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Irene S. Pollin
Sister to Sister, Everyone Has a Heart Foundation

Brian G. Kral
The Johns Hopkins Ciccarone Preventive Cardiology Center

Teresa Shattuck
Shattuck & Associates, Inc.

Michele Debarthe Sadler
Shattuck & Associates, Inc.

Jennifer R. Boyle
The College at Brockport, jboyle@brockport.edu

See next page for additional authors

Authors
Irene S. Pollin, Brian G. Kral, Teresa Shattuck, Michele Debarthe Sadler, Jennifer R. Boyle, Laurene McKillop, Catherine Campbell, Dominique Ashen, Khurram Nasir, Rita F. Redberg, Karlynn BrintzenhofeSzoc, Roger S. Blumenthal, and Erin D. Michos

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High Prevalence of Cardiometabolic Risk Factors in Women Considered Low Risk by Traditional Risk Assessment

Irene S. Pollin, Ph.D., M.S.W.,[1] Brian G. Kral, M.D., M.P.H.,[2] Teresa Shattuck, Ph.D.,[3] Michele Debarthe Sadler, Ph.D.,[3] Jennifer R. Boyle, Ph.D.,[3] Laurene McKillop, Ph.D.,[1] Catherine Campbell, M.D.,[2] M. Dominique Ashen, Ph.D., CRNP,[2] Khurram Nasir, M.D., M.P.H.,[4] Rita F. Redberg, M.D.,[5] Karlynn BrintzenhofeSzoc, Ph.D., M.S.W., OSW-C,[6] Roger S. Blumenthal, M.D.,[2] and Erin D. Michos, M.D., M.H.S.[2]

Abstract

Background: Cardiovascular disease (CVD) is the leading cause of death in women in the United States. The purpose of this study was to characterize the prevalence and awareness of traditional CVD risk factors, obesity, and coronary heart disease (CHD) risk classification using the Framingham Risk Score (FRS) among women attending the 2006 Sister to Sister National Woman's Heart Day event.

Results: A total of 8936 participants (mean age 49 ± 14 years) were evaluated. There was a modest prevalence of traditional risk factors on screening, including non-high-density lipoprotein-cholesterol (HDL-C) >160 mg/dL (27%), HDL-C <40 mg/dL (16%), random glucose level >140 mg/dL (6%), uncontrolled blood pressure ≥140/90 mm Hg (12%), current smoking (6%), and a positive family history of CHD (21%). There was a high prevalence of overweight (39%) or obese individuals (35%) (body mass index [BMI] 25–30 and ≥30 kg/m^2, respectively), as well as those with high waist circumference (≥35 inches) (55%). Women were classified by FRS as low (85%), intermediate (6%), and high risk (9%). When cardiometabolic risk analyses included waist circumference in addition to the FRS, 59% of low-risk and 50% of intermediate-risk women had 1 or 2 risk factors, and 19% and 41% had ≥3 risk factors, respectively. Women were often unaware of risk factors on screening; among women without a previous diagnosis of dyslipidemia or hypertension, 48% and 7%, respectively, were given new diagnoses.

Conclusions: Women participating in the 2006 Sister to Sister National Woman's Heart Day event have a high prevalence of cardiometabolic risk factors, especially dyslipidemia, obesity, and high central adiposity, that place them at higher risk for the development of CVD and other comorbidities. The newly identified multiple risk factors in this population support the value of community health screening in women.

