

## **Racial Differences in Women's Prodromal and Acute Symptoms of Myocardial Infarction**

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# RACIAL DIFFERENCES IN WOMEN'S PRODROMAL AND ACUTE SYMPTOMS OF MYOCARDIAL INFARCTION

By Jean C. McSweeney, RN, PhD, Patricia O'Sullivan, EdD, Mario A. Cleves, PhD, Leanne L. Lefler, PhD, APN, Marisue Cody, PhD, Debra K. Moser, RN, DNSc, Kelly Dunn, RN, PhD, PHCNS-BC, Margaret Kovacs, EdD, ARNP-BC, Patricia B. Crane, RN, PhD, Lois Ramer, DNSc, FNP-BC, Patricia R. Messmer, PhD, RN-BC, Bonnie J. Garvin, RN, PhD, and Weizhi Zhao, MS

**Background** Minority women, especially black and Hispanic women, have higher rates of coronary heart disease and resulting disability and death than do white women. A lack of knowledge of minority women's symptoms of coronary heart disease may contribute to these disparities.

**Objective** To compare black, Hispanic, and white women's prodromal and acute symptoms of myocardial infarction.

**Methods** In total, 545 black, 539 white, and 186 Hispanic women without cognitive impairment at 15 sites were retrospectively surveyed by telephone after myocardial infarction. With general linear models and controls for cardiovascular risk factors, symptom severity and frequency were compared among racial groups. Logistic regression models were used to examine individual prodromal or acute symptoms by race, with adjustments for cardiovascular risk factors.

**Results** Among the women, 96% reported prodromal symptoms. Unusual fatigue (73%) and sleep disturbance (50%) were the most frequent. Eighteen symptoms differed significantly by race ( $P < .01$ ); blacks reported higher frequencies of 10 symptoms than did Hispanics or whites. Thirty-six percent reported prodromal chest discomfort; Hispanics reported more pain/discomfort symptoms than did black or white women. Minority women reported more acute symptoms ( $P < .01$ ). The most frequent symptom, regardless of race, was shortness of breath (63%); 22 symptoms differed by race ( $P < .01$ ). In total, 28% of Hispanic, 38% of black, and 42% of white women reported no chest pain/discomfort.

**Conclusions** Prodromal and acute symptoms of myocardial infarction differed significantly according to race. Racial descriptions of women's prodromal and acute symptoms should assist providers in interpreting women's symptoms. (*American Journal of Critical Care*. 2010;19:63-73)

**M**inority women, especially black and Hispanic women, have higher rates of disability and death due to coronary heart disease (CHD) than do white women, even when adjustments are made for socioeconomic status.<sup>1-4</sup> The reasons for minority women's poor outcomes are well established and include disparities in access to care and substandard treatment.<sup>5-7</sup> Lack of recognition of early symptoms of CHD and acute myocardial infarction (AMI) by women and health care providers also contributes to these poor outcomes, because delayed recognition of symptoms limits options for efficacious treatment. However, little is known about the prodromal and acute symptoms of AMI in minority women.

Recently, researchers<sup>8-10</sup> have explored differences in CHD and AMI symptoms, primarily between men and women. For example, Canto et al<sup>8</sup> reviewed both large multisite and smaller studies conducted from 1970 through 2005 and concluded that chest pain/discomfort is the most commonly reported acute symptom among both men and women, but more women than men report non-chest pain. However, because of insufficient numbers of minority women in studies such as those reviewed by Canto et al, no comparisons of women's symptoms by race have been reported. Although results of a few studies<sup>11-19</sup> have

indicated that women's prodromal and acute symptoms, descriptors, or expectations may vary by race or ethnicity, little is known about the most common signs and symptoms of CHD and AMI in minority women.<sup>20</sup> Commenting on the challenge of diagnosing heart disease in women, Dracup<sup>21(p2396)</sup> concluded that to foster early recognition and diagnosis, researchers must identify "those factors that shape symptom presentation." Women's interpretation and description of their symptoms may be influenced by race and cultural background.<sup>11-17</sup> Therefore, examination of women's symptoms by race is warranted and may add valuable information to assist in modulating the difficulty of diagnosing CHD in women.

