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Community-Based Cardiovascular Disease Prevention to Reduce Cardiometabolic Risk in Latina Women: A Pilot Program

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Abstract

Background: Cardiovascular disease (CVD) is the leading cause of death in women, yet significant health disparities exist for high-risk groups, including Latinas, and comprehensive, culturally relevant, and effective prevention intervention models are lacking. We used a systems approach to develop, assess, and pilot a community-based education program for improving outcomes for knowledge/awareness of CVD, cardiometabolic risk, and health behaviors in Latinas.

Methods: Latinas ($n = 35$, mean age 50) participated in a 4-month community-based bilingual preventive cardiovascular education program. Pre/post analyses were for knowledge/awareness of CVD risk factors, symptoms, calling 911; personal risk factors (smoking, physical inactivity, family history of CVD); clinical parameters (weight, body mass index [BMI], waist, blood pressure, fasting lipids, and glucose); diagnosis of metabolic syndrome (MetS); and serum inflammatory markers (tumor necrosis factor [TNF]-α, high-sensitivity C reactive protein [hsCRP], and interleukin [IL]-12).

Results: Baseline knowledge/awareness was relatively low, risk factors and MetS prevalent, and serum inflammatory markers elevated. Postintervention, participants demonstrated significant ($p < 0.05$) improvements in knowledge of symptoms, risk factors for CVD, calling 911, and knowledge/adoption of heart-healthy behaviors. Clinical health status also improved, especially for serum triglycerides ($p < 0.05$; 21% decline), prevalence of MetS (from 43% to 37% of participants), and serum levels of the proinflammatory TNF-α (from 16.9 ± 1.11 pg/mL to 13.5 ± 0.8 pg/mL, $p < 0.05$).

Conclusion: A bilingual culturally appropriate community-based CVD-prevention program based on health education, medical screenings, and empowerment is a successful, effective, adaptable, and replicable model to significantly improve cardiometabolic risk in Latinas.

Introduction

Cardiovascular disease (CVD) remains a major cause of morbidity and mortality for both men and women in the United States, disproportionately affects women,[1,2] and accounts for the greatest number of deaths among women across racial and ethnic backgrounds. Compared to Caucasian women, Hispanic/Latina women are at higher risk of developing CVD and have high disease prevalence, estimated at 31% in 2010.[3]

The Hispanic/Latino community represents one of the largest and most rapidly growing populations in the country[4] and experiences significant disparities in the prevention and treatment of CVD.[5] Hispanic/Latina women have increased prevalence of high cholesterol, hyperglycemia, high blood pressure, and obesity.[6,7] Further, Hispanics/Latinos have a higher prevalence of non-insulin-dependent diabetes mellitus than do non-Hispanic whites.[8–10] Based on National Health and Nutrition Examination Survey (NHANES) data, age-adjusted prevalence of metabolic syndrome (MetS)—a clustering of CVD risk factors—was highest for Mexican American women in the United States at 41%.[2,11] In addition, the Hispanic/Latino community faces significant barriers to healthcare access and healthcare coverage.[12]

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At the national level, the importance of tackling the healthcare and socioeconomic burden of CVD and related disorders has been established as a research priority.[13] Therefore, it is imperative that advances in this field strive to address disparities that exist between various segments of the population. Although many factors may contribute (e.g., differences in prevalence of risk factors between ethnoracial groups, cultural influences on the perception of CVD, social determinants of health), the disparity in women is partly related to a lack of education and awareness surrounding the risks and symptoms of CVD, such as the appropriate actions to take in response to a CVD emergency, including calling 911.[14,15] Hispanics/Latinos may represent a particularly underserved population with respect to education about risk factors affecting cardiovascular health,[16–18] and lack of awareness further compounds risk in this population.

The overall purpose of this study was to conduct a pilot program to determine whether a culturally appropriate and newly developed bilingual community-based CVD-prevention model and risk-reduction intervention was effective in reducing CVD risk among high-risk Hispanic/Latina women in local communities through education, medical screenings, and risk-behavior modification. High-risk women were defined as those with multiple cardiovascular risk factors and a high-risk cardiometabolic profile. The two main goals of the program were for participants to (1) increase their knowledge and awareness of heart disease and its symptoms and risk factors through education and (2) demonstrate improvement in their cardiometabolic risk through cardiovascular clinical risk parameters and/or inflammatory burden in response to improved knowledge and awareness.