Introduction

Cardiovascular disease (CVD) has been the leading cause of death among women for nearly a century, with women having higher CVD mortality rates than men yearly since 1984.[1] Women account for more than half of the nearly 1 million CVD deaths per year in the United States.[2] Cardiometabolic risk factors that contribute to the development of clinically significant CVD and other comorbidities are often unrecognized by women and their physicians, and risk factors are often undertreated when they are recognized.[3–5] As >25% of sudden cardiac death occurs among individu-

[1]Sister to Sister, Everyone Has a Heart Foundation, Bethesda, Maryland.
[2]The Johns Hopkins Ciccarone Preventive Cardiology Center, Baltimore, Maryland.
[3]Shattuck & Associates, Inc., Mt. Airy, Maryland.
[4]Massachusetts General Hospital Cardiac MRI PET CT Program, Boston, Massachusetts.
[5]Division of Cardiology, University of California San Francisco, San Francisco, California.
[6]Catholic University of America, National Catholic School of Social Service, Washington, DC.
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als with no prior symptoms of CVD, it is imperative to identify risk factors for CVD and implement preventive strategies, such as lifestyle changes.[2]

Although progress has been made in raising awareness about heart disease, nearly half of all women fail to realize the association between risk factors, such as high blood pressure, and their own risk of developing CVD.[6] In a recent study examining physicians' awareness of CVD in women, researchers found that <1 in 5 physicians were aware that more women than men die each year from CVD; it is noteworthy that cardiologists represented one third of the sample.[7]

The purpose of this study is threefold: first, to characterize the cardiometabolic risk profiles, including waist circumference (WC), of women attending the 2006 Sister to Sister National Woman's Heart Day event; second, to examine the participants' predicted 10-year risk of hard coronary heart disease (CHD) events by the Framingham Risk Score (FRS); and third, to establish the proportion of women attending the Heart Day event who had newly identified risks for CVD. Sister to Sister is a national grassroots, nonprofit foundation that educates women about heart disease and provides free cardiovascular risk screenings in an effort to encourage women to make necessary lifestyle changes to prevent or reduce their risk of heart disease.

Materials and Methods

Design and subjects

On February 17, 2006, the Sister to Sister, Everyone Has a Heart Foundation held its annual free public screening event in 14 cities across the United States. A total of 9404 women underwent screening at this event, which had been publicized during the prior month in local newspapers, by public service advertisements on television and radio, and by other grassroots outreach efforts. The screening included a standardized questionnaire, a physical screening for standardized cardiometabolic risk factors, receipt of health education materials, and counseling. Health education materials included national standardized education materials about lifestyle approaches to risk reduction based on the American Heart Association (AHA) Evidence-Based Guidelines for Cardiovascular Disease Prevention.[8] Participants also could view demonstrations by nutrition and fitness professionals and learn about lifestyle changes to improve heart health. Each individual was counseled by trained healthcare staff on their risk profile. Bilingual staff was available in 12 of the 14 cities.

All participants of the screening event were included in the study with the exception of men ($n = 442$), respondents with missing age data ($n = 262$), and women who were outside established age ranges: <18 years ($n = 27$) and >80 years ($n = 179$).

Standardized questionnaire

The standardized questionnaire was designed to gather demographic data, medical history, medication use, and family history of CHD. Family history of premature CHD was defined as having a first-degree relative (parent, child, or sibling) with a heart attack, coronary bypass, or angioplasty before the age of 55 in male relatives or before the age of 65 in female relatives. A personal history of CVD was defined as a self-reported history of CHD, heart attack, stroke, peripheral arterial disease, carotid artery stenosis, angioplasty, coronary stent, or bypass surgery. Unfortunately, data about hormone therapy was not collected.

Cardiometabolic risk factor screening

The physical screenings included measurement of the following cardiometabolic risk factors: blood pressure, body mass index (BMI), WC, random nonfasting glucose, and nonfasting total cholesterol and high-density lipoprotein cholesterol (HDL-C). Standardized protocols for screening assessment of the cardiometabolic risk factors listed were consistent with the previously developed methods published from the 2005 Sister to Sister, Everyone Has a Heart screening program.[9] Newly defined hypertension was defined as a systolic blood pressure ≥140 mm Hg or diastolic blood pressure ≥90 mm Hg or both. Non-HDL-C was defined as total cholesterol minus HDL-C. Dyslipidemia was defined by having a non-HDL-C >160 mg/dL or an HDL-C <50 mg/dL; the latter was chosen because this is the level of HDL-C that is considered low for women in the National Cholesterol Education Program (NCEP) definition of metabolic syndrome.[10]

