The StrongWomen–Healthy Hearts Program: Reducing Cardiovascular Disease Risk Factors in Rural Sedentary, Overweight, and Obese Midlife and Older Women

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Objectives. We tested a community-based intervention designed to reduce cardiovascular disease risk in sedentary midlife and older women who were overweight or obese.

Methods. In a randomized controlled trial conducted in 8 counties in Arkansas and Kansas, counties were assigned to the intervention (a 12-week twice-weekly heart health program) group or to the delayed-intervention control group. Ten to fifteen women were selected from each site, and participants' weight, waist circumference, diet, physical activity, and self-efficacy were measured before and after the intervention. Data were analyzed with multiple regressions.

Results. Compared with the control group, participants in the intervention group had a significant decrease in body weight (–2.1 kg; 95% confidence interval [CI]=–3.2, –1.0), waist circumference (–2.3 in; 95% CI=–4.2, –0.5), and energy intake (–390 kcal/day; 95% CI=–598, –183); an increase in activity (+1637 steps/day; 95% CI=712, 2562); and an increase in self-efficacy for dietary and physical activity behaviors.

Conclusions. Our results suggest that a community-based program can improve self-efficacy, increase physical activity, and decrease energy intake, resulting in decreased waist circumference and body weight among at-risk women. (*Am J Public Health.* 2009;99:1271–1277. doi:10.2105/AJPH.2008.145581)

Cardiovascular disease (CVD) is the leading cause of death and disability for women in the United States, claiming approximately 500 000 women's lives each year.[1] The direct and indirect costs of CVD were estimated at more than $430 billion in 2007.[1] As the American population ages, the burden of CVD will continue to increase.[2]

It is important to focus efforts on midlife and older women, because their numbers are increasing in the US population.[2,3] Even though CVD develops over decades and early prevention is important, lifestyle modifications can also reduce risk in older adults.[4] Yet few women are leading heart-healthy lifestyles. According to data from the 1999–2000 National Health and Nutrition Examination Survey, half of women aged 51 to 70 years fail to eat at least 5 servings of fruits and vegetables per day.[5] Nearly 40% of women aged 45 to 54 years do not engage in any leisure-time physical activity, and this rate decreases further with age.[6,7] Weight control is important for CVD risk reduction,[8] and nearly 70% of midlife and older women are overweight or obese.[9]

One strategic prevention approach is the development and evaluation of targeted educational and behavioral programs that can be implemented widely by community organizations that reach many high-risk women. Only a few such programs exist. The Centers for Disease Control and Prevention's WISEWOMAN program focuses on cardiovascular screening for midlife, uninsured women.[10] In addition, it has a lifestyle intervention component that has shown modest improvements in behavioral and clinical outcome measures.[11–14] Other community-based projects targeting women and CVD have successfully increased aerobic activity[15] and decreased weight and waist circumference.[16]

More community-based programs that improve heart health in midlife and older women are needed. To address this need, we developed the StrongWomen–Healthy Hearts program at Tufts University. We used an existing partnership between the StrongWomen program at Tufts and the Cooperative State Research, Education, and Extension Service (CSREES) of the US Department of Agriculture.[17] CSREES educators have in-depth knowledge of the communities they serve and run health-related programs in their counties; thus, they are well-positioned to deliver interventions related to heart health. Furthermore, CSREES provides an infrastructure for national dissemination. We examined the outcomes of the StrongWomen–Healthy Hearts intervention in Arkansas and Kansas.

METHODS

To test the feasibility and effectiveness of the StrongWomen–Healthy Hearts program, we conducted a randomized controlled trial in Arkansas and Kansas. The 8 participating counties were either nonmetropolitan with large rural areas or completely rural.[18] More than 90% of residents in all counties were White, the median household income ranged from $27 139 to $41 138, and the percentage of the adult population with an undergraduate degree or higher ranged from 8.5% to 22.2%.[19] The factors that likely facilitated or served as barriers to physical activity and heart-healthy eating in these communities were assessed for this study and are described elsewhere.[20]

Study Design

Randomization was by community (county). We recruited 8 counties to provide adequate power to assess an expected increase in aerobic fitness of approximately 10%. We recruited counties whose CSREES educators were able to adhere to our research goals and time frame. We pair-matched 4 counties within each state by population density and

socioeconomic status. One county from each pair was then randomly assigned to the intervention group; the other 4 counties (2 in each state) served as controls and conducted a delayed intervention.