To compare prodromal and acute symptoms of myocardial infarction in women of different races/ethnicities, we conducted a study to

- describe the prodromal and acute symptoms of AMI that women report and determine whether black, Hispanic, and white women differ in their symptoms
- determine whether the prodromal and acute symptoms of black, Hispanic, and white women differ in severity and frequency when adjustments are made for known cardiovascular risk factors

## Methods

The study was a multicenter, retrospective telephone survey of an ethnically diverse group of women who had experienced an AMI with subsequent hospitalization in the previous 4 to 6 months. This time frame was selected because women in earlier studies indicated that they needed time to identify which symptoms were prodromes to AMI on the basis of changes in symptoms before and after AMI.<sup>22,23</sup> Women's names were obtained from 15 urban and rural medical centers of various sizes in 8 geographically diverse states across the United States. Employees at each center compiled a list of the names of all women who had a discharge code

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of 410.0-410.9 (*International Classification of Diseases, Ninth Revision*), indicating AMI, and verified this diagnosis with the medical record. Recruiters at each center attempted to telephone all women on the list to determine the women's interest in participating in the study, establish self-reported ethnicity and race, and ascertain language preference. Recruiters then provided the investigators with a list of women who expressed interest, including each woman's contact information, date of AMI, discharge code (*International Classification of Diseases, Ninth Revision*), ethnicity/race (race), and language preference. All appropriate institutional review boards for the protection of human participants approved the study.

Research assistants telephoned potential participants, explained the study, and verified eligibility. Besides having AMI diagnosed in the previous 4 to 6 months, eligible women were 21 years or older; identified themselves as black (non-Hispanic), Hispanic, or white (non-Hispanic); spoke either English or Spanish; had telephone access; and passed the Blessed Cognitive Screen.<sup>24</sup> After gaining verbal consent from the women, research assistants administered the cognitive screen, and if a woman passed the screen, conducted the interviews in the participant's preferred language: English, Mexican Spanish, or Caribbean/South American Spanish. During the interviews, the assistants entered responses directly into an ACCESS database, which was programmed to force choices and reject responses outside the specified range. This strategy minimized missing and erroneous data.

### Measurement

The McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey (MAPMISS), which includes 33 prodromal and 37 acute symptoms,<sup>25</sup> was used to collect data. The psychometric properties of the MAPMISS have been described elsewhere.<sup>23,25</sup> Symptoms are categorized as general (eg, fatigue, feeling anxious) or as discomfort/pain. For the MAPMISS, "prodromal symptoms (1) are new or change in intensity or frequency before the AMI, (2) are intermittent before the AMI, and (3) disappear or return to previous levels after the AMI."<sup>23(pp2619-2620)</sup> Acute symptoms appear with the AMI and resolve after treatment. The MAPMISS also contains questions about 10 risk factors (body mass index >29, diabetes mellitus, hypertension, hypercholesterolemia, nicotine addiction, consistent exposure to secondhand smoke, lack of exercise, age >50 years, personal history of CHD, and family history of CHD), comorbid conditions, and demographics. Preliminary work

indicated most women did not know their serum cholesterol numbers; therefore, women were asked if they had ever been told by a clinician that their cholesterol level was high or elevated. Nicotine addiction was defined as being a smoker at the time of the AMI. Data on exposure to secondhand smoke was collected by asking the women if they were consistently exposed to secondhand smoke "every day or most days" at any location (eg, home, work).

Because women were recruited from sites across the United States, the MAPMISS was translated into Spanish by using standard protocols. Two bilingual health professionals translated the MAPMISS into Mexican Spanish and Caribbean/South American Spanish and then back into English, with 100% agreement on the back-translation. The Spanish versions were pilot tested in Texas and Florida with 19 Hispanic women who had experienced an AMI in the previous 6 months. The women did not add any additional prodromal or acute symptoms and had no difficulty understanding or answering the questions.

### Data Analysis

On the basis of the women's responses, 2 symptom description indexes were created. For the prodromal symptom index, each of the 33 prodromal symptoms was weighted according to its reported severity (on a scale of 0 to 3, with 3 = most severe) and frequency (on a scale of 0.167 to 7, less than monthly to daily; 7 = daily), and summed across symptoms (range, 0-693). The acute symptom index was calculated in a parallel manner on the basis of 37 acute symptoms; frequency was omitted because acute symptoms were one-time events (range, 0-111).

