Published in final edited form as:
Clin Cardiol. 2013 March ; 36(3): 133–138. doi:10.1002/clc.22092.

Women at Risk for Cardiovascular Disease Lack Knowledge of Heart Attack Symptoms

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SUMMARY

Background—It is not known whether cardiovascular disease (CVD) risk level is related to knowledge of the leading cause of death of women, or heart attack symptoms.

Hypothesis—Women with higher CVD risk estimated by Framingham Risk Score (FRS) or Metabolic Syndrome (MS) have lower CVD knowledge.

Methods—Women visiting primary care clinics completed a standardized behavioral risk questionnaire. Blood pressure, weight, height, waist size, fasting glucose and lipid profile were assessed. Women were queried regarding CVD knowledge.

Results—Participants (n=823) were Hispanic women (46%), Non-Hispanic White (37%), Non-Hispanic Black (8%). FRS was determined in 278: low (63%), moderate (29%), and high (8%); 24% had ≥3 components of MS. The leading cause of death was answered correctly by 54%, heart attack symptoms by 67%. Knowledge was lowest among racial/ethnic minorities and those with less education (both p<0.001). Increasing FRS was inversely associated with knowing the leading cause of death (low 72%, moderate 68%, high 45%, p=0.045). After multivariable adjustment, moderate/high FRS was inversely associated with knowing symptoms (moderate OR 0.52, 95% CI 0.28–0.98, high OR 0.29, 95% CI 0.11–0.81), but not the leading cause of death. MS was inversely associated with knowing the leading cause of death (p<0.001) or heart attack symptoms (p=0.018), but not after multivariable adjustment.

Conclusions—Women with higher FRS were less likely to know heart attack symptoms. Efforts to target those at higher CVD risk must persist or the most vulnerable may suffer disproportionately, not only because of risk factors, but also inadequate knowledge.

Keywords

Cardiovascular disease knowledge; women's health; Metabolic Syndrome; Framingham Risk Score

INTRODUCTION

Knowledge of cardiovascular disease (CVD) among women continues to be suboptimal despite advances made in the last fifteen years as a result of educational and public awareness efforts. While awareness of the leading cause of death increased between 1997

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CONFLICTS
The authors have no conflicts of interest.

and 2009, there is room for improvement.(1, 2) Moreover, CVD knowledge remains lower among Hispanic and African-American women.(3, 4)

Improving CVD knowledge remains an important goal, as it is integral to promoting healthy lifestyles and preventing disease. Barriers to increased awareness include low levels of education, low health literacy, low socioeconomic status, shortcomings in clinician and public health education, and systems-level barriers.(5, 6) Presumably, women at highest risk for CVD receive education about cardiovascular disease and while improving CVD knowledge may improve CVD outcomes (7), there is conflicting data about whether cardiovascular risk level is associated with the level of CVD health knowledge. One study reported that a higher risk for stroke was associated with more knowledge about stroke risk factors (8), while others have shown no significant difference (9, 10), or an inverse relationship.(11, 12) Although one study found that increased cardiovascular risk was associated with less knowledge of heart attack symptoms (13), there is overall little data regarding the relationship between CVD risk level and knowledge about CVD.

While cardiovascular mortality among young women, ages 35 to 54 years decreased from 1989 to 2000, mortality increased between 2000 and 2002 (14) signaling a need to emphasize primary prevention. Among patients without known cardiovascular disease, research has helped to identify those at risk for future CVD and mortality by defining Framingham Risk Score (FRS)(15, 16) and Metabolic Syndrome (MS).(17) Less is known about whether risk is related to knowledge. It is not known whether cardiovascular risk among women is associated with CVD knowledge.

Accordingly, the goal of this study was to examine the association between cardiovascular risk in women without known CVD, an important target for primary prevention, and their knowledge about CVD. We focused on the leading cause of death in women and symptoms of a heart attack, initiated by the American Heart Association and Healthy People 2010, (18) continuing to Healthy People 2020. (19) Given that obesity has been identified as a modifiable CVD risk factor (20), and that FRS and MS are used to predict risk for CVD, we sought to characterize participants along these lines to determine if there was association between these factors and CVD knowledge.