Materials and Methods

Site, participants, and recruitment

This study was conducted by the Women's Cardiovascular Medicine Program at the University of California, Davis, and the Sacramento Latino Medical Association (SaLMA), using a model systems approach to cardiovascular disease prevention through an academic-community partnership (Fig. 1). Participants were recruited through community announcements, flyers, and word of mouth in Sacramento, CA, between September 2012 and January 2013. The Institutional Review Board (IRB) of the University of California, Davis, approved the study, and all participants provided informed consent. Spanish- and English-language versions of all study materials and consent documents were provided. Pregnant and lactating women were not eligible to participate, owing to program focus on weight maintenance and/or reduction.

Program

The Latina Preventive Heart Disease Program was modeled after our previously published studies,[25,26] adapted for cultural competence, and enhanced by a unique bilingual curriculum developed for the program. Program implementation consisted of three phases.

Phase I. The yearlong program planning, development, and recruitment process was undertaken to develop the program with a community advisory workgroup to ensure cultural relevance and to develop the key health messages.

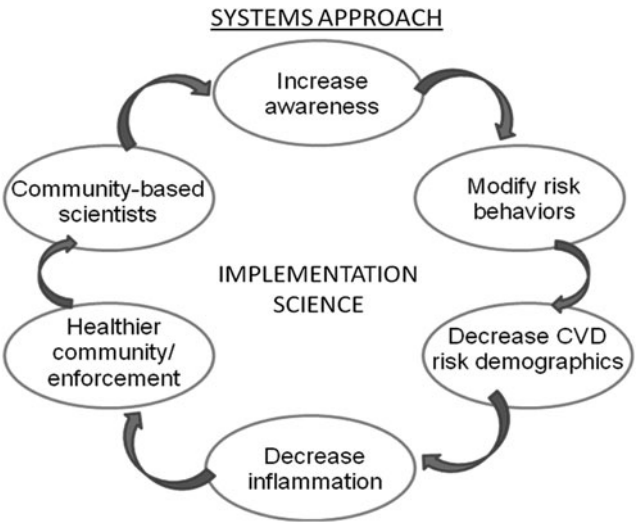

FIG. 1. Model systems approach to cardiovascular disease (CVD) prevention through academic-community partnerships. Our model pilot program aimed to integrate research findings into community health education through the process of implementation science and thereby help create healthier communities.

Phase II. The program implementation of educational sessions consisted of eight bimonthly (every 2 weeks) sessions delivered in increments of 2.0–2.5 hours over the course of 4 months. Participants were busy working women, and sessions were held on Saturday mornings to minimize work conflicts, reflecting the preference of participants. Curriculum materials were compiled, adapted, and translated from three primary sources: the American Heart Association (AHA) ''Go Red for Women'' campaign, the National Institute of Health ''Heart Truth Campaign,'' and the Department of Health and Human Services Office on Women's Health womenshealth.gov materials. The entire educational curriculum can be found online (http://www.ucdmc.ucdavis.edu/internalmedicine /cardio/pdf /complete_curriculum.pdf). All aspects of the program, including recruitment, data collection, course activities, and educational sessions, were bilingual and conducted primarily in Spanish.

The study team, made up of volunteer nurses, students, physicians, and one paid research coordinator, enhanced the program's cost-effectiveness. To standardize delivery and content, as well as to create program cohesiveness, the team participated in a half-day training session on heart disease in women, program goals and objectives, curriculum and teaching materials, and relevant research methods, including IRB requirements. All educational sessions included small-group discussions and a low- to moderate-intensity physical activity component (such as walking, yoga, and stretches). At each session, the women were counseled on heart-healthy behaviors and provided with educational lectures, written educational materials, personal testimonials, and/or educational demonstrations. The program was enhanced by activities for self-efficacy, including leaders modeling for participants, participants modeling for each other, discussion of successes and barriers in implementing and attaining heart-healthier lifestyles, and group problem solving, support, and encouragement. Participants were also encouraged

to use self-monitoring tools, such as logs, journaling, pedometers, and tape measures for waist measurements, and to establish lifestyle-change goals. Participant attendance at each session was encouraged by the leaders, group members, and/or a buddy system. Participants were given incentives (e.g., heart-healthy cookbooks, heart-shaped tape measures, red dress pins, healthy snacks) but were not compensated.