Proportions and exact 95% confidence intervals were computed for each cardiovascular risk factor by racial group (age, body mass index, high cholesterol, hypertension, diabetes mellitus, personal or family history of cardiovascular disease, nicotine addiction, exposure to secondhand smoke, and no exercise during the 6 months before the AMI). Differences among racial groups were compared by using  $\chi^2$  tests. Poisson regression, with adjustments for cardiovascular risk factors, was used to compare the number of symptoms in different racial groups. After square

No comparisons of women's symptoms by race have been reported.

Controlling for cardiovascular risks, there were no differences in severity or frequency of prodromal symptoms among the groups.

**Table 1**  
Differences in women's cardiovascular risk factors, by race

Risk factor	No. (%) of women [95% CI]				P
	Black (n = 545)	Hispanic (n = 186)	White (n = 539)	All (N = 1270)	
Age >50 years	438 (80.4) <sup>a</sup> [76.8-83.6]	156 (83.9) <sup>a,b</sup> [77.8-88.8]	481 (89.2) <sup>b</sup> [86.3-91.7]	1075 (84.6) [82.5-86.6]	<.001
Body mass index <sup>c</sup> >29	327 (60.0) <sup>b</sup> [55.8-64.1]	70 (37.6) <sup>a</sup> [30.7-45.0]	216 (40.1) <sup>a</sup> [35.9-44.3]	613 (48.3) [45.5-51.1]	<.001
High cholesterol	357 (65.5) <sup>a,b</sup> [61.3-69.5]	135 (72.6) <sup>b</sup> [65.6-78.9]	325 (60.3) <sup>a</sup> [56.0-64.5]	817 (64.3) [61.6-67.0]	.008
Hypertension	471 (86.4) <sup>b</sup> [83.3-89.2]	135 (72.6) <sup>a</sup> [65.6-78.9]	389 (72.2) <sup>a</sup> [68.2-75.9]	995 (78.3) [76.0-80.6]	<.001
Diabetes mellitus	286 (52.5) <sup>b</sup> [48.2-56.7]	87 (46.8) <sup>b</sup> [39.4-54.2]	174 (32.3) <sup>a</sup> [28.3-36.4]	547(43.1) [40.3-45.8]	<.001
Personal history of cardiovascular disease	263 (48.3) <sup>a</sup> [44.0-52.5]	115 (61.8) <sup>b</sup> [54.4-68.8]	239 (44.3) <sup>a</sup> [40.1-48.6]	617 (48.6) [45.8-51.4]	<.001
Family history of cardiovascular disease	494 (90.6) <sup>a</sup> [87.9-93.0]	158 (84.9) <sup>a</sup> [79.0-89.8]	516 (95.7) <sup>b</sup> [93.7-97.3]	1168 (92.0) [90.3-93.4]	<.001
Nicotine addiction	154 (28.3) <sup>b</sup> [24.5-32.2]	19 (10.2) <sup>a</sup> [6.26-15.5]	161 (29.9) <sup>b</sup> [26.0-33.9]	334 (26.3) [23.9-28.8]	<.001
Exposure to secondhand smoke	345 (63.3) <sup>b</sup> [59.1-67.4]	85 (45.7) <sup>a</sup> [38.4-53.1]	363 (67.3) <sup>b</sup> [63.2-71.3]	793 (62.4) [59.7-65.1]	<.001
No exercise 6 months before acute myocardial infarction	331 (60.7) <sup>b</sup> [56.5-64.9]	78 (41.9) <sup>a</sup> [34.8-49.4]	295 (54.7) <sup>b</sup> [50.4-59.0]	704 (55.4) [52.7-58.2]	<.001

Abbreviation: CI, confidence interval.

<sup>a, b</sup> Values with same superscript letter indicate nonsignificant post hoc difference (Bonferroni adjusted  $P = .003$ ).

<sup>c</sup> Body mass index calculated as weight in kilograms divided by height in meters squared.

root transformation of the severity or frequency symptom index or both to improve normality, general linear models were generated, with adjustments for cardiovascular risk factors, to compare symptom indexes for different racial groups.