METHODS

Participants were a convenience sample of women attending the outpatient clinics of New York Presbyterian Hospital, Columbia University, who took part in a cross-sectional study to evaluate cardiovascular disease knowledge and cardiovascular risk among urban women. The study was approved by the Columbia University Institutional Review Board, and all participants provided informed consent. Participants were enrolled from April 2007 to June 2011. Exclusion criteria included known history of coronary artery disease, history of cerebrovascular disease, pregnancy, and age younger than 18 years.

All participants completed a standardized face-to-face questionnaire in English or Spanish adapted from the Center for Disease Control and Prevention Behavioral Risk Factor Surveillance System.(21) Demographic data including age, race/ethnicity, education, health insurance, income, and geographic area of residence were collected. Self-reported medical history of diagnoses of diabetes, hypertension, and smoking were also collected. Electronic charts were reviewed for fasting glucose and lipid profile within 3 months of study enrollment. Laboratory data were used if they were drawn 3 months prior to enrollment at the earliest, or 3 months after enrollment at the latest. Blood pressure and waist circumference were determined in all, as well as height and weight in order to calculate Body Mass Index (BMI). BMI (weight [kg]/height [m^2]) was calculated and classified as

underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), and obese (≥30 kg/m^2).

Participants were asked about knowledge of cardiovascular disease, based on American Heart Association and Healthy People 2010 to improve cardiovascular health and quality of life. We asked: 1) what is the leading cause of death among women; 2) what are the early warning symptoms or signs of heart attack; and 3) what are the actions to take if experiencing a heart attack? Options for the leading cause of death were a) breast cancer, b) lung cancer c) HIV/AIDS, d) heart disease, e) stroke. The correct answer was d) heart disease. Options for early warning symptoms or signs of heart attack were a) shortness of breath, b) dizziness, c) chest pain or discomfort, d) significant fatigue, e) all of the above. The correct answer was e) all of the above. Options for what are the actions to take if experiencing a heart attack were a) call 911, b) drive yourself to the hospital, c) ask a friend to drive you to the hospital, d) make an appointment with your doctor. The correct answer was a) call 911.

FRS and MS were used to classify participants' cardiovascular risk, as these risk scores have been shown to be powerful predictors of future CVD and are used commonly in clinical practice. (15–17) FRS was determined using a 10-year prediction tool, similar to the calculator from the National Cholesterol Education Program Third Report of the Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults.(16, 22) The tool estimated 10-year risk of having a cardiovascular event such as stroke, myocardial infarction, peripheral arterial disease, and heart failure. The calculator for women used includes age, total cholesterol, HDL cholesterol, smoking status, systolic blood pressure, currently on medication to treat blood pressure, and diabetes. Low FRS was defined as less than 10% risk of cardiovascular event within 10 years; moderate risk was 10% to less than 20% and high risk was 20% or more. FRS was determined in all participants who had information on all components needed for calculation (age, documented laboratory data within 3 months of enrollment in the study, information on smoking status, blood pressure, medication to treat blood pressure, diabetes). MS was determined by the presence of three or more of the following: waist size >35 inches, triglycerides ≥150, HDL<50, blood pressure ≥130/85, fasting glucose ≥100. Participants were characterized as without Metabolic Syndrome if they had <3 components present. Participants were characterized for MS if all information was available (waist size, laboratory data within 3 months.)

Analyses were completed with SAS for 9.2 (SAS Institute Cary, NC). The significance of differences in knowledge among participants with low, moderate and high FRS was determined using the Mantel-Haenszel Chi-Square Test. Differences in knowledge between women with and without MS were assessed using the 2-sided Fisher's exact test for categorical variables. Multivariable logistic regression analysis was used to test for the effect of cardiovascular risk on knowledge after controlling for race/ethnicity and years of education. Similar analyses were performed for MS and BMI categories. A p value of <0.05 was considered significant for all analyses.