Phase III. Six months were devoted to screening, outcomes, data analysis, evaluation, and write-up. Phase III consisted of two efforts: (1) screening for cardiometabolic risk factors and inflammatory markers and (2) focusing on outcome variables and metrics. Prior to the first educational session (baseline, pre-) and at the completion of the last educational session (post-), participants were screened for knowledge of cardiovascular risk, using a self-administered survey adapted from one previously used and validated by the Department of Health and Human Services, Office on Women's Health (DHHS-OWH.[25,26] Screenings were also performed for clinical parameters: height, weight, body mass index (BMI), waist circumference, and systolic and diastolic blood pressure (SBP and DBP, respectively). Fasting blood samples were collected by venipuncture, and serum was isolated by centrifugation and provided to an outside vendor (Quest Diagnostics) for analyses of fasting blood glucose (FBS) and fasting lipid panel (total cholesterol [TC], low-density lipoprotein [LDL] cholesterol, high-density lipoprotein [HDL] cholesterol, and triglycerides [TG]). For all participants, the time interval between the first and second screenings was 4 months. Pre- and postintervention screenings were also performed for circulating inflammatory marker levels for tumor necrosis factor (TNF)-α, interleukin (IL)-12, and high-sensitivity C reactive protein (hsCRP). These markers were selected because of their known association with CVD.[27–31] For these assays, study participants' pre- and postintervention blood samples were collected into serum-separator tubes, and the serum fraction aliquoted and stored at −80°C until further use. Commercially available enzyme-linked immunosorbent assay (ELISA) kits for TNF-α, IL-12, and hsCRP were obtained from Life Technologies (Benicia, CA), and samples were assayed in duplicate according to the manufacturer's instructions.

In selecting program outcomes, emphasis was placed on aligning objectives and targets with those of Healthy People 2020 goals (http://www.healthypeople.gov/2020/topicsobjectives2020 /objectiveslist.aspx?topicId=21). The primary objectives of this study were to (1) pilot and test a collaborative and community-based preventive heart disease education program in Latina women and (2) assess the preventive educational intervention's efficacy in reducing cardiometabolic risk (blood glucose and lipids, weight, waist circumference, blood pressure) and serum levels of inflammatory markers in Latina women. Specific sub-outcomes were to increase the percentage of participants who (1) recognize the importance of accessing rapid emergency care by calling 911 for symptoms of a heart attack; (2) know the major risk factors for CVD and how to modify those risk factors through their behaviors; (3) engage in heart-healthy behaviors, including weight management, diet, and physical activity; and (4) have controlled CVD risk factors.

Data management and analyses

Data were entered into a dedicated and deidentified clinical database and analyzed using Microsoft's Excel (Redmond, WA) or Systat Software's SigmaPlot (San Jose, CA). For all analyses, only participants with data from both data collection periods were included in the longitudinal analyses ($n=35$). Survey answers for the CVD risk-behavior categories were coded to reflect the degree to which a respondent engaged in the behavior (e.g., 1 = never checks labels for sodium content, 4 = always checks labels for sodium content). Averages were then calculated for each question, based on the number of respondents who chose each answer option for the question. An intermediate cut-off point was established to determine the overall percentage of respondents engaging in healthy versus unhealthy behaviors. Statistical significance was determined by using either Student's *t*-tests (for continuous variables) or McNemar's test (for categorical variables) and statistical significance determined at $p<0.05$.