The number of prodromal and acute symptoms for each woman was calculated and then logistic regression was used to examine the association of racial groups and each prodromal and acute symptom. Significant symptoms at the level of 1% were presented. The adjusted  $P$  values

were further calculated after adjustments were made for the cardiovascular risk factors. SAS, version 9.1 (SAS Institute, Cary, NC) was used for data analysis.

## Results

### Study Participants

Recruiters submitted 1935 names of potential participants. Of these, 286 were ineligible. Of the remaining 1649 eligible women, 225 (14%) could not be located, 87 (5%) declined to participate, and 43 had died (3%). We received consent from 1294

women (78%) but excluded 24 on the basis of the cognitive screen. A total of 1270 women—545 blacks (43%), 186 Hispanics (15%), and 539 whites (42%)—participated in the study.

Mean ages were 62.8 years (SD, 13.3) for black women, 64.3 years (SD, 12.9) for Hispanic women, and 66.6 years (SD, 12.2) for white women. White women were significantly older than black women ( $P = .001$ ). Educational levels ranged from first grade to doctoral degrees, although most of the women had attended high school; the white women had more education than did the minority women ( $P = .001$ ). Income distribution differed significantly ( $P < .001$ ); minorities reported less household income than did whites. More than 50% of the minority women and 23% of the white women reported annual household incomes of less than \$10 000. Table 1 shows the distribution of cardiovascular risk factors by racial group. Significantly more black women than white or Hispanic women reported having a body mass index greater than 29 ( $P < .001$ ) and hypertension before AMI ( $P < .001$ ), and significantly more minority women than white women reported having diabetes mellitus ( $P < .001$ ).

More than 95% of all women, regardless of race reported early warning prodromal symptoms.

### Group Comparisons of Symptoms

On average, women in the black and Hispanic groups reported significantly more prodromal symptoms than did the white women ( $P < .001$ ), and the difference was still significant after adjustments were made for cardiovascular risk factors. However, after adjustments were made for cardiovascular risk factors, severity and/or frequency of prodromal symptoms did not differ among the groups ( $P = .04$ ). As with prodromal symptoms, white women, as a group, reported the fewest acute symptoms and had a significantly lower mean acute severity index than minority women did, even after adjustments were made for cardiovascular risk factors ( $P < .001$ ; Table 2). General linear models, which included race and all risk factors simultaneously, were fitted to compute adjusted significance probabilities of the impact of these factors on the mean number of prodromal and acute symptoms and their respective indexes (Table 3).

### Prodromal Symptoms

In total, 96% of the women ( $n = 1213$ ), regardless of race, reported prodromal symptoms; unusual fatigue was the most frequently reported symptom ( $n = 930$ ; 73%). The other most commonly reported symptoms were sleep disturbances ( $n = 638$ ; 50%), anxiety ( $n = 573$ ; 45%), shortness of breath ( $n = 565$ ; 45%), and frequent indigestion ( $n = 494$ ; 39%). Only 36% of women reported any chest discomfort or pain during the prodromal period.

**Table 2**  
Group comparisons of women's symptoms: number, severity, and/or frequency

Characteristic	Value (95% CI)			$P^a$
	Black (n = 545)	Hispanic (n = 186)	White (n = 539)	
Mean number of prodromal symptoms	7.48 <sup>b</sup> (7.08-7.89)	6.98 <sup>b</sup> (6.22-7.75)	5.84 <sup>c</sup> (5.47-6.20)	<.001
Mean prodromal index (frequency and severity)	74.35 (68.87-79.83)	64.68 (55.44-73.92)	59.72 (54.77-64.66)	.04
Mean number of acute symptoms	9.35 <sup>c</sup> (8.85-9.84)	9.97 <sup>b</sup> (9.08-10.87)	8.04 <sup>d</sup> (7.60-8.47)	<.001
Mean acute index (severity)	21.23 <sup>b,c</sup> (19.97-22.50)	23.02 <sup>b</sup> (20.79-25.24)	17.96 <sup>c</sup> (16.88-19.05)	<.001

Abbreviation: CI, confidence interval.

<sup>a</sup> Adjusted for cardiovascular risk factors presented in Table 1.

<sup>b, c, d</sup> Values with same superscript letter indicate nonsignificant post hoc difference (Bonferroni adjusted  $P = .003$ ).