RESULTS

Demographics and Cardiovascular Risk Profile

Of the 823 participants, 382 (46%) were Hispanic (primarily of Caribbean origin), 301 (37%) were Non-Hispanic White, 66 (8%) were Non-Hispanic Black, 60 (7%) were Asian and 14 (2%) were other race/ethnicity. Mean age was 48 ± 15 years and mean education was 14 ± 4 years. The average body mass index was 27 ± 6 kg/m^2, and 447 (55%) of the participants were overweight or obese. FRS was determined in 278 women; 175 (63%) were low risk, 81 (29%) were moderate risk, and 22 (8%) were high risk. In addition, 322 were

characterized for the components of Metabolic Syndrome; 76 (24%) had ≥ 3 components of MS. (Table 1) The vast majority of participants who could not have FRS determined or be characterized for the components of MS lacked laboratory data within 3 months of study enrollment. The percentage of participants classified as low, moderate or high FRS did not differ by race/ethnicity. A greater percentage of Hispanic and Non-Hispanic Black participants had ≥ 3 components of MS, compared to Non-Hispanic Whites (44% vs. 10% ($p<0.0001$) and 27% vs. 10% ($p=0.013$), respectively). In addition, a greater percentage of Hispanic and Non-Hispanic Black participants were obese compared to Non-Hispanic Whites (41% vs. 15% ($p<0.0001$) and 33% vs. 15% ($p<0.0001$), respectively). Participants with lower levels of education (≤8 years and 9–12 years) were more likely to have moderate or high FRS, have ≥ 3 components of MS and be obese. (Table 2)

Knowledge of Leading Cause of Death

The leading cause of death among women was answered correctly by 445 of 819 (54%) participants. Hispanic participants and those who had fewer years of education were less likely to know the leading cause of death among women. (Table 3) Those with increasing FRS were less likely to know the leading cause of death (low risk 72%, moderate risk 67.5%, and high risk 45%, $p=0.045$, Figure 1). Participants with ≥ 3 components of MS were less likely than those with <3 components of MS to know the leading cause of death of women (39% vs. 72%, $p<0.001$, Figure 1). Additionally, women who were overweight or obese were less likely to know the leading cause of death compared to normal weight women (normal weight 62%, overweight 50%, obese 45%, $p<0.001$).

However, in multivariable logistic regression analysis that included years of education and race/ethnicity, higher FRS was no longer significantly associated with lower knowledge of the leading cause of death. (Table 4) Additionally, the presence of ≥ 3 components of MS and having a BMI classified as overweight or obese were also no longer associated with lower knowledge of leading cause of death.

Knowledge of Heart Attack Symptoms

The question evaluating symptoms of a heart attack was answered correctly by 548 of 820 (67%) women. Hispanic participants and those who had fewer years of education were less likely to know the symptoms of a heart attack. (Table 3) Those with increasing FRS were less likely to know the symptoms of heart attack (low risk 75%, moderate risk 61%, high risk 41%, $p<0.001$, Figure 1). Women with ≥ 3 components of MS were also less likely to know symptoms of heart attack (55% vs. 70%, $p=0.018$, Figure 1). There was no significant difference in knowledge of symptoms of heart attack in participants who were overweight or obese, compared to those of normal weight (normal 68%, overweight 63%, obese 68%).

In multivariable logistic regression analysis that included years of education and race/ethnicity, moderate and high FRS was still associated with less knowledge of heart attack symptoms. (Table 4) However, the presence of ≥ 3 components of MS was not associated with less knowledge of heart attack symptoms.

Knowledge about Calling 911

Knowledge about calling 911 if experiencing heart attack was answered correctly by 725 of 819 (89%) of participants. There was no significant difference in knowledge of the need to call 911 by FRS (low 89%, moderate 90%, high 95%) or by presence of ≥ 3 components of MS, (88% vs. 91%).

