals they set. Additionally, during the first family night, families were told that GEMS staff members would call them within 2 weeks to check their progress toward achieving their goals. Families of club members who did not attend the family nights were sent a "we missed you" card, a packet of handouts given out at the event, a goal form, and a set of tip sheets.

Within 2 weeks of the first family night, families received a motivational phone call from a trained GEMS staff member, to check their progress on the goals they set, to encourage continued efforts toward achieving their goals, and to assist them with any barriers they may have encountered. Principles and techniques from motivational interviewing were used.[11,12] Families who reported that they were making good progress toward their goals were encouraged to set a second nutrition goal and activity goal. All of the families were sent a personally tailored letter during Week 7, referring to their specific goals, and providing encouragement for behavior change.

During both family night events, families were invited to sign up for a Saturday walk ("health hike") in their neighborhood park led by a GEMS staff member. Chilled bottles of water and a low-fat snack were given to all participants, as well as participation incentives, such as stickers for the children and T-shirts for adult family members.

Control Group Program

We found during our formative assessment that a traditional, no-treat-

ment control group would be unacceptable to the parents and the community. The GEMS Club served as an "active placebo," non-nutrition/physical activity condition, and focused on promoting positive self-esteem and cultural enrichment. Participants attended monthly Saturday morning meetings (3 meetings during the 12-week period), which included arts and crafts, self-esteem activities, creating memory books, and a workshop on African percussion instruments. Transportation was provided to girls who needed it.

MEASURES

All measures were administered at the baseline, and again at 12-week follow-up visits, with the exception of percent body fat, sexual maturation, and blood samples, which were measured at baseline only. Baseline clinic visits took place during an 8-week window prior to the start of the 12-week intervention period. Follow-up visits took place within a 2-week period following completion of the 12-week intervention period. There were no significant differences between the treatment and control groups in the mean number of days between baseline and follow-up measures (intervention group=115.3 days [SD=20]; control group=119 days [SD=18], P=.49). Retention among the 54 girls who participated in the study was high (98%). Only one girl did not return for the 12-week follow-up visit.

Obesity and Physical Measures

Weight, height, and waist circumference were measured, according to the GEMS study protocol. Body mass index (BMI; kg/m^2) was computed. Parental height and weight were also measured. Percent body fat was estimated using Dual-X-Ray Absorptiometry (DEXA, Lunar model). Sexual maturation was assessed through direct observation of breast and pubic hair development by centrally trained female staff, using 5 standard stages of pubertal development.[13] During the clinic visit, an overnight fasting blood sample was drawn from girls according to a standardized GEMS protocol, and sent to the University of Minnesota centralized lab for analysis of insulin, glucose, and lipid levels.

Physical Activity

The Computer Science Application (CSA) accelerometer was used to measure physical activity in girls (Computer Science Applications, Inc, Shalimar, Fla). The CSA monitor has been demonstrated to be a reliable and valid measure of activity level in children.[14,15] At the baseline and follow-up measurement visits, girls put on the CSA monitor and were instructed to wear it continuously for 3 days, including during sleep, except while showering or swimming. Girls were asked to record on a log any time in which the CSA monitor was taken off. The CSA monitor was attached to a belt and worn above the hip. After 3 complete days, CSA monitors and logs were collected from the girls at their schools. Measures used for the outcome analyses included average total CSA counts per minute between 6 AM–12 midnight, and minutes of moderate-to-vigorous physical activity from 12 noon–6 PM, the most active time of the day for the girls.

The GEMS Activity Questionnaire (GAQ), developed by the GEMS research group, was used as a self-reported measure of physical activity.[16] The GAQ is a modification of the Self-Administered Physical Activity Checklist (SAPAC), and evaluates both previous-day and usual activities.[17] The GAQ includes a checklist of 28 activities typically performed by African-American girls, along with pictures of the activities (eg, bicycling, climbing on playground equipment, playing basketball, performing indoor chores). For each activity, girls checked off whether they had engaged in that activity yesterday, the duration of the activity ("none," "less than 15 minutes," or "15 minutes or more"), whether they "usually" engage in the activity, and the frequency of engagement ("none," "a little," or "a lot"). The GAQ, Met-Adjusted Usually Score was used for these analyses.[16]

Dietary Intake. We collected two 24-hour recalls (the first one face-to-face, the second by telephone) on non-consecutive days (one weekday and one weekend day, when possible) from each girl, both at baseline and at follow up. Parents assisted the girls' dietary recalls to improve validity. Dietary intake was collected and analyzed using the University of Minnesota Nutrition Data System for Research (NDS-R, 4.02–30). Detailed quality assurance reviews were performed at the University of Minnesota. Primary macro-nutrient variables of interest were: total energy intake (kcal/day), and percent of energy derived from fat. The number of servings per day of fruit, juice, vegetables, water, and sweetened beverages, were also calculated.

Demographic Characteristics

Demographic characteristics included the age and race of girls and parents, parent education, total household income, household composition, and home ownership.