Results

Forty-two women were successfully recruited for the study and provided informed consent. Thirty-five women completed the entire educational intervention, and only this group was used for paired pre/post results and subsequent analyses. The demographic profile of those who completed the intervention is shown in Table 1 and did not differ significantly from individuals who dropped out (data not shown). Conflict with work schedules was the barrier cited most often to continuing participation in the program. The participants' average age was 49.7 years (range 22–71 years). All participants self-identified as Latina/Hispanic (94% Mexican), and most were either Spanish-speaking only or bilingual.

Table 1. Demographic Profile of Study Participants

Characteristics	*Percent enrollees*
Age, years (self-report)	
18–25	5.9
26–35	2.9
36–45	23.5
46–55	26.5
56–65	41.2
>65	0
Country of origin (self-report)	
Mexico	94
Other Latin America	6
Married (self-report)	
Yes	81
No	19
Highest level of education (self-report)	
High school or less	33
High school/GED	21
Some college	25
2-year college (associate's degree)	4
4-year college (bachelor's degree)	8
Master's degree	0
Doctoral degree (PhD)	0
Professional degree (MD or JD)	8

Completers, $n=35$.
GED, general equivalency diploma.

Participants initially self-assessed their perceived personal risk factors for CVD (diagnosed diabetes, family history of CVD, hypertension, elevated cholesterol, physical inactivity, overweight or obesity, and smoking) through a prestudy survey. These self-assessments of CVD risk were then compared to actual risk objectively determined from participant clinical variables and cardiometabolic risk profiles. There was significant underestimation of CVD risk by study participants as follows: 67% of the study cohort reported being overweight or obese, yet 83% of the cohort was overweight or obese (BMI $\geq 25\,kg/m^2$); central obesity as determined by waist circumference ≥ 35 inches was present in 74%; 12% of the cohort self-reported hyperlipidemia, yet 15% had TC ≥ 240 mg/dL, 79% had LDL cholesterol ≥ 100 mg/dL, 35% had HDL cholesterol ≤ 50 mg/dL, and 32% had TG ≥ 150 mg/dL; only 15% of the participants self-reported hypertension, yet 70% had blood pressures $\geq 120/80$ mm Hg and 27% had blood pressures $\geq 140/90$ mm Hg. Diabetes mellitus was self-reported by 16% of participants and clinically diagnosed in 15%.

Knowledge of CVD symptoms was relatively low at baseline and ranged from 28% to 56% correct responses, depending on the symptom. As a result of the educational intervention, study participants greatly improved their knowledge of all heart attack symptoms (Fig. 2A). The greatest increase in knowledge occurred for knowledge and awareness of inframammary and interscapular radiation of chest pain, both of which have been reported to occur more commonly in women.[32] Knowledge of taking emergency action by calling 911 was high at baseline (93%) yet improved further to 100% of participants postintervention. The gains in knowledge of CVD symptoms and calling 911 were all statistically significant ($p < 0.05$) compared to baseline.

Baseline knowledge of each of the six major CVD risk factors was also relatively low overall at baseline and ranged from 24% to 94% correct responses, depending on the risk factor (Fig. 2B). The lowest risk-factor knowledge was for diabetes and central obesity as determined by waist circumference (24% and 27% correct responders, respectively). As a result of the educational intervention, participants significantly improved their knowledge and awareness of all CVD risk factors, with the greatest knowledge gains (% increase in knowledge) for waist circumference (58%), overweight or obesity assessed by BMI (49%), hypertension (48%), and diabetes (58%). The gains in knowledge of CVD risk factors were all statistically significant ($p < 0.05$) compared to baseline.