DISCUSSION

Despite public health efforts, knowledge of the leading cause of death of women and knowledge of heart attack symptoms remains suboptimal. While most efforts to understand CVD knowledge gaps have focused on demographic factors such as race/ethnicity and education level, we further characterized a primary prevention population of women by including CVD risk classification based on laboratory and clinical data. The addition of CVD risk categories afforded a deeper understanding of the known knowledge disparities, and we found that women at higher risk for cardiovascular disease, assessed by moderate or high FRS, were less likely to know symptoms of a heart attack than their lower risk counterparts. We found no difference in knowledge of the leading cause of death of women by FRS after multivariable adjustment. While we found that the presence of ≥3 components of MS was associated with lower knowledge of both heart attack symptoms and leading cause of death, after multivariable analysis, the relationship was no longer present. However, it is notable that a large proportion of women with MS were of Hispanic origin and also had low knowledge of leading cause of death and heart attack symptoms, so this may be a particularly low knowledge group.

In this study of an urban primary care population of women, we found results that correspond to previous surveys showing lower knowledge of leading cause of death and heart attack symptoms among racial/ethnic minorities (2, 3) and those with fewer years of education.(23, 24) The findings are also similar to reports of lower knowledge of stroke symptoms among racial/ethnic minorities.(9, 11) In contrast to merely 53% who knew to call 911 if experiencing symptoms of a heart attack in the previous work (2), in this study 89% answered correctly, and there was no difference by FRS or MS. This difference may be attributed to increasing efforts to improve action take for heart attack symptoms given suboptimal awareness of importance of calling 911 (25), such as in campaigns from the US Department of Health and Human Services “Make The Call, Don’t Miss a Beat”(26). Furthermore, a large percentage of racial/ethnic minority women residing in New York City utilize emergency services for many health care needs, which is a well-recognized target for improvement.(27, 28)

Patients with the very highest cardiovascular risk, such as those with previous events might be expected to have higher knowledge of heart attack symptoms because they may have experienced a prior incident. Here, by excluding patients with known CVD, we focused on an important primary prevention population, that is, those with multiple risk factors. FRS is a recognized tool to evaluate risk in a primary care population, traditionally with high risk being delineated as ≥20% risk of CVD event in 10 years, (16, 22) and more recently more stringent criteria have been utilized, suggesting that ≥10% risk of CVD event in 10 years should be considered high risk (6). Thus, our moderate risk population is at least moderate risk by traditional FRS but may even be considered as at high risk. The association between lower knowledge of heart attack symptoms and higher FRS in patients without a previous event is troubling. Decreased knowledge of stroke and heart attack symptoms was described among self-reported high risk CVD participants, (13) and decrease knowledge of leading cause of death was found among those with MS. (25) This is a collective cause for concern because higher risk patients are most likely to experience stroke or heart attacks that are potentially preventable with risk factor modification.(22, 29–31)

The explanation for the association between higher FRS and lower knowledge of heart attack symptoms is not clear. Action steps to reduce risk including patient engagement, consistent medical care (32), identification of risk factors (33), delivery of patient-centered educational messages (6, 34) and development of a risk reduction plan (22, 29–31) are critical. While participants were recruited from primary care clinics, factors such as

inconsistent health care, lack of sensitive educational messages and inadequate plans for risk reduction could have contributed to the higher FRS. These deficiencies may also represent a missed opportunity for discussions of symptoms of a heart attack.

Given that patients with more knowledge of symptoms have a greater likelihood of calling 911 (35), inadequate knowledge of symptoms of heart attack among higher risk participants is troublesome. Delay in symptom recognition is a barrier to prompt therapy (36), and timely action resulting from recognition of symptoms leads to superior outcomes. (37) Attempts to improve outcomes by increasing knowledge have been mixed. After CVD media campaigns, a Swedish study reported that acute myocardial infarction therapy was more timely. (7) On the other hand, the US REACT trial showed more knowledge of heart attack symptoms (1), but no change in delay time.(38) While strides have been made in decreasing cardiovascular mortality by risk factor modification and therapeutic advances (39, 40), health education has been outlined as an important goal for prevention of CVD in women overall in 2011 guidelines (6), and symptom recognition and prompt therapy has been outlined as a goal of Healthy People 2020 (19) and plays an important role in improving outcomes.