PSYCHOSOCIAL VARIABLES: GIRLS

Dietary

Healthy Choice Behavioral Intentions. A 12-item measure assessing behavioral intentions for choosing healthy food items was included.[18] Participants were asked, "If you had your choice, which would you pick? . . ." and then asked to choose between 2 food options, one healthy, and one less healthy (α=.42). *Self-Efficacy for Healthy Eating.* A 9-item (α=.61) self-efficacy measure was developed. Participants were asked, "How hard would it be for you to . . ." eat more of particular foods and less of oth-

er foods (eg, eat fruit for an after school snack, rather than an order of french fries). *Diet Knowledge.* A 6-item measure assessing diet knowledge was included.[18] *Fruit and Vegetable Snack Accessibility.* A 2-item measure (α=.48) assessed fruit and vegetable snack accessibility in the home. *Parent Encouragement for Healthy Eating.* A 5-item measure (α=.69) assessed parental encouragement for healthy eating.

Physical Activity

Physical Activity Self-Concept. The athletic competence sub-scale from the Self-Perception Profile for Children was modified to assess physical performance self-concept.[19] The 9-item scale (α=.70) included paired responses for each item (eg, "I do very well at all kinds of sports" vs "I don't do very well at all kinds of sports"), and participants chose the item that best describes them. *Physical Activity Preference.* A 37-item physical activity preference measure was used with 4 response options for specific activities: 1) "I've never done it"; 2) "Don't like it"; 3) "Like it a little"; or 4) "Like it a lot." Physical activity preference (α=.86) scores, and sedentary activity preference (α=.60) scores were computed. *Physical Activity Outcome Expectancies.* This 17-item measure was modified from an existing measure (W. Taylor, unpublished data). A score for positive expectancies for physical activity (α=.72) was computed. *Self-Efficacy for Physical Activity.* A 9-item measure of self-efficacy for physical activity (α=.71) was developed. Items included, "How hard do you think it would be to be physically active instead of watching television?" *Physical Activity Home Environment.* A 5-item (α=.90) measure was developed to assess home environmental factors related to physical activity. A sample is: "It is safe to play outside near where I live": 1) Almost never; 2) Sometimes; or 3) Almost always.

Body Image/Weight Concern

Body Satisfaction. Line drawings, similar to those developed by Stunkard et al,[20] were adapted, and illustrated 8 body sizes, ranging from very thin to very heavy. Participants were asked, "Which picture looks the most like you?" and "Which picture shows the way you would like to look?" A body size satisfaction/discrepancy score was computed for each girl. *Weight Control Behaviors.* The elementary school version of the McKnight Risk Factor Survey (MRFS)[21] was used to assess moderate weight control behaviors (α=.77) (eg, exercising), and unhealthy weight control behaviors (α=.67).

PSYCHOSOCIAL VARIABLES: PARENTS

Dietary

Availability of Lower-Fat and Higher-Fat Foods. Primary caregivers were asked about the home availability of regular, low-fat, and fat-free versions of 29 food items, and 2 sub-scales were computed: Lower-Fat Alternatives (α=.68), and Higher-Fat Foods (α=.65). *Low-fat Food Practices.* A 25-item questionnaire adapted from Kristal's Food Habit Behavior Scale[22] was used to assess the frequency of preparing and serving lower-fat foods at home. *Motivation for Healthy Eating.* A 5-item scale to assess motivation for healthy eating (α=.75) was developed. Sample item: "How interested are you in drinking less regular soda pop?" *Self-Efficacy for Healthy Food Preparation.* A 10-item scale was developed to measure self-efficacy for healthy food preparation (α=.80). Sample item: "How hard would it be for you to have fresh fruit on the kitchen counter, or somewhere your daughter could easily see it?" *Food Availability.* A 31-item measure, designed to assess availability of foods and beverages in the home during the past week, was developed for this study. Sub-scales included a vegetable availability scale (α=.73), a fruit availability scale (α=.53), and a sweetened beverage availability scale (α=.20). *Parental Dietary Intake.* The National Cancer Institute (NCI) fat screener was used to estimate percentage of parental energy intake derived from fat,[23,24] and the NCI fruit and vegetable screener was used to estimate intakes of both fruit and vegetables.[25,26]

Physical Activity

Motivation for Physical Activity. A 2-item scale measured motivation for physical activity (α=.70). Parents were asked to rate their level of interest in spending more time being physically active, in general, and with their daughters, in particular. *Self-Efficacy for Physical Activity with Daughter.* A 5-item measure assessing parental self-efficacy for physical activity with their daughters (α=.83) was developed. Sample item: "How hard would it be for you to get your daughter to be physically active instead of watching TV?" *Parental Support of Daughters' Activity Levels.* A 6-item measure assessing parental support of daughters' activity levels (α=.69) was developed. Sample item: "I try to get my daughter to play outside when the weather is nice." *TV Watching.* Four items assessed parental report of daughter TV watching on weekdays and weekends (α=.80).