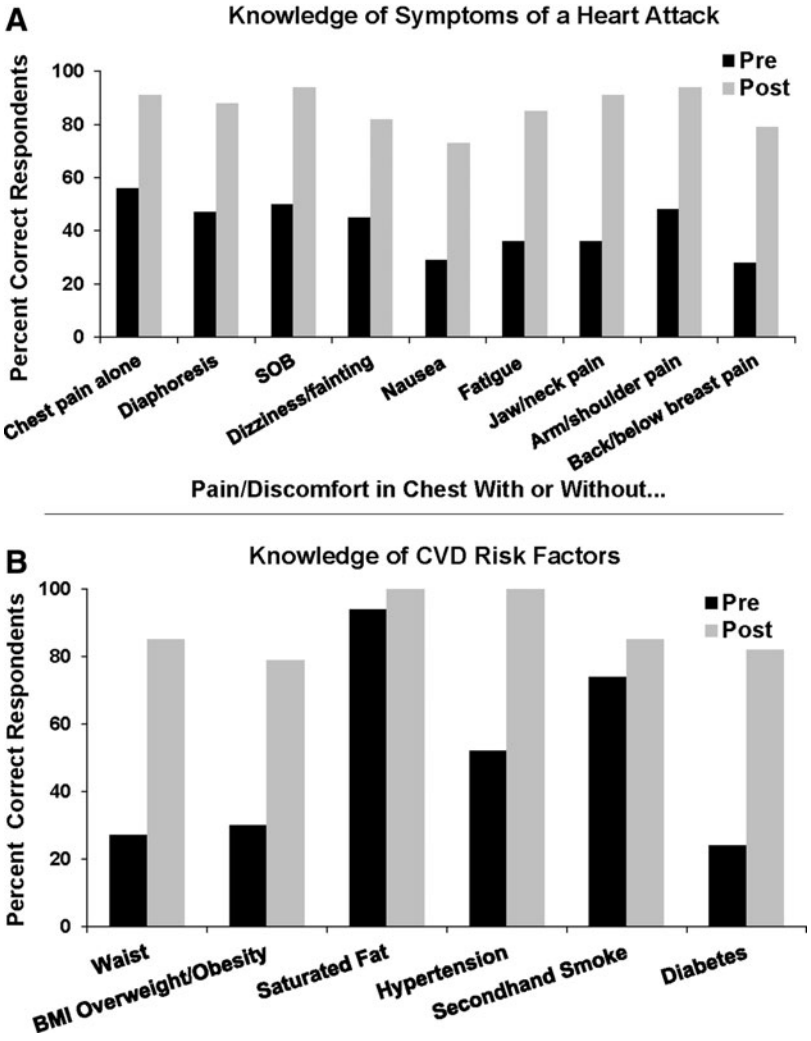

FIG. 2. Changes in knowledge of CVD symptoms and risk factors. Study participants completed pre- and postintervention surveys assessing their knowledge of risk factors for and symptoms of CVD. **(A)** Knowledge of heart attack symptoms, including pain/discomfort in the chest with or without the other symptoms listed. **(B)** Knowledge of CVD risk factors. Data are expressed as the percentage of respondents who answered the question correctly. The gains in knowledge were statistically significant for all symptoms and risk factors compared to baseline ($p < 0.05$).

At baseline, participant knowledge of heart-healthy behaviors and effective lifestyle-modification strategies (e.g., how to reduce sodium and fat in the diet and increase physical activity) was low. Postintervention, there was significant improvement in adoption of all heart-healthy behaviors. Over the 4-month program, the percentage of respondents who opted for low-sodium dietary choices increased from 44% to 78% (Fig. 3A). Similarly, the percentage of respondents adopting a low-cholesterol/low-fat diet increased from 56% to 89% (Fig. 3B). Risk- modification behaviors related to weight management improved the most, with 100% of respondents engaged in weight-management strategies by the end of the intervention, compared to only 50% preintervention (Fig. 3C). CVD risk behaviors related to physical activity also improved in the cohort over the course of the intervention, such that the percentage of study participants who engaged in some sort of physical activity either at work or at home increased by 26% and 46%, respectively.

At baseline, participants had clinical risk-factor levels above the recommended cut points for women[33] for the following (cohort mean levels): BMI (30 kg/m^2), waist circumference (38 inches), TC (208 mg/dL), and LDL cholesterol (127 mg/dL). FBS levels in the cohort were very minimally elevated (101 mg/dL). Although clinical parameters improved following the study program, the educational intervention was most successful in reducing TG levels, which declined by 11% in the cohort overall. Subgroup analysis of subjects with baseline hypertriglyceridemia (TG ≥ 150 mg/dL), demonstrated a significant ($p < 0.05$) 21% reduction in serum TG levels (from 193 to 152 mg/dL) during the 4 months of the intervention (result not shown).