Results of  $\chi^2$  tests indicated significant differences ( $P < .01$ ) for 18 of the 33 prodromal symptoms. When logistic regression was used to examine the association between the frequency of prodromal symptoms and race, with controls for the 10 cardiovascular risk factors, 10 symptoms remained significantly different ( $P \leq .001$ ; Table 4). A complete list of prodromal symptoms on the MAPMISS, including those that were not significant in this study, has been reported elsewhere.<sup>23</sup>

**Table 3**  
Significance probabilities for the effect of race and cardiovascular risk factors on women's symptoms

Race and cardiovascular risk factors	Mean number of prodromal symptoms	Mean prodromal index (frequency and severity)	Mean number of acute symptoms	Mean acute index (severity)
Race	<.001	.04	<.001	<.001
Age >50 years	<.001	.01	<.001	<.001
Body mass index <sup>a</sup> >29	<.001	<.001	<.001	<.001
High cholesterol	.55	.56	.03	.44
Hypertension	.11	.19	.03	.13
Diabetes mellitus	.04	.21	.02	.53
Personal history of cardiovascular disease	<.001	<.001	<.001	<.001
Family history of cardiovascular disease	.001	.04	.37	.29
Nicotine addiction	<.001	.004	<.001	<.001
Exposure to secondhand smoke	<.001	.11	.72	.58
No exercise 6 months before acute myocardial infarction	.70	.21	.05	.32

<sup>a</sup> Body mass index calculated as weight in kilograms divided by height in meters squared.

**Table 4**  
Significant differences in frequency of women's prodromal symptoms, by race

Variable	No. (%) of patients			<i>p</i> <sup>a</sup>	
	Black (n = 545)	Hispanic (n = 186)	White (n = 539)	Raw	Adjusted <sup>a</sup>
<b>Generalized symptoms</b>					
Unusual fatigue	421 (77.2)	124 (66.7)	385 (71.4)	.009	.17
Anxiety	279 (51.2) <sup>b</sup>	95 (51.1) <sup>b</sup>	199 (36.9) <sup>c</sup>	<.001	<.001
Frequent indigestion	235 (43.1) <sup>b</sup>	50 (26.9) <sup>c</sup>	209 (38.8) <sup>b</sup>	<.001	.004
Heart racing	233 (42.8) <sup>b</sup>	68 (36.6) <sup>b,c</sup>	153 (28.4) <sup>c</sup>	<.001	<.001
New vision problems	217 (39.8) <sup>b</sup>	43 (23.1) <sup>c</sup>	132 (24.5) <sup>c</sup>	<.001	<.001
Change in thinking or remembering	202 (37.1) <sup>b</sup>	60 (32.3) <sup>b,c</sup>	135 (25.0) <sup>c</sup>	.001	.001
Loss of appetite	183 (33.6) <sup>b</sup>	50 (26.9) <sup>b,c</sup>	124 (23.0) <sup>c</sup>	<.001	.006
Difficulty breathing at night	182 (33.4) <sup>b</sup>	38 (20.4) <sup>b,c</sup>	107 (19.9) <sup>c</sup>	<.001	<.001
Hand/arms tingling	172 (31.6)	47 (25.3)	125 (23.2)	.007	.06
Numbness or burning in hands/fingers	171 (31.4) <sup>b</sup>	45 (24.2) <sup>b,c</sup>	104 (19.3) <sup>c</sup>	<.001	<.001
Cough	147 (27.0) <sup>b</sup>	59 (31.7) <sup>b</sup>	98 (18.2) <sup>c</sup>	<.001	<.001
Increased frequency of headaches	109 (20.0)	29 (15.6)	68 (12.6)	.005	.06
Increased intensity of headaches	91 (16.7) <sup>b</sup>	36 (19.4) <sup>b</sup>	48 (8.9) <sup>c</sup>	<.001	<.001
<b>Discomfort/pain symptoms</b>					
Centered high in chest	102 (18.7) <sup>b,c</sup>	46 (24.7) <sup>b</sup>	76 (14.1) <sup>c</sup>	.004	.004
Leg(s)	61 (11.2) <sup>b</sup>	29 (15.6) <sup>b</sup>	22 (4.1) <sup>c</sup>	<.001	<.001
Both arms	30 (5.5)	24 (12.9)	33 (6.1)	.003	.01
Right arm or shoulder	24 (4.4) <sup>b,c</sup>	16 (8.6) <sup>b</sup>	13 (2.4) <sup>c</sup>	.002	.004
Jaw/teeth	17 (3.1) <sup>c</sup>	20 (10.8) <sup>b,c</sup>	23 (4.3) <sup>c</sup>	<.001	.001

<sup>a</sup> Adjusted for cardiovascular risk factors listed in Table 1.