The goal was to recruit 10 to 15 women per county site, providing a sufficient final sample and appropriate class sizes. All participants were recruited by CSREES educators through articles or advertisements in local newspapers, flyers, and announcements at meetings. Participants in all counties were assessed at baseline. The intervention group then participated in the program, and the control group received no intervention. All participants were assessed after the conclusion of the program. Following all intervention and assessment activities, the control group was given the opportunity to receive the intervention.

CSREES educators were trained by research staff (S.C.F. and R.A.S.) to conduct assessments of screening and outcome measurements and to implement the curriculum. Each county site received a stipend of $400 to cover equipment and supply costs to run the program. Participants received a $25 gift certificate upon completion of the final assessments.

Participants

Our target study population was women who were 40 years and older who lived independently, were sedentary (not doing any type of exercise more than once per week), and had a body mass index (BMI; weight in kilograms divided by height in meters squared) of 24 kg/m^2 or higher. We chose the lower BMI cutoff to include women at risk for becoming overweight because there is a strong secular trend for increased weight gain during adulthood.[21,22] Most participants were required by institutional review board protocols to obtain permission to participate from their primary care physician.

Exclusionary criteria were an unstable medical condition that would preclude participation in an exercise program, as determined by the Physical Activity Readiness Questionnaire[23]; current participation in another lifestyle modification program; inability to prepare food; cognitive impairment; and pregnancy. At baseline we used a validated 6-item test to screen for cognitive impairment.[24] The test was administered by CSREES educators and scored by research personnel.

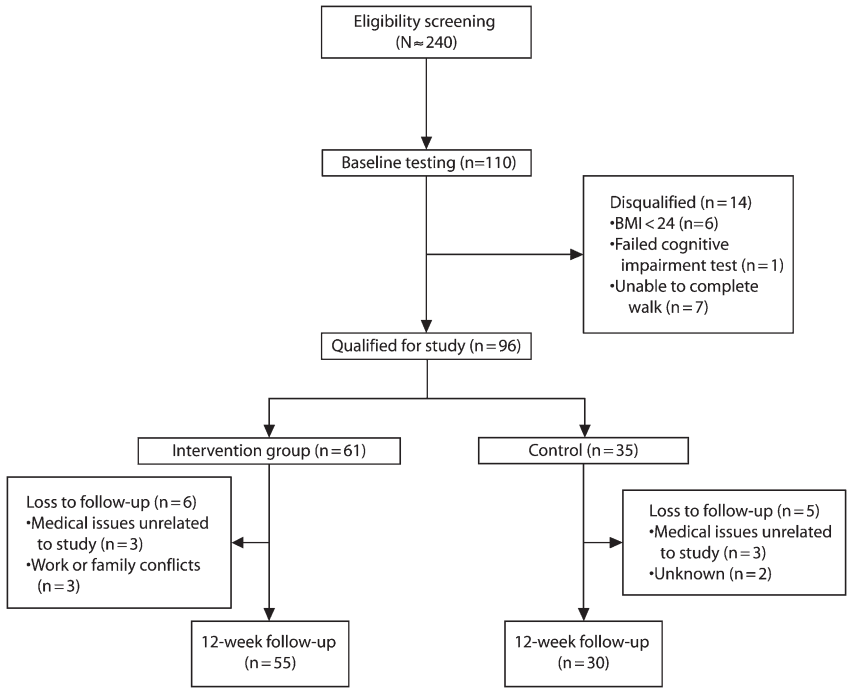
CSREES educators screened approximately 240 women by phone to determine eligibility (Figure 1). Of these, 136 met eligibility criteria, and 110 completed baseline testing. Fourteen were disqualified at baseline testing: 6 reported BMI values during the phone screening that were within the study range, but their values measured at baseline assessment were too low; 7 were unable to complete the 2-km walk, indicating potential physical impairments that would preclude participation in aerobic activity; and 1 had a positive result in the cognitive impairment test.

Measures

Anthropometric measurements comprised height in centimeters (stadiometer model 214, Seca North America, Hanover, MD), weight in kilograms (scale model 880, Seca North America), and waist and hip circumference in inches (girth measuring tape model 200, Seca North America). Measurements were obtained in triplicate with standard procedures.[25] Weight and height measurements were used to calculate BMI.