Analysis of the serum levels of proinflammatory markers revealed markedly elevated baseline levels (means $\pm$ standard error of the mean [SEM]) in the study cohort for IL-12 (108 ± 10.3 pg/mL), hsCRP (9.51 ± 2.24 mg/L), and TNF-α (16.9 ± 1.11 pg/mL), indicating a high inflammatory burden in study participants. As a result of the intervention, there was a significant ($p < 0.05$) 20% reduction in levels of TNF-α that declined to a mean of 13.5 ± 0.8 pg/mL (Fig. 4). IL-12 and hsCRP were not improved by the intervention in our study group.

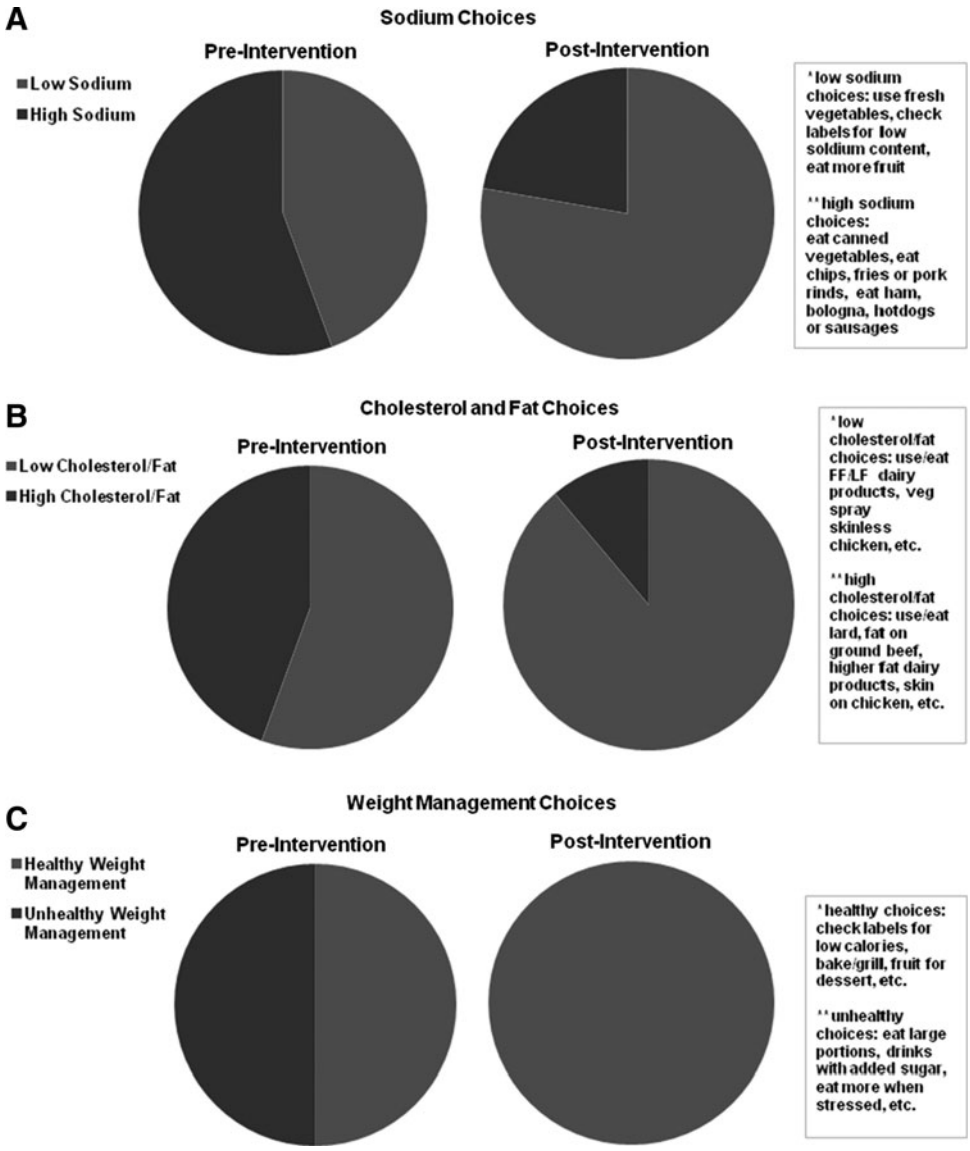

FIG. 3. Adoption of heart-healthy lifestyle behaviors. Study participants completed pre- and postintervention surveys assessing their knowledge of risk-factor modification strategies for CVD and their lifestyle behavior choices concerning sodium intake, cholesterol and fat intake, weight management, and physical activity. **(A)** Comparison of the percentage of participants making low- versus high-sodium food choices at the pre- and postintervention time points. **(B)** Comparison of the percentage of participants making low- versus high-cholesterol and high-fat food choices at the pre- and postintervention time points. **(C)** Comparison of the