<sup>b, c</sup> Values with same superscript letter indicate nonsignificant post hoc difference (Bonferroni adjusted  $P \leq .003$ ).

Symptoms were classified as either generalized or pain/discomfort. Black women had the highest rates of all generalized symptoms except increased intensity of headaches and cough before AMI. Hispanic women had the highest rates of all pain/discomfort symptoms during the prodromal period.

Because angina is a classic CHD symptom and the locations of chest pain/discomfort on the MAP-MISS are not mutually exclusive, these locations (generalized chest area, centered high in chest, and left breast) were combined to examine the frequency

of women reporting any chest pain/discomfort. A total of 44% of the Hispanic women, 39% of the black women, and 30% of the white women reported having chest pain/discomfort during the prodromal period. Women also reported a variety of shoulder, arm, and hand sensations, including burning,

numbness, and pain. Again, because these symptoms were not mutually exclusive, they were combined to form inclusive symptoms of sensations in either the right or the left upper extremity. Fewer than 21% of the women reported any prodromal symptoms in the right or the left upper extremity.

Finally, a list was developed of the 10 most common prodromal symptoms by race, with the

combined chest and combined upper extremity locations as single symptoms (Table 5). Unusual fatigue was the most frequently reported symptom, regardless of race. Sleep disturbance was the second most commonly reported symptom for black and white women and the third for Hispanic women. Anxiety was the second most common symptom for Hispanic women. Prodromal chest pain/discomfort ranked fourth for Hispanic women, sixth for white women, and eighth for black women.

### Acute Symptoms

Of the 1270 women, all but 3 reported acute symptoms. These 3 said they had not experienced any symptoms. Shortness of breath was the most frequently reported symptom ( $n = 798$ ; 63%); next, in order, were weakness ( $n = 697$ ; 55%), unusual fatigue ( $n = 613$ ; 48%), dizziness ( $n = 559$ ; 44%), and cold sweat ( $n = 508$ , 40%). According to the results of  $\chi^2$  tests, racial groups differed significantly ( $P < .01$ ) in 22 of the 37 acute symptoms (Table 6). According to the results of logistic regression, used to examine the association between the frequency of acute symptoms and race, with adjustments for cardiovascular risk factors, 15 symptoms remained significantly different ( $P \leq .003$ ). Of these 15 symptoms, black women reported 2 generalized symptoms, feeling hot and flushed and indigestion,

Only 37.7% reported any chest discomfort or pain during the prodromal period.

**Table 5**  
Women's 10 most frequent prodromal symptoms, by race

Rank	Black (n = 545)		Hispanic (n = 186)		White (n = 539)	
	Symptoms	% (95% CI)	Symptoms	% (95% CI)	Symptoms	% (95% CI)
1	Unusual fatigue	77.2 (73.5-80.7)	Unusual fatigue	66.7 (59.4-73.4)	Unusual fatigue	71.4 (67.4-75.2)
2	Sleep disturbance	52.1 (47.8-56.4)	Anxiety	51.1 (43.7-58.5)	Sleep disturbance	48.2 (43.9-52.5)
3	Anxiety	51.2 (46.9-55.5)	Sleep disturbance	50.5 (43.1-57.9)	Shortness of breath	43.2 (39.0-47.5)
4	Shortness of breath	47.0 (42.7-51.3)	Any chest pain/ discomfort <sup>a</sup>	43.5 (36.3-51.0)	Frequent indigestion	38.8 (34.6-43.0)
5	Frequent indigestion	43.1 (38.9-47.4)	Shortness of breath	40.9 (33.7-48.3)	Anxiety	36.9 (32.8-41.1)
6	Heart racing	42.8 (38.6-47.0)	Heart racing	36.6 (29.6-43.9)	Any chest pain/ discomfort <sup>a</sup>	30.1 (26.2-34.1)
7	New vision problems	39.8 (35.7-44.1)	Change in thinking or remembering	32.3 (25.6-39.5)	Heart racing	28.4 (24.6-32.4)
8	Any chest pain/ discomfort <sup>a</sup>	39.4 (35.3-43.7)	Cough	31.7 (25.1-38.9)	Arms weak/heavy	25.2 (21.6-29.1)
9	Change in thinking or remembering	37.1 (33.0-41.3)	Loss of appetite	26.9 (20.7-33.9)	Change in thinking or remembering	25.0 (21.4-28.9)
10	Loss of appetite	33.6 (29.6-37.7)	Frequent indigestion	26.9 (20.7-33.9)	New vision problems	24.5 (20.9-28.3)