Process Evaluation

Process evaluation monitors implementation of the intervention, helps explain the outcomes, and provides meaningful data to help refine the intervention. Several process evaluation measures were collected. Intervention staff completed checklists after every session, documenting attendance, whether the activity was completed, and level of participation. Each session was also observed by a project staff person. Attendance at the family events was documented, and parents completed evaluation forms. Post-intervention evaluation surveys were administered to parents and girls, and focus groups were conducted with parents in the intervention and control groups.

Table 2. Description of characteristics of girls at baseline by treatment group

	Overall (*N*=54)	Intervention (*N*=26)	Control (*N*=28)	*P* Value
Girl age (yr), mean (SD)	9.3 (0.9)	9.4 (0.9)	9.1 (0.8)	.18
% Biracial	13.0	11.5	14.3	.76
Height (cm), mean (SD)	138.4 (8.2)	140.3 (9.0)	136.5 (7.1)	.08
Weight (kg), mean (SD)	40.3 (13.3)	44.2 (16.3)	36.7 (8.8)	.04
Waist circumference (cm), mean (SD)	68.7 (12.5)	72.0 (14.4)	65.7 (9.8)	.11
BMI (kg/m^2), mean (SD)	20.7 (4.9)	21.9 (5.9)	19.5 (3.3)	.20
BMI percentile (%)				.63
BMI <85th percentile	40.7	34.6	46.4	
BMI >85th <95th percentile	29.6	30.8	28.6	
BMI ≥95th percentile	29.7	34.6	25.0	
% Body fat, mean (SD)	30.8 (11.0)	32.7 (12.7)	29.1 (9.1)	.36
% Pubertal (≥stage 2 breast or pubic hair)	79.2	80.0	78.6	.99
% With TV in bedroom	79.6	73.1	85.7	.32
Blood values*				
Total cholesterol mg/dL, mean (SD)	168.5 (24.4)	170.7 (30.2)	166.8 (19.3)	.65
% High cholesterol (≥200 mg/dL)	8.8	20.0	0.0	.04
% High LDL-cholesterol (≥130 mg/dL)	11.8	20.0	5.3	.18
Fasting insulin (μU/mL)	11.5 (9.4)	11.7 (5.8)	11.3 (11.7)	.92

* Fasting blood was measured in 34 girls, 15 interventions, and 19 control girls.

Data Analysis

Analysis methods are described in the article entitled *Common Elements of GEMS*, by Rochon et al. Briefly, statistical comparisons were performed to compare treatment group differences at baseline for demographic characteristics and outcome variables. For binary and ordinal variables, standard techniques for categorical data were applied. For continuous variables, the Wilcoxon-Mann-Whitney test was performed for 2-group comparisons. For continuous variables at 12 weeks follow up, analysis of covariance (ANCOVA) was primarily used to assess between-group differences in the primary and secondary outcomes. The baseline value of the outcome was entered as a covariate. Because the "servings" variables (eg, the number of servings of sweetened beverages) represented a "count" measure, Poisson regression models were used for these variables. Given the small sample size of this pilot study, tests of statistical significance were used as guides for interpretation, rather than as definitive inferential tests.

Table 3. Description of baseline characteristics of parent/caregiver by treatment group

	Overall (*N*=54)	Intervention (*N*=26)	Control (*N*=28)	*P* Value
Age (yr), mean (SD)	36.8 (7.6)	39.0 (8.3)	34.7 (6.2)	.08
Race/ethnicity (%)				
African-American	83.0	76.0	89.3	.43
Biracial	5.6	8.0	3.6	
Caucasian only	11.4	16.0	7.1	
Education (%)				.33
High school graduate or less	35.3	45.8	25.9	
Tech school/some college	45.1	37.5	51.8	
College grad/post grad	19.6	16.7	22.3	
Total household income (%)				.15
<$20,000	25.0	20.0	29.6	
$20,000–$39,999	46.2	60.0	33.3	
≥$40,000	28.8	20.0	37.1	
Female-headed household (%)	44.4	42.3	46.4	.79
Home ownership (%)	40.7	38.5	42.9	.78
BMI (kg/m^2), mean (SD)	32.8 (7.4)	33.5 (7.3)	32.2 (7.6)	.41
Overweight (BMI 25–29.9) (kg/m^2) (%)	32.7	32.0	33.3	.99
Obese (BMI ≥30) (kg/m^2) (%)	59.6	60.0	59.3	.99

Results

Table 2 shows girls' baseline characteristics by treatment group. The average age of the girls was approximately 9 years. About 80% of girls were pubertal (≥stage 2 breast or pubic hair development); however, all were pre-menarcheal at baseline. The mean BMI of the girls was 20.7 kg/m^2, with mean percent body fat of 31%.

Parental baseline demographic data are shown in Table 3. Approximately 83% of parents were African-American only, 6% were biracial, and 11% were Caucasian. The majority of households were low-income, with 54% of parents reporting incomes of less than $30,000 per year. Approximately 44% of homes were female-headed households. The average BMI for parents was 32.8 kg/m^2. The majority (92%) of parents were overweight (BMI≥25–29.9) or obese (BMI≥30). There were no between-group differences for parental baseline variables.