We measured dietary intake with consecutive 3-day food records over 2 weekdays and 1 weekend day. Research staff trained in dietary assessment methods trained CSREES educators on how to instruct participants to record food intake. Research staff followed up with participants by telephone to obtain missing or incomplete information on the food records and entered the data into the University of Minnesota Nutrition Data System for Research.[26] We used this software to calculate daily nutrients and servings from food groups derived from the Dietary Guidelines for Americans[27] and MyPyramid.[28]

We chose the 2-km walking test developed by the President Urho Kaleva Kekkonen Institute in Finland to assess pre- and postintervention aerobic fitness levels. It has been validated with older adults and obese populations[29–31] and has been used to demonstrate change in community-based interventions.[32,33] Participants were asked to complete a 2-km walk as fast as they were able, without endangering their health, at a constant, brisk, maintainable pace. In this test, time to complete the walk, ending heart rate, age, and BMI are typically used to obtain an estimate of maximal oxygen uptake, a standard measure of fitness. Flat 2-km courses



Note. BMI = body mass index.

FIGURE 1—Flowchart of participant selection: StrongWomen–Healthy Hearts Study, Arkansas and Kansas, 2007.

TABLE 1—Baseline Characteristics, by Treatment Group: StrongWomen–Healthy Hearts Program, Arkansas and Kansas, 2007

	Control Group, Mean (SD) or %	Intervention Group, Mean (SD) or %	*P*
Age, y	57.0 (8.1)	57.8 (9.8)	.66
Weight, kg	86.4 (15.0)	89.8 (18.3)	.35
BMI, kg/m^2	32.1 (5.5)	33.4 (5.6)	.26
Waist circumference, in	39.6 (4.4)	40.8 (5.3)	.28
Energy, kcal/d	1776 (439)	1709 (359)	.25
Saturated fat, % kcal	12.3 (3.2)	12.5 (3.4)	.87
Dietary cholesterol, mg/d	231 (116)	245 (129)	.59
Steps/d[a]	4201 (1805)	4249 (1710)	.90
Time to complete 2-km walk, min, sec	25, 08 (4, 50)	26, 02 (4, 43)	.37
Cooks at home	97.1	88.5	.33
Smoker	5.7	4.9	.87
Married	65.7	85.2	.03
Other household members, no.	1.5 (1.0)	1.6 (1.3)	.56
Works full time	51.4	52.5	.92
Education			.57
Some high school	0	3.3	
High school graduate	17.6	26.7	
Some college or technical school	47.1	36.7	
College graduate	20.6	23.3	
Graduate school	14.7	10.0	
Income, %			.27
< 20 000	8.8	8.5	
20 000–49 999	47.1	27.1	
50 000–74 999	26.5	33.9	
75 000–100 000	17.6	25.4	
> 100 000	0	5.1	

Note. BMI = body mass index. All baseline participants were included, regardless of study completion status. The sample size for the control group was n = 35. The sample size for the intervention group was n = 61.
[a]Data from 53 intervention group and 34 control group participants; data points under 1000 steps were excluded from this calculation.

were measured with a Garmin eTrex global positioning system (Garmin International Inc, Olathe, KS). Participants were also asked to wear a pedometer (Omron HJ-112, Omron Manufacturing of America, Inc, St Charles, IL) for 7 days to determine average steps per day as a measure of habitual physical activity. We excluded pedometer data if fewer than 2 complete days of data were recorded.[34]

All participants answered questions about demographics, cooking in their household, and smoking status. Most demographic and smoking questions were based on items in national surveys.[19,35] In addition, we assessed self-efficacy for dietary change with a single question for each of 5 dietary behaviors targeted in the intervention. These items were similar to dietary self-efficacy questions that have demonstrated reliability and validity,[36,37] for example, "How confident are you that you could eat more fruits and vegetables if you wanted to?" Physical activity self-efficacy was assessed with 11 questions adapted from a previously validated instrument.[38] The response scale for all self-efficacy questions ranged from 1 (not at all confident) to 5 (completely confident). Responses were averaged to obtain an overall score. The internal consistency (Cronbach α) in this study was 0.90.

Intervention

The StrongWomen–Healthy Hearts program took place 2 days per week for 12 weeks. All 4 intervention sites began the program midwinter 2007. Each of the 24 classes lasted approximately 1 hour. The primary aim of the physical activity component of the classes was to progressively increase to 30 minutes of moderate-to-vigorous aerobic activity, either dancing to a DVD created for this project or walking outside if location and weather permitted. A second aim was to promote lower-intensity lifestyle physical activity outside of class.