Non-Asian women with a WC ≥35 inches or Asian women with a WC ≥31 inches were defined as having increased central adiposity.[11] Women with a BMI between 25 and 29.9 kg/m^2 were defined as overweight, and those with a BMI ≥30 kg/m^2 were defined as obese. Increased central adiposity by WC was used in assessment of cardiometabolic risk[11] except in 915 women (10.7% of sample population) in whom WC was not obtained; in these cases, a conservative measurement of BMI ≥30 was used instead.

Framingham risk score

An FRS was calculated for each participant using the NCEP Adult Treatment Panel (ATP) III algorithm to determine predicted 10-year risk for hard CHD events (fatal and nonfatal myocardial infarction [MI]). Individuals were classified as high, intermediate, or low risk by FRS defined by a 10-year CHD risk of >20%, 10%–20%, or <10%, respectively.[10]

Data management and statistics

All data were collected on standardized screening forms and entered into a Microsoft ACCESS database by city. Data were then transferred into an SPSS file (SPSS, Inc., Chicago, IL) and merged into one aggregate file. Analysis was conducted using SPSS version 11.0.1. Nominal data are presented as number and percent of total. Continuous data are presented as mean with standard deviation (SD). Frequency and cross-tabulations were conducted to examine relationships among numbers of risk factors, individual risk factors, and Framingham Risk estimate.

Results

The study population consisted of 8936 women aged 18–80 years (mean 49 ± 14 years) of diverse demographic and clinical characteristics (Table 1). Nearly two thirds of participants were members of a racial/ethnic minority group. The

Table 1. Demographic and Clinical Characteristics of Female Participants

Characteristic	*Number (n = 8936)*	*%*
Sociodemographic characteristics		
Race/ethnicity		
White	3212	36
African American	3447	39
Hispanic	1318	15
Asian	397	4
Other	352	4
Missing	210	2
Age groups (years)		
18–<40	2320	26
40–<50	2122	24
50–<60	2423	27
60–<79	2071	23
Completed 2–4 years of college or certification program	5006	56
Clinical characteristics		
Cardiovascular disease	359	4
Heart attack/blocked arteries in heart or brain	216	2
Angioplasty or stent	86	1
Coronary bypass surgery	43	1
Stroke or carotid artery disease	134	2
Diabetes	518	6
History of high blood pressure	2519	28
History of high cholesterol	2263	25
Faily history of CHD	1887	21
Taking medication		
Cholesterol	1076	12
Blood pressure	1967	2
Diabetes	453	5
Blood thinner	182	2
Aspirin	1560	18
Herbal therapies, nutritional supplements, or vitamin supplements to prevent heart disease	892	10
Smoker		
Current smoker	532	6
Past smoker	1147	13

age and racial distributions of the 2006 participants were similar to those of women attending the 2005 screening day.[9] Only 4% of the study participants ($n = 359$, mean age 57 ± 13 years) reported a previous diagnosis of CVD. Of those, 73% reported a history of heart attack or coronary artery revascularization procedure, and 37% reported a history of carotid artery disease or stroke. Medication and supplement use was reported by 40% of all respondents. Of these individuals, 25% reported taking an herbal, nutritional, or vitamin supplement to prevent heart disease. One fifth of all participants reported a family history of premature CHD (21%), and over a quarter (28%) reported a history of high blood pressure.

Screening results (Table 2) demonstrated that 27% of women had high non-HDL-C, 40% had low HDL-C, and 33% had a history of high blood pressure or newly diagnosed high blood pressure (Tables 1 and 2). Over half (58%) of women fell into the prehypertension category (blood pressure ≥120/80 but < 140/90 mm Hg). Based on BMI measures, three quarters of all women were deemed to be overweight (39%) or obese (35%). WC was elevated in 55% of participants.