Table 4 presents differences between treatment and control groups at the 12-week follow-up visit. After adjustment for baseline level, BMI did not differ between the treatment groups; however, there was a trend for waist circumference to be 1.4 cm higher in the intervention, compared to the control, group (*P*=.08). Physical activity measures demonstrated consistently greater activity levels in the intervention, compared

Table 4. Mean (SE) outcome measures at 12-weeks adjusted for baseline values and between-group adjusted mean differences

	Intervention (*N*=26) Mean (SE)	Control (*N*=27) Mean (SE)	Adjusted Mean Difference*	*P* Value
Physical measures				
Body mass index (kg/m²)	21.7 (0.2)	21.5 (0.2)	0.2 (0.2)	.35
Waist circumference (cm)	72.0 (0.5)	70.7 (0.5)	1.4 (0.8)	.08
Physical activity				
CSA count/min	503.7 (26.9)	446.2 (24.6)	57.4 (36.5)	.12
Minutes Mod-Vig PA (12 PM–6 PM)	119.0 (10.1)	116.1 (9.2)	2.9 (13.7)	.83
GAQ, met-adjusted usually score	4.6 (0.3)	4.3 (0.3)	0.3 (0.5)	.53
Dietary intake†				
FJ & V servings/day‡	1.5 (0.2)	1.8 (0.2)	−0.4 (0.1)	.31
Sweetened beverage servings/day‡	1.1 (0.2)	0.9 (0.1)	0.6 (0.1)	.68
Water servings/day	0.7 (0.1)	0.6 (0.1)	0.6 (0.1)	.61
Total energy intake (kcal)	1225.0 (70.0)	1369.0 (68.7)	−124.0 (98.1)	21
% calories from fat	31.0 (1.2)	32.1 (1.1)	−1.1 (1.7)	.52
Diet psychosocial variables				
Healthy choice behavioral intentions	9.1 (0.5)	6.3 (0.4)	2.8 (0.6)	.001
Self-efficacy for healthy eating	1.5 (0.1)	1.5 (0.1)	−0.1 (0.1)	.44
Diet knowledge	5.0 (0.2)	3.5 (0.2)	1.5 (0.3)	.001
F&V snack availability	2.0 (0.1)	2.1 (0.1)	−0.1 (0.1)	.31
Parent encouragement for healthy eating	2.4 (0.1)	2.1 (0.1)	0.3 (0.1)	.06
Physical activity (PA) psychosocial variables				
PA self-concept	1.3 (0.0)	1.3 (0.0)	−0.0 (0.1)	.67
PA preference	2.4 (0.1)	2.3 (0.1)	0.2 (0.1)	.04
Sedentary activity preference	2.7 (0.1)	2.7 (0.1)	−0.0 (0.1)	.65
Positive expectancy for PA	1.4 (0.1)	1.5 (0.1)	−0.1 (0.1)	.20
Self-efficacy for PA	1.5 (0.1)	1.7 (0.1)	−0.2 (0.1)	.10
PA home environment	2.2 (0.1)	2.3 (0.1)	−0.1 (0.1)	.27
Body image/weight concern				
Silhouettes—look like you	4.2 (0.2)	4.0 (0.2)	0.1 (0.3)	.60
Silhouettes—like to look	3.3 (0.2)	2.5 (0.2)	0.8 (0.3)	.01
Silhouette difference (current–ideal)	0.9 (0.3)	1.6 (0.3)	−0.7 (0.4)	.08
Weight concern—moderate behaviors	2.2 (0.1)	1.8 (0.2)	0.4 (0.1)	.004
Weight concern—unhealthy behaviors	1.7 (0.1)	1.4 (0.1)	0.3 (0.1)	.04
Tried to lose weight (% sometimes or ''a lot'')	78.9 (7.8)	63.3 (7.8)	15.6 (11.1)	.16
Parent-reported diet variables				
Availability of higher-fat foods	0.4 (0.0)	0.5 (0.0)	−0.1 (0.0)	.001
Availability of lower-fat foods	0.2 (0.0)	0.2 (0.0)	0.1 (0.0)	.07
Low-fat food practices	2.2 (0.1)	2.0 (0.1)	0.2 (0.1)	.01
Motivation for healthy eating	3.6 (0.1)	3.4 (0.1)	0.1 (0.2)	.40
Self-efficacy for healthy food preparation	1.7 (0.1)	2.0 (0.1)	−0.2 (0.1)	.05
Sweetened beverage availability	2.9 (0.2)	3.4 (0.2)	−0.5 (0.3)	.12
Vegetable availability	7.4 (0.4)	6.9 (0.4)	0.5 (0.6)	.38
Fruit availability	6.3 (0.4)	6.0 (0.4)	0.3 (0.5)	.58
Bottled water availability (%)	81.3 (7.8)	75.2 (7.2)	6.1 (0.1)	.57
% energy from fat	32.0 (1.1)	35.4 (0.9)	−3.4 (1.5)	.03
Fruit intake	3.8 (0.9)	3.5 (0.8)	0.3 (1.2)	.78
Vegetable intake	1.4 (0.2)	1.9 (0.2)	0.5 (0.4)	.18
Parent-reported activity variables				
Motivation for PA	3.8 (0.1)	3.6 (0.1)	0.2 (0.1)	.16
Self-efficacy for PA with daughter	3.5 (0.1)	3.5 (0.1)	0.0 (0.1)	.82
Parent support of daughter's activity level	2.8 (0.1)	2.9 (0.1)	−0.1 (0.2)	.65
Daughter TV watching	2.8 (0.1)	2.9 (0.1)	−0.2 (0.2)	.42