LIMITATIONS

A self-report questionnaire was used, which is subject to recall and social desirability bias. The use of multiple-choice questions may have allowed some to guess the correct answer. Participants were women from the urban Northeast and results may not be comparable among other geographic areas or among men.

CONCLUSIONS

Women with higher Framingham Risk Score were less likely to know the symptoms of heart attack than their lower risk counterparts. Educational efforts aimed at racial/ethnic minority women, specifically Hispanic women, individuals with lower education, and women who have moderate or high FRS should target persons with lowest knowledge about symptoms of heart attack. Future research should query participants' knowledge of personal risk factors as an important step in prevention of cardiovascular disease. Efforts to focus on those at high risk for cardiovascular disease must persist lest the vulnerable may suffer disproportionately not only due to risk profile but also because of inadequate knowledge.

Acknowledgments

Supported in-part by the Department of Health and Human Services (1HHCWH05003-01-11), Arlene and Joseph Taub Foundation, Paterson NJ, Edwina and Charles Adler Foundation and by Columbia University's CTSA grant, UL1-RR024156 from the NCRR/NIH.

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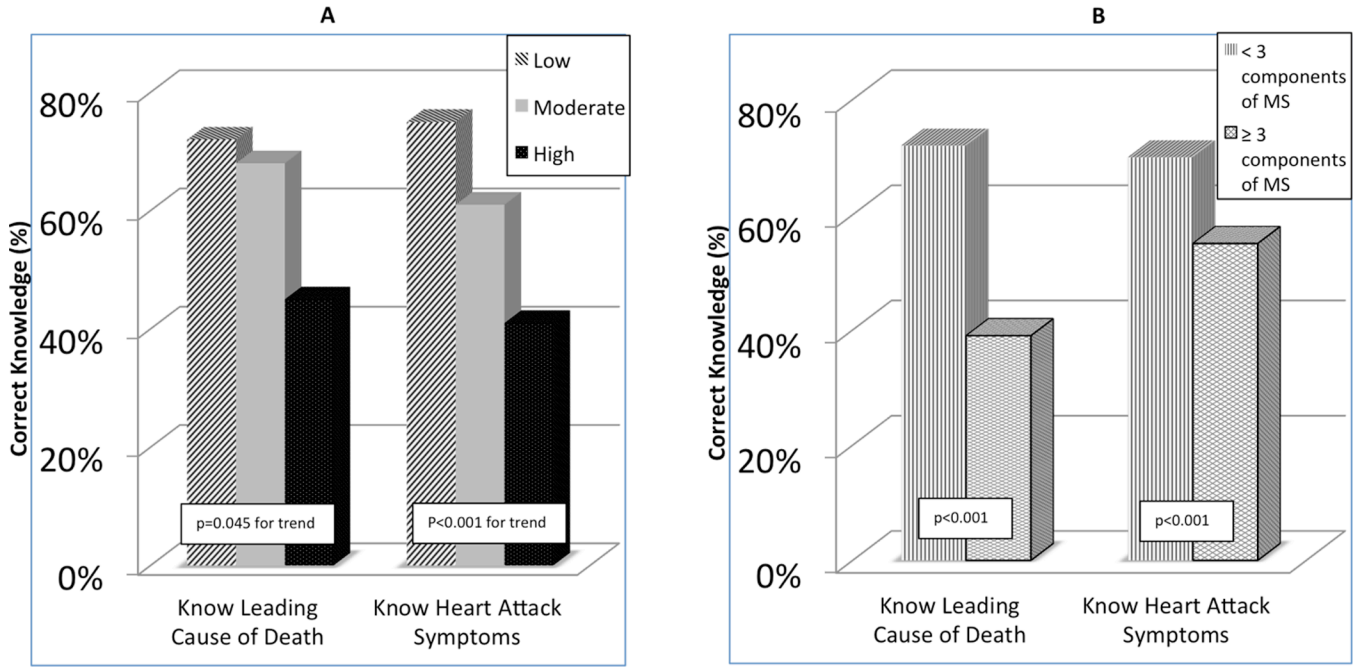