The aims of the dietary component, which comprised didactic and hands-on training, were to modify intake patterns and to improve weight control. This component emphasized an eating pattern rich in fruits, vegetables, low- or nonfat dairy products, fish, whole grains, and legumes; it encouraged consumption of leaner meats and poultry and less saturated and trans fats. Smaller portion sizes were also emphasized. Social cognitive theory served as the theoretical underpinning of the intervention. Behavioral strategies included self-monitoring of food intake and physical activity, goal setting, and skill building for meal preparation, supermarket shopping, and restaurant eating. Hands-on skill-building activities included preparation of recipes in small groups. Formative research helped inform development of the curriculum.[20]

For process evaluation, CSREES educators completed a brief weekly questionnaire about attendance, participant engagement with the classes, and ability to carry out the intervention as designed. In addition, study personnel observed 1 class at each site to assess fidelity to the intervention.

Statistical Analyses

We determined differences between the control and intervention groups at baseline with the χ^2 test for categorical variables and the *t* test for continuous variables. To test outcome variables, we constructed regression models with pre–post change (in weight, for example) as the dependent variable and with a group variable (intervention or control) to determine the treatment effects.

The models also controlled for baseline values, age, education level, marital status, and the clustering of participants by county to achieve robust standard errors. Analyses were performed with Stata software version 8.0 for Windows (StataCorp LP, College Station, TX).

TABLE 2—Baseline Characteristics and Outcomes of Intervention, by Treatment Group: StrongWomen–Healthy Hearts Program, Arkansas and Kansas, 2007

	Baseline		Postintervention		Pre–Post Change		
	Control, Mean (SD)	Intervention, Mean (SD)	Control, Mean (SD)	Intervention, Mean (SD)	Control, Mean (SD)	Intervention, Mean (SD)	Adjusted Difference,[a] Mean (95% CI)
Weight, kg	85.6 (13.6)	89.5 (18.8)	85.9 (13.9)	87.7 (19.6)	0.3 (1.8)	−1.7 (2.4)	−2.1** (−3.2, −1.0)
BMI, kg/m^2	31.8 (5.3)	33.2 (5.7)	31.9 (5.4)	32.6 (6.0)	0.1 (0.7)	−0.6 (0.9)	−0.8** (−1.2, −0.5)
Waist circumference,[b] in	39.7 (4.3)	40.5 (5.3)	39.9 (4.9)	38.4 (5.7)	0.2 (1.7)	−2.0 (2.1)	−2.3* (−4.2, −0.5)
Energy, kcal/d	1782 (431)	1697 (367)	1685 (435)	1278 (295)	−97 (422)	−419 (391)	−390** (−598, −183)
Carbohydrate, g/d	210.8 (51.8)	205.3 (53.3)	208.2 (55.4)	154.2 (40.9)	−2.6 (47.2)	−51.1 (54.0)	−56.6*** (−75.7, −37.5)
Protein, g/d	69.7 (16.2)	67.8 (15.3)	66.4 (17.5)	60.7 (15.1)	−3.2 (18.9)	−7.0 (16.5)	−5.2 (−15.8, 5.4)
Fat intake							
Total fat, g/d	75.6 (27.1)	70.3 (22.5)	68.8 (27.7)	49.7 (17.3)	−6.8 (25.2)	−20.6 (21.0)	−15.7* (−28.3, −3.2)
Saturated fat, g/d	26.0 (11.2)	24.0 (9.9)	22.0 (9.2)	15.6 (6.0)	−4.0 (10.3)	−8.4 (9.2)	−5.2* (−9.4, −1.0)
Saturated fat, % kcal	12.6 (3.2)	12.3 (3.6)	11.3 (2.7)	10.7 (2.9)	−1.3 (3.2)	−1.6 (3.4)	0.0 (−0.9, 1.0)
Dietary cholesterol, mg/d	240 (120)	240 (128)	208 (55)	154 (41)	−32 (142)	−86 (134)	−60*** (−78, −43)
Food intake, servings/d							
Fruit and vegetables	4.0 (1.9)	4.3 (2.5)	3.6 (1.8)	4.7 (2.5)	−0.3 (2.1)	0.3 (2.0)	0.6 (−0.2, 1.3)
Whole grains	1.5 (1.6)	1.4 (1.0)	1.6 (1.9)	1.6 (1.0)	0.2 (0.9)	0.2 (1.2)	0.0 (−0.6, 0.6)
Low- and nonfat dairy products	0.2 (0.4)	0.4 (0.5)	0.3 (0.5)	0.4 (0.5)	0.1 (0.4)	0.1 (0.3)	0.0 (−0.2, 0.1)
Fish (baked or grilled)	0.6 (1.2)	0.3 (0.6)	0.4 (0.8)	0.4 (0.7)	−0.2 (1.0)	0.1 (0.8)	0.1 (−0.1, 0.4)
Sweet foods and desserts	1.0 (0.7)	1.1 (0.9)	1.1 (0.9)	0.5 (0.5)	0.1 (1.1)	−0.7 (0.9)	−0.6* (−1.1, −0.1)
Time to complete 2-km walk, min:sec	24:46 (4:40)	25:57 (4:38)	24:28 (5:24)	24:17 (4:33)	−0:18 (2:23)	−1:40 (2:14)	−1:13 (−3:03, 00:37)
Steps/d[c]	4050 (1444)	4300 (1691)	3976 (1231)	6327 (2709)	−113 (845)	1807 (2546)	1637** (712, 2562)