* Intervention minus control group difference at 12-week follow-up, adjusted for baseline value (except for FJ & V, sweetened beverages, and water).
† Dietary intake variables are averaged across the 2 diet recalls.
‡ Means and standard errors are predicted by the Poisson Regression Model, adjusted mean differences are ratios.

to the control, group; CSA counts per minute, minutes of moderate to vigorous physical activity between 12 PM and 6 PM, and self-report of usual physical activity, all increased more among girls in the intervention group, compared to girls in the control group, although none of these differences reached statistical significance. A less consistent pattern emerged for diet. Intervention group girls had lower caloric intake, lower percent of calories derived from fat, and more servings of water/day, compared to control group girls; however, fruit and vegetable servings/day were lower, and servings of sweetened beverages/day were higher, for intervention group, compared to control group, girls. As with BMI and physical activity measurements, none of these differences were significant.

Girls in the intervention group reported significantly higher scores on the healthy choice behavioral intentions (P=.001), diet knowledge (P=.001), and on preferences for physical activity (P=.04) at follow up, compared to girls in the control group. At follow up, girls in the intervention group were more likely to report a preference for a larger body size (P=.01), and were more likely to report engaging in both moderate (P=.004), and unhealthy, behaviors related to weight concern (P=.04), compared to girls in the control group. No between-group differences in the prevalence of dieting were observed.

At 12-weeks follow up, parents of girls in the intervention group reported significantly less availability of higher-fat foods (P=.001), more low-fat food practices (P=.009), and lower energy intake from fat in their own diets (P=.03), compared to parents of girls in the control group. No significant between-group differences were observed for the other parent-reported diet and activity measures, although 12-week follow-up measures generally changed in the direction expected for the intervention group parents.

Table 5. Process evaluation data for intervention group (N=26 participants)

Attendance	
Girl friends for KEEPS sessions, mean (SD)	21.0 (3.4)
Family night #1, girls (%)	79
Family night #1, parents (%)	79
Family night #2, girls (%)	83
Family night #2, parents (%)	72
Attended ≥1 night, girls (%)	95
Attended ≥1 night, parents (%)	88
Girl satisfaction ratings (% ''a lot'')	
How much did you like . . .	
Club meetings	92
Snacks	76
Activities	84
Physical activity	92
Family nights	92
Parent satisfaction ratings (% ''a lot'')	
Take home family packs	83
Family nights	83
Setting family goals	71
Encouragement phone calls	71
Encouragement letter	58
Overall satisfaction with GEMS	96
Perception of daughter's satisfaction	88
Would recommend GEMS to other parents	100

Process Evaluation

Examination of the process evaluation data demonstrated that, on average, girls attended 21 of the 24 Girl friends for KEEPS sessions (Table 5). Almost all girls (92%) reported liking the afterschool program (ie, the club meetings) "a lot." Family nights were well attended, with 88% of the parents and 95% of the girls attending at least one family night. Over 80% of the parents, and 90% of the girls, enjoyed the family nights, with about half the parents reporting that the family nights helped "a lot" in making changes in eating or activity for their family. Motivational telephone calls were completed for 86% of parents, and 38% said the calls helped them "a lot" in making changes in eating or activity. Over 80% of the parents indicated that they had bought some of the low-fat snack foods sent home with the girls. The organized neighborhood health hikes were not well attended, which may have been partially due to inclement weather conditions. Out of 6 scheduled walks (2 per school), only a total of 2 families attended. Overall satisfaction with the program was high, with the majority of parents reporting that both they and their daughters were very satisfied with GEMS. All parents reported that they would recommend GEMS to other parents.

The Saturday GEMS Club meetings for girls in the control group were also well attended. On average, girls attended 2 of the 3 sessions, with almost two thirds (64%) attending all 3 sessions. The majority (85%) of the girls reported that they liked the club meetings "a lot." Over three fourths (78%) of the parents in the control group reported that they were satisfied with GEMS, and almost all (96%) said they would recommend GEMS to other parents. Of interest, 70% of the girls, and 78% of the parents, said they would like the GEMS Club meetings to occur weekly, rather than monthly.