percentage of participants making healthy versus unhealthy weight-management choices at the pre- and postintervention time points. More participants adopted heart healthy behaviors post- versus preintervention.

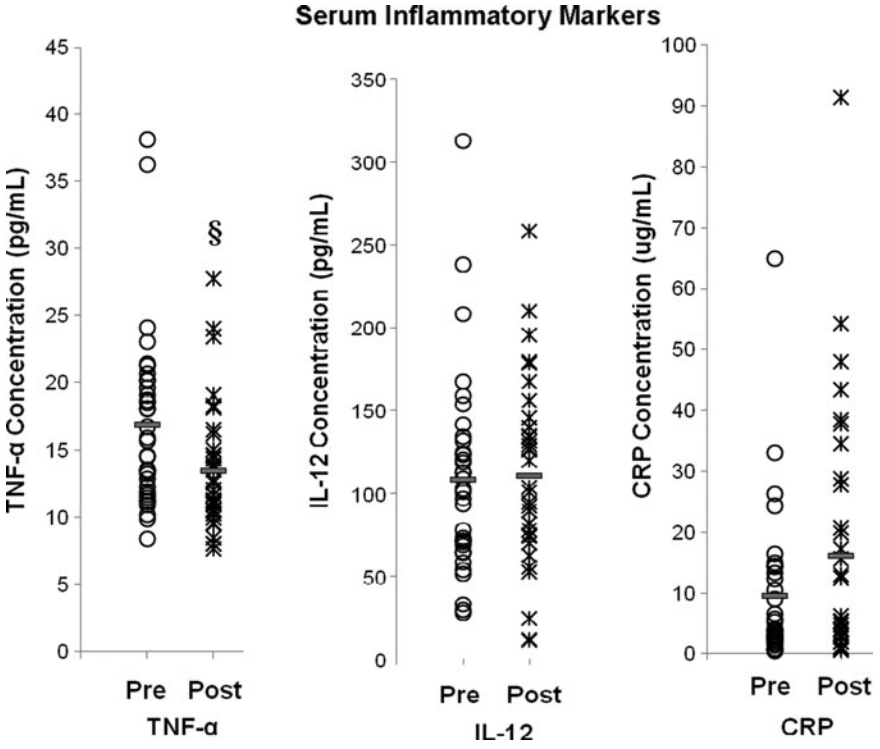

FIG. 4. Changes in serum inflammatory markers. Pre- and post-intervention serum enzyme-linked immunoassay (ELISA) analysis of the tumor necrosis factor (TNF)-α, interleukin (IL)-12, and C-reactive protein (CRP). Data are represented as individual results for each of the participants; $p < 0.05$ for pre- versus post-TNF-alpha.

MetS, a clustering of CVD risk factors, confers increased CVD risk and in women is defined by the AHA as three of the following five risk factors: waist ≥35 inches, BP ≥135/85 mm Hg, TG ≥150 mg/dL, HDL <50 mg/dL, and FBS ≥100 mg/dL.[34] In our cohort, the order of prevalence for each of the diagnostic criteria for the MetS was as follows (highest to lowest prevalence): central adiposity, low HDL cholesterol, elevated TG levels, elevated SBP, and elevated FBS. At baseline, the MetS was highly prevalent (43%); as a result of the 4-month educational intervention, prevalence was reduced to 37% (p = not significant[ns]), driven primarily by a 31% reduction in FBS.