Participants without a previous a history of CVD were stratified by FRS (Table 3). Results demonstrate that 85% were considered low risk by FRS (<10 % 10-year hard CHD risk). When cardiometabolic factors, including increased WC (or obesity in cases of missing data), were added to the traditional risk factors defining the FRS (Table 4), of those women classified by FRS as low risk, 19% had ≥3 risk factors, and among those classified as intermediate risk, 41% had ≥3 risk factors. In women with low FRS, obesity was the most prevalent cardiometabolic risk factor (Table 5).

When comparing risk factor levels between women with and without a WC measurement, several differences emerged. Women without a WC measure were significantly more likely than those with a measure to be older ($p < 0.0001$), to have higher diastolic blood pressure ($p < 0.008$), and to have a lower BMI ($p < 0.0001$). There were no differences in measures of systolic blood pressure, total cholesterol, or HDL-C.

Many women learned of previously undiagnosed risk factors by screening (Fig. 1). Among women without a previous diagnosis of hypercholesterolemia, 36% had a non-HDL-C >160 mg/dL, 38% had an HDL-C <50 mg/dL, and 48%

Table 2. Frequency of Cardiometabolic Risk Factor Levels

	n	%
Non-HDL cholesterol (mg/dL)		
≤160	6545	73
>160	2387	27
HDL-cholesterol (mg/dL)		
<40	1391	16
40–49	2113	24
≥50	5428	61
Random glucose (mg/dL)		
≤140	8396	94
>140	516	6
Blood pressure (mm Hg)		
<120/80	2738	31
120–139/80–89 (prehypertensive)	5155	58
≥140/90 (hypertensive)	1033	12
BMI (kg/m^2)		
<25	2354	27
25–29.9 (overweight)	3459	39
≥30 (obese)	3082	35
Waist circumference (in)		
<35	3583	45
≥35	4395	55

had an abnormal non-HDL-C or HDL-C. Among women with no prior history of hypertension, 7% were found to have a blood pressure ≥ 140/90 mm Hg.

Discussion

Cardiometabolic risk factors and FRS

This study demonstrates that multiple cardiometabolic risk factors are extremely prevalent in women participating in a community health screening even among a population of presumed generally healthy women, where 85% of participants fell into the low 10-year CHD risk category by the FRS. Among these low-risk women, notably, the most prevalent risk factor was being overweight, with 50% having an increased WC. The high prevalence of obesity was followed by the relatively high prevalence of low HDL-C (38%), high non-HDL-C (21%), and family history of premature CHD (20%). When increased central adiposity or obesity was included in risk assessment among women classified low-risk by the FRS, 59% had 1 or 2 risk factors, and an additional 20% had ≥3 risk factors. About a third of the low-risk women with an elevated random glucose or hypertension or who were smokers had ≥3 other risk factors (34%, 26%, and 28% respectively). It is important to note, though, that the FRS predicts 10-year CHD risk and not total CVD risk. These findings highlight that many of these low-risk women by the FRS have high lifetime risk of metabolic syndrome and CVD. Other smaller studies have reported similar findings.[12,13]

Table 3. Framingham Risk Level[a]

Framingham risk level	n	%
Low	7226	85
Intermediate	489	6
High	811	9
Total	8526	100

[a]Excludes participants with CVD (n = 359).