DISCUSSION

The Minnesota GEMS project was a feasibility study, focused on develop-

ing and implementing culturally appropriate intervention activities, and testing measures designed to assess program impact and process evaluation. We were also interested in assessing whether an after-school program would be a feasible and acceptable venue for intervention delivery, and whether there would be support for the program from the girls, parents, and community. Phase 1 of GEMS was devoted to designing and testing intervention activities, and developing and pilot-testing the measurement instruments for conducting a full-scale study. Since the pilot study had a relatively short intervention period of 12 weeks, and included only 54 girls, it lacked sufficient power to detect statistically significant differences. Therefore, no between-group differences were observed for BMI, and only a few significant findings for other variables were observed. Nevertheless, for a majority of the variables, differences between the intervention and control group girls were in the hypothesized direction. For example, compared to the control group, girls in the intervention group increased their physical activity level, and improved their behavioral intentions for healthy eating, nutrition knowledge, and physical activity preferences. In addition, parents of girls in the intervention group reported making positive changes in lower-fat food practices and preparation, and reported consuming a lower percent of calories from fat. The effects of the pilot intervention on parents' healthy choice intentions, diet knowledge, provision of food alternatives, and low-fat food practices, were promising. Although results were not definitive, we were encouraged that shifts over the 12-week period in physical activity, total energy intake, and percentage of calories derived from fat, were in the hypothesized direction, and believe this indicates the potential efficacy of a longer intervention.

Surprisingly, follow-up results showed a trend toward higher mean waist circumferences among intervention group girls, compared to control group girls, with an adjusted mean difference of 1.4 cm between groups. A likely explanation for this finding is that the intervention group included 3 of the heaviest girls in the study. These girls had higher weights and waist circumferences at baseline, and also gained weight faster during the study. For example, the mean waist circumference increase between baseline and follow up in these 3 girls was 8.0 cm, while being only 2.7 cm for the other 22 intervention group girls.

Intervention group girls were more likely to report both moderate, and less healthy, weight concern behaviors at 12-week follow up. While the moderate behavior scale included items about modifying food intake and activity level that were intervention targets, the unhealthy behavior scale included items about skipping meals and fasting. Intervention messages focused on promoting healthy eating and physical activity, rather than on losing weight or dieting; however, care must be taken to ensure that obesity prevention programs do not inadvertently lead to the development of excessive concern with weight and shape, or cause unhealthy weight control behaviors.

Because this study was developmental in nature, particular attention was placed on process evaluation. Only a few studies have tested obesity prevention efforts in children.[27–34] Few non-school-based obesity prevention studies have been conducted. Challenges to non-school-based programs include maintaining attendance, keeping the program fun and the participants engaged, and providing transportation. Our enrollment and participation rates, as well as rates of satisfaction with the program among both girls and parents, were encouraging. Girls in the intervention group attended a mean of 21 of 24 sessions. Both parents and girls rated the program highly, and 100% of the parents said they would recommend the GEMS program to other parents. Focus group interviews conducted with parents of control group girls indicated that most of these parents wished the program had been longer than 3 sessions, and that their children had received more health-oriented information. We found in our formative assessment research that a no-treatment control group would be unacceptable to parents and the community. Therefore, we offered control-group programming that was less intense, and focused on self-esteem building and cultural enrichment through arts and music. An "active placebo" control group was absolutely necessary to conducting this study, and while its inclusion added to study costs and personnel time, it helped develop stronger community ties.

We found that a community after-school intervention program targeted toward African-American girls at high risk for obesity was well received, and offers a promising model for health behavior interventions. Most obesity prevention programs have been conducted during the school day.[35] The school environment confers many advantages, including the reduction of barriers of cost and transportation, and providing access to a large, already assembled population. Nevertheless, schools have become increasingly focused on meeting educational and academic standards, and allowing sufficient time for health promotion efforts is difficult. Schools are also limited in their ability to address culturally unique needs, because they often serve children from different ethnic groups. Community-based settings represent an untapped resource, and offer potential for interventions to help youth acquire, maintain, or increase positive health behaviors related to eating and physical activity. After-school hours constitute a substantial amount of time each week, and often students do not have opportunities to spend this time constructively, particularly those living in impoverished neighborhoods. Community programs can also be tailored to respond to the diverse needs

and values of different ethnic and racial groups. The schools and neighborhoods in which we delivered our GEMS pilot program were ethnically diverse. In focus groups, many GEMS parents told us that they were attracted to the program because it was culturally specific, and targeted only African-American girls.