Note. CI = confidence interval; BMI = body mass index. For the control group, n = 30; for the intervention group, n = 55 (except as noted).
[a]Adjusted for age, education level, marital status, baseline value, and clustering by site.
[b]Intervention group, n = 54.
[c]Data from 46 intervention group and 28 control group participants; data points under 1000 steps were excluded from this calculation.
*P < .05; **P < .01; ***P < .001.

RESULTS

Baseline data were obtained on 96 qualified participants (Figure 1): 61 in intervention communities (28 in Arkansas, 33 in Kansas) and 35 in control communities (14 in Arkansas and 21 in Kansas). Of these, 85 completed postintervention testing (55 in intervention communities and 30 in control communities), for an overall completion rate of 88.5%. Reasons for loss to follow-up were medical issues unrelated to the study (n=6), work or family conflicts (n=3), and unknown reasons (n=2). Participants who were lost to follow-up did not differ significantly from those who completed the study in demographic characteristics or baseline values for main outcome variables (data not shown). The intraclass correlation coefficient for this sample was 0.18.

At baseline, there were no significant differences between intervention and control groups on demographic and anthropometric characteristics, dietary intake, aerobic fitness, or steps per day (Table 1). However, a larger percentage of the participants in the intervention group were married. All women were White except one, who was American Indian, reflecting the demographics of the communities.

The average attendance for all intervention sites was approximately 80%. Leader feedback and site visits indicated that there was good fidelity to the intervention. Issues with the program as designed were minor and addressed as needed. For example, one site had a carpeted floor, making one of the aerobic dance moves difficult to perform. The CSREES educator used input from research staff to make a minor modification.

Dietary Effects

Pre- and postintervention values and changes in anthropometrics, diet, and physical activity are displayed in Table 2. After the intervention, women in the intervention group, compared with those in the control group, showed significant decreases in body weight (–2.1 kg; 95% confidence interval [CI]=–3.2, –1.0) and BMI (–0.8 kg/m^2; 95% CI=–1.2, –0.5). Waist circumference decreased significantly in intervention group participants compared with controls (–2.3 inches; 95% CI=–4.2, –0.5).

Compared with the control group, the intervention group reported significant decreases in intakes of energy (–390 kcal/day; 95% CI=–598, –183), carbohydrate (–56.6 g/day; 95% CI=–75.7, –37.5), fat (–15.7 g/day; 95% CI=–28.3, –3.2), and cholesterol (–60

mg/day; 95% CI=−78, −43). Changes in protein intake were not significantly different between the intervention and control groups. There was a significant decrease in intake of total grams of saturated fat in the intervention group compared with the control group (−5.2 g/day; 95% CI=−9.4, −1.0), but the change in percentage of energy from saturated fat was not significantly different between the 2 groups. Intervention participants decreased sweet food and dessert servings per day compared with control participants (−0.6 servings/day; 95% CI=−1.1, −0.1). There was a trend toward significance in fruit and vegetable servings (0.6 servings/day; 95% CI=−0.2, 1.3; *P*=.11). No other food group changes were observed.