Recent data from the Framingham Heart Study of women free of CVD at 50 years of age found that lifetime risk for CVD events was 40% for women, which exceeds the lifetime risk of breast cancer, lung cancer, and colorectal cancer combined.[14] Unfortunately, few women in the Framingham Study had optimal levels of risk factors at age 50 (5%). Only 8% of women without risk factors at age 50 developed CVD events compared with 50% of women with ≥2 risk factors; thus, low-risk CVD status at 50 years of age conferred upon low-risk women an excess of 8 years of survival.[14] The presence of any risk factor at age 50 increases the lifetime CVD risk in women, with the presence of diabetes conferring the greatest risk (57% risk of developing CVD through 75 years of age). This reinforces the importance of preventive efforts, such as lifestyle modifications, to begin early in life; even the presence of a single major risk factor by middle age is associated with shorter survival.

The low-risk classification of these women with high lifetime risk of CVD has important clinical implications, as the NCEP Guidelines for use of aspirin and lipid-lowering medication in primary prevention are based on the FRS for hard CHD events.[10] Because more points are assigned to chronological age in the FRS risk prediction, younger individuals typically have very low 10-year risks but may still have substantial lifetime risks. Low risk is not the same as no risk, but the label of low risk status by the FRS can potentially lead to false reassurance and may lower motivation to engage in lifestyle modifications. Furthermore, in a recent study, physicians were significantly more likely to assign intermediate-risk women than intermediate-risk men to the low-risk category.[7] Assignment of risk level significantly predicted the types of lifestyle changes and preventive pharmacotherapy that physicians would recommend,[7] as patients with a low FRS were significantly less likely than patients with an intermediate or high FRS to receive counseling about physical activity and diet. Even when their FRS is comparable, women receive fewer prevention recommendations, such a lipid-lowering therapy, aspirin, and lifestyle advice, than do men.[7,15]

The recent AHA 2007 Updates to the Cardiovascular Preventive Guidelines for Women[8] acknowledged some of the limitations of FRS and, therefore, recommended a new scheme for CVD risk classification in women of high risk, at-risk, and

Table 4. Comparison of Framingham Risk Scores and Number of Cardiometabolic Risk Factors[a]

Number of CVD risk factors	*Framingham risk score*					
	Low		*Intermediate*		*High*	
	n	%	n	%	n	%
0	1600	22	47	10	70	9
1–2	4231	59	242	50	359	45
≥3	1369	19	197	41	378	47

[a]Cardiometabolic risk factors include hypertension (≥140/90 mm Hg); non-HDL-cholesterol (>160 mg/dL); HDL-cholesterol (<50 mg/dL); non-fasting glucose (>140 mg/dL); smoker; family history; WC ≥35 inches (≥31 inches for Asian women) or, if no WC measure, BMI ≥30 kg/m^2.

TABLE 5. LOW FRAMINGHAM RISK SCORE AND SPECIFIC CARDIOMETABOLIC RISK FACTORS

Risk factor	% of low-risk women with risk factor	Number of other risk factors					
		0		1–2		3 or more	
		n	%	n	%	n	%
Non-HDL cholesterol (>160 mg/dL)	21	311	14	1527	67	442	19
HDL-cholesterol (<50 mg/dL)	38	618	19	2217	67	495	15
Hypertension (≥140/90 mm Hg)	11	91	9	634	65	248	26
Random glucose (>140 mg/dL)	5	54	11	257	54	163	34
Smoking	4	66	13	299	59	141	28
WC[b]	50	1047	24	2822	64	531	12
Family history	20	351	20	1069	61	333	19

[a]Number of other risk factors excludes the current risk factor.
[b]WC ≥ 35 inches (≥31 inches for Asian women) or if no WC measure, BMI ≥30 kg/m^2.

optimal risk. Whereas women with established CVD and diabetes still fell into the high-risk category, women who have even one major CVD risk factor were acknowledged to be at increased lifetime risk for CVD. Other women at increased lifetime risk of CVD include those with evidence of subclinical CVD with or without risk factors, poor exercise capacity, or unhealthy lifestyles including poor diet, reduced physical activity, and obesity.[8] Optimal risk in the AHA prevention guidelines was considered to be an FRS < 10% and a healthy lifestyle with no CVD risk factors. The addition of an optimal risk category can be used to reassure some women while motivating others.