Parental participation and involvement is critical in obesity prevention efforts in children. The powerful influence of the relationship between the parent/caregiver and the child offers the parent opportunities to model health behaviors, to create an environment conducive to active or sedentary lifestyles, to choose and prepare food, and to encourage and reinforce positive eating and physical activity patterns, all of which suggest that parents must be involved in behavior change efforts. However, little is known regarding the best ways to involve families in promoting change in school or community-based health interventions.[36] Parental attendance at intervention events has generally been low; in some studies, fewer than 25% of participants attended.[37] We had high parental participation for the 2 family events, with 79% and 72% of the parents attending the first and second event, respectively. The majority (83%) of the parents who attended, reported they enjoyed the family nights, and approximately half said the family nights helped their family make changes in eating and physical activity. Parental participation was high because the girls were excited about the events, and wanted their parents to attend. All family members were invited, and dinner was provided. Door prizes and family photographs were also offered as incentives. Since there were only 2 events, it is not clear whether this level of participation would have been maintained with more events over a longer intervention period. In most intervention studies, it is difficult to sustain active family involvement at outside events.[37,38] Because of this, some studies have used a home-based approach, mailing or sending materials home; however, these are lower intensity strategies, and may not be sufficient to produce behavior change.[39]

The family goal setting and follow-up encouragement telephone calls were highly rated by parents, with almost three fourths of the parents reporting that they felt these activities to be worthwhile. These techniques show promise, and should be explored in future studies. Resnicow et al[40] recently used telephone counseling, based on motivational interviewing, in a church-based intervention designed to increase fruit and vegetable consumption in African-American adults. Change in fruit and vegetable intake was significantly greater in the motivational interviewing group than in the comparison or self-help groups.

Given the increasing prevalence of obesity in children, particularly among African-American, Hispanic, and American Indian youth, the prevention of overweight and obesity is an important public health goal.[2] We found that a community-based, after-school program built around being physically active through fun and engaging activities, and emphasizing behavioral skills for healthy eating and activity, had high acceptability and participation among girls and parents. The feedback from girls and parents indicated that they liked having a culturally exclusive program. While we demonstrated the feasibility of implementing an obesity prevention program for low-income African-American girls in inner-city neighborhoods, our pilot intervention was only 3 months long. In addition, while parental participation in the family events was high, this study included only 2 scheduled family events, and one telephone counseling call. The biggest challenge would be to sustain this level of enthusiasm and participation among both girls and parents, since effecting change in diet and activity behavior, and, ultimately, reducing weight gain, will require a longer period of time. Important directions for future research efforts will be to develop strategies for creating supportive environments and social support systems designed to promote healthy eating and activity patterns, and to identify the most effective obesity prevention strategies for specific populations.

ACKNOWLEDGMENTS

This work was supported by the National Heart, Lung, and Blood Institute, National Institutes of Health Cooperative agreement UO1 HL62668-02.

REFERENCES

1. US Department of Health and Human Services. *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity.* Rockville, Md: US Dept of Health and Human Services, Public Health Service, Office of the Surgeon General; 2001.
2. Crawford PB, Story M, Wang MC, Ritchie LD, Sabry ZI. Ethnic issues in the epidemiology of childhood obesity. *Pediatr Clin North Am.* Aug 2001;48(4):855–878.
3. Fingerhut LA, Warner M. *Injury Chartbook. Health, United States, 1996–1997.* Hyattsville, Md: National Center for Health Statistics; 1997.
4. Fagot-Campagna A, Pettitt DJ, Engelgau MM, et al. Type 2 diabetes among North American children and adolescents: an epidemiologic review and a public health perspective. *J Pediatr.* 2000;136(5):664–672.
5. Dietz WH. Critical periods in childhood for the development of obesity. *Am J Clin Nutr.* May 1994;59(5):955–959.
6. Malina RM, Bouchard C. *Growth, Maturation, and Physical Activity.* Champaign, Ill: Human Kinetics Books; 1991.
7. Baskin ML, Ahluwalia HK, Resnicow K. Obesity intervention among African-American children and adolescents. *Pediatr Clin North Am.* Aug 2001;48(4):1027–1039.
8. Kuczmarski RJ, Ogden CL, Guo SS, et al. 2000 CDC Growth Charts for the United States: methods and development. *Vital Health Stat 11.* May 2002;246:1–190.
9. Bandura A. *Social Foundations of Thought and Action: A Social Cognitive Theory.* Englewood Cliffs, NJ: Prentice-Hall; 1986.
10. Blum RW. Healthy youth development as a model for youth health promotion. A review. *J Adolesc Health.* 1998;22(5):368–375.
11. Miller WR, Rollnick S. *Motivational Interviewing: Preparing People to Change Addictive Behavior.* New York, NY: Guilford Press; 1991.
12. Miller WR. Motivational interviewing: research, practice, and puzzles. *Addict Behav.* Nov–Dec 1996;21(6):835–842.