Physical Activity and Self-Efficacy Effects

At baseline, the average time for the walking test was 25 minutes 42 seconds (SD=4 min 45 sec). Our intention was to use the test time and heart rate at the end of the walk to calculate an estimated maximal oxygen uptake with a validated regression equation.[30] Heart rates were within the targeted range for this age group, suggesting that participants were exerting themselves adequately. However, the average walk time was substantially slower than expected, which nullified the estimation formula. Therefore, we only reported walk time. The pre–post change in walk time was 1 minute 13 seconds faster in the intervention group than in the control group, a trend toward significance (95% CI=−3 min 03 sec, 0 min 37 sec; *P*=.16). The intervention group participants significantly increased the number of steps taken per day compared with controls (1637 steps/day; 95% CI=712, 2562).

Participants in the intervention group significantly increased their self-efficacy for all dietary factors and for physical activity (Table 3).

DISCUSSION

Women who participated in the StrongWomen–Healthy Hearts program lost weight and decreased waist circumference over the 12-week intervention period. Both of these anthropometric changes are strongly correlated with reduction in risk of cardiovascular disease.[39,40] The modest weight loss we observed has potential public health implications, because each kilogram of weight lost is associated with decreased blood pressure[41] and diabetes risk.[42] In addition, any decrease or leveling of weight is relevant in this population because it helps prevent the increase that is typically observed in adulthood.[21,22]

The weight loss is consistent with findings that the intervention group participants decreased energy consumption and increased energy expenditure. Changes in kilocalories per day can be attributed mainly to decreases in carbohydrate and fat rather than protein, which is beneficial for preserving lean body mass while decreasing fat mass.[43] Although there was a greater decrease in total fat intake in the intervention group than in the control group, the intervention had no effect on saturated fat after adjustment for energy intake.

The decrease in total daily energy intake may be explained in part by the decrease in sweet foods and desserts consumed by the intervention group. Consumption of fruits and vegetables, which may help decrease overall caloric intake because of their low caloric density and high fiber content,[44] also trended toward significance. However, we did not observe significant differences between the groups in consumption of any other food groups. Although the curriculum emphasized replacing less healthful foods (i.e., foods higher in calories and saturated fat and lower in nutrient density) with heart-healthy ones, it appears that intervention group participants generally cut down on less-healthful foods without increasing more-healthful ones. Additional qualitative research may help inform improved messages about the replacement of foods in future iterations of the curriculum.

Data from the walking test revealed a trend toward greater fitness in the intervention group, although there may not have been sufficient statistical power to detect a difference with the control group. It is noteworthy that participants were so unfit that their preintervention 2-km walk times could not be used in the algorithm to compute an estimated maximal oxygen uptake. In previous studies, the average walk time for overweight women was 18.7 minutes[31]; the average for all participants at baseline in our study was 25.7 minutes. This is consistent with other reports of low levels of cardiorespiratory fitness among adults in the United States, particularly women.[45,46] An important area for future research is to examine the

TABLE 3—Self-Efficacy at Baseline and After the Intervention, by Treatment Group: StrongWomen–Healthy Hearts Program, Arkansas and Kansas, 2007

	Baseline		Postintervention, Mean (SD)		Pre–Post Change		
Self-Efficacy	Control, Mean (SD)	Intervention, Mean (SD)	Control, Mean (SD)	Intervention, Mean (SD)	Control, Mean (SD)	Intervention, Mean (SD)	Adjusted Difference,[a] Mean (95% CI)
Consuming more fruits and vegetables	4.3 (0.8)	4.1 (0.9)	4.0 (0.9)	4.3 (0.8)	−0.4 (1.0)	0.2 (1.1)	0.4* (0.1, 0.8)
Including more healthful fats in diet	4.1 (0.9)	3.8 (1.0)	3.9 (0.8)	4.3 (0.8)	−0.2 (0.9)	0.4 (1.2)	0.4* (0.1, 0.8)
Consuming more whole grains	4.2 (1.0)	4.1 (0.8)	4.0 (0.9)	4.4 (0.9)	−0.2 (1.0)	0.2 (1.0)	0.4** (0.2, 0.7)
Consuming more low- and nonfat dairy products	4.1 (0.9)	3.9 (1.1)	3.5 (1.1)	4.2 (0.8)	−0.6 (1.2)	0.3 (1.2)	0.8* (0.1, 1.5)
Consuming more fish (baked or grilled)	3.5 (1.4)	3.5 (1.1)	3.1 (1.4)	3.8 (1.0)	−0.3 (0.9)	0.3 (1.2)	0.88* (0.3, 1.2)
Physical activity[b]	3.0 (0.8)	3.0 (0.6)	3.0 (0.9)	3.4 (0.7)	0.0 (0.7)	0.4 (0.7)	0.4* (0.1, 0.8)