Obesity and risk

Obesity is a significant CVD risk factor in nearly all the world's populations.[16] Additionally, obese persons are more likely to develop the comorbid conditions of type 2 diabetes mellitus, dyslipidemia, hypertension, osteoarthritis, gallbladder disease, liver disease, and certain cancers.[17] Along with traditional risk factors of elevated blood pressure, blood glucose, and lipid levels, WC can further aid in identifying patients at risk for CVD in a primary care setting.[18] Identification of obesity and central adiposity at an earlier age presents an opportunity for risk reduction through targeted interventions well before CVD or other comorbidities become clinically manifest.

Studies have demonstrated that active women have lower CVD risk than inactive women, and even light to moderate activity is associated with CVD risk reduction.[19,20] A reduction in WC by caloric restriction and increased amount of moderate intensity activity may directly reduce the cardiometabolic risk profile of obese individuals.[21] Accordingly, the NIH Guidelines recommend a combination of a low-calorie diet, increased physical activity, and behavioral therapy as the first-line intervention for weight loss and weight maintenance in overweight persons with risk factors or in the obese.[22]

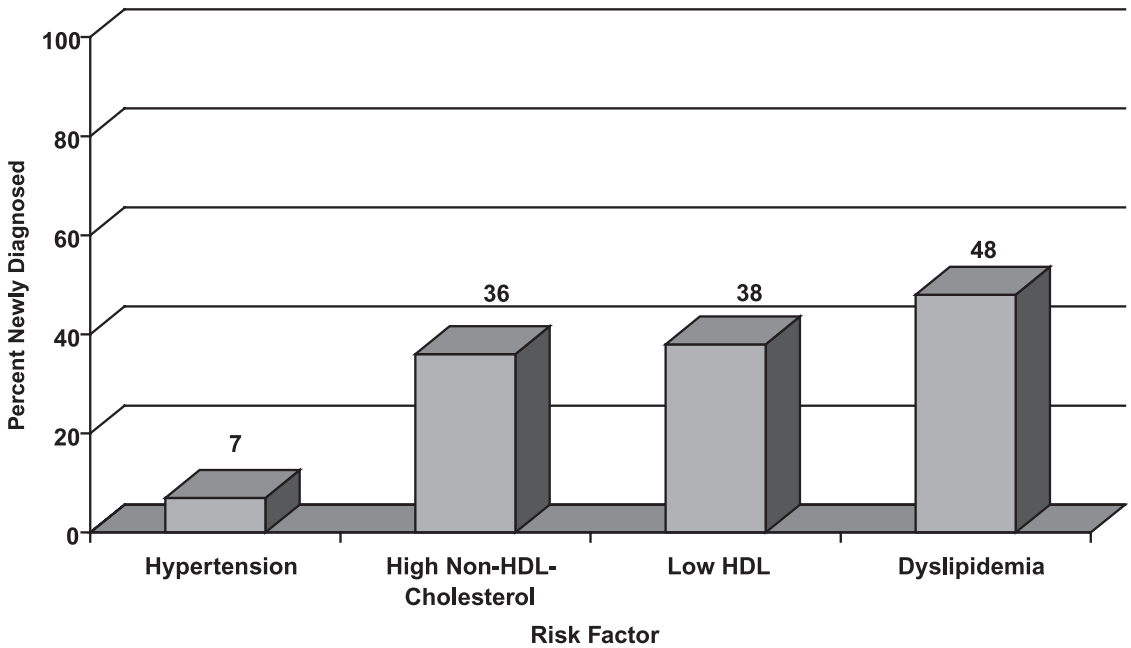

FIG. 1. Percent of newly identified risk factors during health screening.