Figure 1. Cardiovascular Risk and Knowledge

Panel A: Univariate Association between Knowledge of Leading Cause of Death, Knowledge of Heart Attack Symptoms and Framingham Risk Score (FRS)

Panel B: Univariate Association between Knowledge of Leading Cause of Death, Knowledge of Heart Attack Symptoms and Metabolic Syndrome (MS)

Table 1

Characteristics of Participants (N=823)

	n (%) or mean ± standard deviation
Race/ethnicity	
Hispanic	382 (46%)
Non-Hispanic White	301 (37%)
Non-Hispanic Black	66 (8%)
Asian	60 (7%)
Other	14 (2%)
Age (years)	48 ± 15
Education (years)	14 ± 4
Body Mass Index (BMI) (kg/m^2) n=819	27 ± 6
Underweight (BMI <18.5)	19 (2%)
Normal weight (BMI 18.5–24.9)	353 (43%)
Overweight (BMI25–29.9)	246 (30%)
Obese (BMI ≥30)	201 (25%)
Framingham Risk Score n=278	
Low	175 (63%)
Moderate	81 (29%)
High	22 (8%)
Metabolic Syndrome (MS) n=322	
≥ 3 components of MS	76 (24%)
< 3 components of MS	246 (76%)

Table 2

Race/Ethnicity, Education and Framingham Risk Score and Metabolic Syndrome

	Framingham Risk (n=278)			**Metabolic Syndrome (MS) (n=322)**	
	Low	**Moderate**	**High**	**< 3 components of MS**	**≥ 3 components of MS**
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Race/Ethnicity					
Non-Hispanic White	102 (68%)	41 (27%)	7 (5%)	141 (90%)	15 (10%)
Hispanic	47 (55%)	28 (33%)	10 (12%)	64 (56%)	50 (44%)
Non-Hispanic Black	13 (46%)	11 (39%)	4 (14%)	22 (73%)	8 (27%)
Asian	9 (82%)	1 (9%)	1 (9%)	15 (83%)	3 (17%)
Other	4 (100%)	0 (0%)	0 (0%)	4 (100%)	0 (0%)
p value			0.09		**<0.0001**
Education Years					
≤8 years	12 (33%)	16 (44%)	8 (22%)	19 (39%)	30 (61%)
9–12 years	21 (51%)	15 (37%)	5 (12%)	24 (11%)	22 (45%)
>12 years	139 (70%)	50 (25%)	9 (5%)	195 (89%)	27 (55%)
p value			**<0.0001**		**<0.0001**

Table 3

Knowledge by Race/ethnicity and Education

	Know Leading Cause of Death (n=819)	**Know Heart Attack Symptoms (n=820)**
	n (%)	**n (%)**
Race/Ethnicity		
Non-Hispanic White	265 (88%)	244 (81%)
Hispanic	100 (26%)	221 (58%)
Non-Hispanic Black	37 (56%)	46 (70%)
Asian	33 (55%)	29 (48%)
Other	33 (55%)	29 (48%)
p value	**p< 0.001**	**p< 0.001**
Education Years		
≤8 years	14 (14%)	41 (42%)
9–12 years	43 (23%)	110 (59%)
>12 years	384 (73%)	393 (75%)
p value	**p<0.001**	**p<0.001**

Table 4

Multivariable Model: Framingham Risk Score and Knowledge

	Know Leading Cause of Death	**Know Heart Attack Symptoms**
	OR (95% CI)	**OR (95% CI)**
Moderate Framingham Risk	1.34 (0.60–3.02)	**0.52 (0.28–0.98)**
High Framingham Risk	0.84 (0.23–3.14)	**0.29 (0.11–0.81)**
Demographic Factors		
Education years	**1.29 (1.15–1.45)**	1.06 (0.98–1.15)
Hispanic Race/ethnicity	**0.14 (0.06–0.33)**	**0.33 (0.15–0.73)**
Non-Hispanic Black	0.37 (0.13–1.09)	0.76 (0.29–2.01)
Asian	0.23 (0.05–1.09)	**0.18 (0.05–0.67)**
Other Race/ethnicity	0.35 (0.03–3.64)	0.55 (0.05–5.59)