13. Tanner J. *Growth at Adolescence.* 2nd ed. Oxford, England: Blackwell Scientific Publications; 1962.
14. Trost SG, Ward DS, Moorehead SM, Watson PD, Riner W, Burke JR. Validity of the computer science and applications (CSA) activity monitor in children. *Med Sci Sports Exerc.* Apr 1998;30(4):629–633.
15. Janz KF. Validation of the CSA accelerometer for assessing children's physical activity. *Med Sci Sports Exerc.* 1994;26(3):369–375.
16. Treuth MS, Sherwood NE, Jacobs DR Jr, et al. Physical activity measures for the pilot interventions for the Girls Health Enrichment Multi-site Studies (GEMS). *Prev Med.* In press.
17. Sallis JF, Strikmiller PK, Harsha DW, et al. Validation of interviewer- and self-administered physical activity checklists for fifth grade students. *Med Sci Sports Exerc.* Jul 1996; 28(7):840–851.
18. Stevens J, Cornell CE, Story M, et al. Development of a questionnaire to assess knowledge, attitudes, and behaviors in American Indian children. *Am J Clin Nutr.* 1999; 69(suppl 4):773S–781S.
19. Harter S. The perceived competence scale for children. *Child Dev.* 1982;53:87–97.
20. Stunkard A, Sorenson T, Schulsinger F. Use of the Danish Adoption Register for the study of obesity and thinness. In: Kety S, Rowland L, Sidman R, Matthysse S, eds. *Genetics of Neurological and Psychiatric Disorders.* New York, NY: Raven Press; 1983.
21. Shisslak CM, Renger R, Sharpe T, et al. Development and evaluation of the McKnight Risk Factor Survey for assessing potential risk and protective factors for disordered eating in preadolescent and adolescent girls. *Int J Eat Disord.* March 1999;25(2):195–214.
22. Kristal AR, Shattuck AL, Henry HJ, Fowler AS. Rapid assessment of dietary intake of fat, fiber, and saturated fat: validity of an instrument suitable for community intervention research and nutritional surveillance. *Am J Health Promot.* 1990;4:288–295.
23. Thompson FE, Kipnis V, Subar AF, et al. *Performance of a Short Instrument to Estimate Usual Dietary Intake of Percent Calories from Fat.* Bethesda, Md: National Cancer Institute, Information Management Services, Inc; 1998.
24. National Cancer Institute. Fat Screener. Available at: http://www.riskfactor.cancer.gov/diet/screeners/fat/.
25. Thompson FE, Subar AF, Radimer K, et al. *Performance of Two Cognitively Enhanced Fruit and Vegetable Short Assessment Forms.* Cleveland, Ohio: National Cancer Institute, Cleveland State University; September 2000.
26. National Cancer Institute. Fruit and Vegetable Screener. Available at: http://www.riskfactor.cancer.gov/diet/screeners/fruitveg/instrument.html.
27. Caballero B, Davis S, Davis CE, et al. Pathways: a school-based program for the primary prevention of obesity in American Indian children. *J Nutr Biochem.* 1998;9:535–543.
28. Fitzgibbon ML, Stolley MR, Kirschenbaum DS. An obesity prevention pilot program for African-American mothers and daughters. *J Nutr Educ.* 1995;27:93–99.
29. Robinson TN. Behavioral treatment of childhood and adolescent obesity. *Int J Obes Relat Metab Disord.* 1999;23(suppl 2):S52–S57.
30. Resnicow K, Yaroch AL, Davis A, et al. GO GIRLS!: development of community-based nutrition and physical activity program for African-American adolescent females. *J Nutr Educ.* 1999;31:283–285.
31. Resnicow K, Yaroch AL, Davis A, et al. GO GIRLS!: results from a nutrition and physical activity program for low-income, overweight African-American adolescent females. *Health Educ Behav.* Oct 2000;27(5):616–631.
32. Stolley MR, Fitzgibbon ML. Effects of an obesity prevention program on the eating behavior of African-American mothers and daughters. *Health Educ Behav.* 1997;24(2): 152–164.
33. Donnelly JE, Jacobsen DJ, Whatley JE, et al. Nutrition and physical activity program to attenuate obesity and promote physical and metabolic fitness in elementary school children. *Obes Res.* May 1996;4(3):229–243.
34. Gortmaker SL, Peterson K, Wiecha J, et al. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. *Arch Pediatr Adolesc Med.* 1999; 153(4):409–418.
35. Story M. School-based approaches for preventing and treating obesity. *Int J Obes Relat Metab Disord.* 1999;23(suppl 2):S43–S51.
36. Baranowski T, Davis Hearn M. Health behavior interventions with families. In: Gochman DS, ed. *Handbook of Health Behavior Research IV: Relevance for Professionals and Issues for the Future.* New York, NY: Plenum Press; 1997.
37. Nader PR, Sallis JF, Abramson IS, et al. Family-based cardiovascular risk reduction education among Mexican- and Anglo-Americans. *Fam Community Health.* 1992;15(1): 57–74.
38. Nader PR, Sellers DE, Johnson CC, et al. The effect of adult participation in a school-based family intervention to improve children's diet and physical activity: the Child and Adolescent Trial for Cardiovascular Health. *Prev Med.* 1996;25(4):455–464.
39. Perry CL, Luepker RV, Murray DM, et al. Parent involvement with children's health promotion: a one-year follow-up of the Minnesota home team. *Health Educ Q.* 1989; 16(2):171–180.
40. Resnicow K, Jackson A, Wang T, et al. A motivational interviewing intervention to increase fruit and vegetable intake through Black churches: results of the Eat for Life trial. *Am J Public Health.* Oct 2001;91(10): 1686–1693.