Value of screening events

The results of this study support the value of screening events in raising awareness of the causes of heart disease. Cardiometabolic risk factors were common in this cohort. In addition, 48% of women with no previous diagnosis of dyslipidemia and 7% with no prior diagnosis of hypertension were found to be at risk at the screening event compared with 47% with newly diagnosed dyslipidemia and 16% newly diagnosed hypertension in the 2005 Sister to Sister screening day.[9] These results support the literature showing that a large number of women continue to be at high lifetime cardiovascular risk.[14]

Fortunately, women are becoming more aware of the dangers of heart disease. In a 2006 AHA survey, 57% of women correctly responded that heart disease is the number one killer of women, up from 34% in 2000.[23] This AHA survey also demonstrated that a woman's knowledge about her personal risk of heart disease was correlated with increased action to modify risk. However, about one third of women significantly underestimated their personal risk.

A woman's knowledge about personal risk previously correlated with increased action to lower that risk.[6] Follow-up data in a random subpopulation of women attending the 2006 Sister to Sister National Woman's Heart Day event (n = 157) reinforce these findings. Almost three quarters (72%) of the follow-up sample reported following up on recommendations made at the screening day to see a healthcare provider. Most of these (71%) reported going to a doctor's office for this follow-up care. In addition, the results indicate these women took additional steps to reduce CVD risk. For example, since attending the Heart Day event, 64% reported changing their diet, 47% losing weight, 23% measuring their waistline, 61% monitoring their blood pressure, 61% increasing their physical activity, 6% stopping smoking, and 20% starting stress management strategies.

Study limitations

Over 8900 women across 14 cities were represented in this study, but these women were not necessarily representative of the general population of American women. Self-selection to participate may lead to a source of bias in the sample, although a strength of this study is that data were collected from a community sample and may be less influenced by healthy volunteer bias. Additional research should be conducted with other demographic groups, such as specific racial/ethnic, age, and socioeconomic groups to validate the results of the study.

Measurement error is another possible limitation of the study. Although steps were taken to minimize error, such as standardized screening protocols across measurement sites, the possibility still exists that some risk factors were misclassified. Approximately 1 in 10 women in this study opted out of the WC measurement. This suggests that this measurement may not be suitable for all settings and that the percentage of women with increased WC in our sample may be underestimated.

There were significant limitations on how risk factors were diagnosed. Although the NCEP advises a 9–12-hour fast before cholesterol screening is performed, the diagnoses of dyslipidemia and hyperglycemia in this study were made based on a single nonfasting blood draw. In addition, hypertension was diagnosed by an elevated blood pressure on a single screening day, but per the AHA guidelines, hypertension should be confirmed with at least two other measurements on two or more separate visits after the initial screening. Finally, past medical history was self-reported by participants. A woman might not have reported a prior history of dyslipidemia or hypertension, whereas medical records if available might have reflected otherwise, which may have influenced our determination of the prevalence of newly diagnosed risk factors. However, even if these risk factors had been previously diagnosed in their medical records, the women with newly diagnosed risk factors were unaware of these risk factors and were not at optimal goals.

Conclusions

A high percentage of women attending the 2006 National Woman's Heart Day event were found to have modifiable cardiometabolic risk factors. The majority of women were found to have a low global risk by FRS despite having multiple cardiometabolic risk factors, suggesting that evaluation of other risk factors should be used in conjunction with the FRS to fully estimate a woman's risk for CVD. Identification of multiple risk factors in women participating in this study demonstrates the value of screening events, such as the Sister to Sister, Everyone Has a Heart Foundation free public screening events. Indeed, limited follow-up with a subset of the participants indicated that many of them took actions after the Heart Day Event to reduce their CVD risk.

Disclosure Statement

There are no conflicts of interest.

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Address reprint requests to:
Erin D. Michos, M.D., M.H.S.
Johns Hopkins Ciccarone Center for the Prevention of Heart Disease
Carneige 568
600 North Wolfe Street
Baltimore, MD 21287

E-mail: edonnell@jhmi.edu