Note. CI = confidence interval. Self-efficacy was measured on a Likert scale (1–5).
[a]Adjusted for age, education level, marital status, baseline value, and clustering by site.
[b]Mean score of 11-question scale measuring self-efficacy under various conditions (under stress, when depressed, when anxious, and so on).
*$P < .05$; **$P < .01$.

validity of such measures and to develop new ones that can be used in the field with overweight, sedentary, and unfit populations.

It is encouraging that waist circumference was reduced significantly in the intervention group. Waist circumference, which is feasible to measure in field trials, can serve as a surrogate marker for abdominal fat mass. Abdominal fat mass correlates with increased risk of CVD, and women with a waist circumference greater than 35 inches are considered to be at increased risk.[40]

Our results were comparable to those of other community-based interventions that target women.[11–15] In a similar 12-week intervention with rural women, the intervention group showed a trend for improved cardiorespiratory fitness.[15] Published reports on outcome evaluations for the lifestyle component of the WISEWOMAN program, which serves under- or uninsured midlife women, are available for 3 states: North Carolina,[11] Massachusetts,[12] and Arizona.[13] All 3 compared some type of minimal intervention, typically standard care, with at least one enhanced, theory-based intervention.[47] None of the studies observed a significant difference in degree of change in blood pressure, serum cholesterol, or BMI between enhanced and minimal intervention groups, although this may have been because the minimal intervention was itself robust enough to create change. In many cases, both groups showed improvements in these and other measures.

Collectively, these findings, including our program, suggest that it is possible to facilitate meaningful behavior change in midlife and older women. It will be important to continue to refine these strategies to maximize impact.

Most of the study's limitations stemmed from the community-based design. The best approach is to randomize after recruitment and baseline testing to minimize differences between the intervention and controls groups caused by the recruitment process. This was not feasible. However, because the control group received a delayed intervention, recruitment was similar between the 2 groups. The main difference between them was when they began the program. There were no differences between the 2 groups on all known variables at baseline except percentage married, suggesting an absence of recruitment bias, although it cannot be ruled out.

CSREES educators who implemented the intervention also assessed participants and were not blinded to the treatment condition; this was another potential source of bias. However, they were trained to use standard protocols to help ensure objective and reliable measurements, and they conducted the assessments as a team, with CSREES educators travelling to each intervention or control site within each state to further ensure consistency at each site. The dietary data were self-reported, with inherent likelihood of inaccuracies and underreporting.[48] It is possible that the intervention group introduced systematic bias because of what they felt they should eat as a result of the classes. However, this would have resulted in spurious intervention effects, rather than the absence of effect we observed for the food groups.

At baseline, study participants' intakes of calories, macronutrients, saturated fat, and cholesterol were very similar to values for women in these age groups taken from a representative sample of the US population.[49] This suggests that these participants were typical in dietary intake and that the results may be generalizable to similar populations of midlife and older women. However, the recruitment methods resulted in a sample that had somewhat more education and higher income than the overall county averages for women in this age group. In future studies, recruitment methods will be refined so that samples are more representative. Furthermore, although representative of the counties, all participants were White except for one. It is likely that the program would need modification for use in counties with more diversity.

Our results suggest that the StrongWomen–Healthy Hearts program was effective in changing self-efficacy, a determinant of behavior, and several targeted behaviors. These changes likely contributed to the anthropometric changes in body weight and waist circumference associated with reduced risk of cardiovascular disease. It will be important in future studies to examine the longer-term effects on these outcomes. This program, which was moderately intensive and feasible to implement with CSREES educators, has the potential to be replicated and disseminated to many women in the communities in which they live. ■

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All authors helped to conceptualize ideas, interpret findings, and review drafts of the article. S.C. Folta synthesized analyses and led the writing. J.F. Kuder assisted with the analyses.

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Human Participant Protection

This study was approved by the institutional review boards of Tufts University, University of Arkansas, and Kansas State University. All participants provided written informed consent.

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