Discussion

Awareness and knowledge of cardiovascular disease, personal risk factors, and effective therapeutic lifestyle changes are essential for empowering women to adopt heart-healthy lifestyles, modify risk, and prevent cardiovascular disease. However, culturally relevant and effective models for change and empowerment are lacking for Latina women. Herein, we demonstrate a successful pilot program that resulted in increased participant awareness of the symptoms of a heart attack and accessing rapid emergency care by calling 911; knowledge of the major risk factors for CVD and how to modify them through heart-healthy behaviors (diet, weight management, and physical activity); the control of CVD risk factors; and an improvement in the cardiometabolic and inflammatory risk profile of participants. Implications of our findings are discussed in the context of the theme of delivery of health education to minority and at-risk women.

Our group of Latinas had significant and similar knowledge gaps to those reported in national studies,[35] particularly for diabetes and overweight/obesity, yet higher awareness of the importance of calling 911 than previously reported.[35] The latter may reflect local factors, including the influence of local and public media efforts. The overall lack of CVD risk awareness is likely the result of the complex interplay of cultural factors, access to care, health beliefs, sociodemographics, and others and highlights the importance of continued public health educational efforts at the local and national levels. The program was particularly effective at improving knowledge and awareness of CVD risk factors and adoption of heart-healthy behaviors. Participants knew that they were part of a group evaluating the effects of a CVD- prevention program, and this awareness may have biased our results; women participated in the program despite limited free time and competing demands, owing to a strong personal desire to improve their health and that of their families.

Cardiovascular risk factors are highly prevalent in women and Latina women.[9,35–37] Indeed, in our cohort, there was a relatively high prevalence of MetS, a significant CVD risk modifier.[34,38,39] Herein, we characterize the relative prevalence of the clinical variables accounting for MetS in this population. We further demonstrate that improved knowledge and awareness not only has a beneficial impact on lifestyle behaviors but also reduces cardiometabolic risk and improves clinical risk factors, especially for triglycerides. Thus, the community-based education and prevention program we piloted and tested in Latinas may be an effective model of health education to reduce prevalence of MetS.

Inflammation is a hallmark of cardiovascular disease, a marker of subclinical disease in the vasculature, and a purported early risk predictor of CVD.[33,40–42] Our intervention improved the inflammatory profile for TNF-α, which is activated in subclinical cardiovascular disease, and involved in a number of deleterious cardiovascular mechanisms,

including atherosclerosis, ischemia, reperfusion injury, and heart failure.[27,40,43] Although the effectiveness of an educational intervention to reduce inflammatory risk profile has previously been shown in other populations,[44] this is, to our knowledge, the first report in Latina women in a community setting.

Regarding lessons learned and limitations of our work, voluntary feedback and completion of evaluation forms by study participants revealed that the educational program was well received. In addition, participants uniformly indicated satisfaction with the design, content, and delivery of the curriculum. Constructive suggestions included extending the program length and duration to permit a long-term report on sustainability of adoption of health behaviors. However, our previous work with other high-risk women reported that gains following a 4-month educational intervention were sustained for an additional 3 months of follow-up.[25] Future efforts need to balance program duration against the potential for an adverse impact on participant retention.

In conclusion, we have described and piloted a unique, comprehensive, bilingual, and successful educational curriculum designed for CVD prevention and have demonstrated its efficacy in improving heart-disease awareness, adoption of heart-healthy behavior, cardiometabolic risk, and inflammatory burden in Hispanic/Latina women. Although we cannot establish causality, this community-participatory approach could lead to risk reduction for the subsequent development of CVD. Future CVD interventions and initiatives aimed at Latina women should consider providing education that is both culturally relevant and delivered in a bilingual manner. In this article, we have provided one such curriculum to attain this goal. We have also provided and conceptualized a systems-approach model (Fig.1) to community-based CVD prevention with potential for broad applicability to women, communities, public health stakeholders, and clinician providers.

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Author Disclosure Statement

The authors have no conflicts of interest.

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