Abbreviation: CI, confidence interval.

<sup>a</sup> Includes at least 1 location of generalized chest pain, centered high in chest, and/or left breast pain/discomfort.

**Table 6**  
Significant differences in frequency of women's acute symptoms, by race

Variable	No. (%) of women			<i>P</i> <sup>a</sup>	
	Black (n = 545)	Hispanic (n = 186)	White (n = 539)	Raw	Adjusted
<b>Generalized symptoms</b>					
Unusual fatigue	277 (50.8) <sup>b,c</sup>	109 (58.6) <sup>b</sup>	227 (42.1) <sup>c</sup>	<.001	.003
Dizzy or faint	269 (49.4)	76 (40.9)	214 (39.7)	.004	.03
Hot, flushed	252 (46.2) <sup>b</sup>	51 (27.4) <sup>c</sup>	173 (32.1) <sup>c</sup>	<.001	<.001
Indigestion	224 (41.1) <sup>b</sup>	48 (25.8) <sup>c</sup>	154 (28.6) <sup>c</sup>	<.001	<.001
Heart racing	194 (35.6) <sup>b</sup>	67 (36.0) <sup>b,c</sup>	125 (23.2) <sup>c</sup>	<.001	.005
Numbness in hands/fingers	149 (27.3) <sup>b</sup>	50 (26.9) <sup>b,c</sup>	97 (18.0) <sup>c</sup>	<.001	.007
Vomiting	149 (27.3) <sup>b</sup>	42 (22.6) <sup>b,c</sup>	101 (18.7) <sup>c</sup>	.004	.01
Loss of appetite	145 (26.6)	53 (28.5)	106 (19.7)	.008	.08
New vision problems	145 (26.6) <sup>b</sup>	37 (19.9) <sup>b,c</sup>	77 (14.3) <sup>c</sup>	<.001	<.001
Headache	125 (22.9) <sup>b,c</sup>	50 (26.9) <sup>b</sup>	80 (14.8) <sup>c</sup>	<.001	.005
Coughing	89 (16.3) <sup>b</sup>	36 (19.4) <sup>b</sup>	52 (9.6) <sup>c</sup>	<.001	.002
Choking sensation	83 (15.2)	34 (18.3)	50 (9.3)	.001	.02
<b>Discomfort/pain symptoms</b>					
Centered high in chest	177 (32.5) <sup>c</sup>	87 (46.8) <sup>b</sup>	166 (30.8) <sup>c</sup>	<.001	<.001
Left breast	133 (24.4) <sup>b</sup>	44 (23.7) <sup>b,c</sup>	73 (13.5) <sup>c</sup>	<.001	<.001
Back/between shoulder blades	84 (15.4) <sup>d</sup>	70 (37.6) <sup>b</sup>	112 (20.8) <sup>c</sup>	<.001	<.001
Neck/throat	71 (13.0) <sup>c</sup>	44 (23.7) <sup>b</sup>	87 (16.1) <sup>c</sup>	.003	.001
Generalized chest	70 (12.8) <sup>c</sup>	41 (22.0) <sup>b,c</sup>	110 (20.4) <sup>b</sup>	.001	.003
Leg(s)	40 (7.3) <sup>b</sup>	27 (14.5) <sup>b</sup>	9 (1.7) <sup>c</sup>	<.001	<.001
Both arms	38 (7.0) <sup>c</sup>	34 (18.3) <sup>b</sup>	77 (14.3) <sup>b</sup>	<.001	<.001
Top of shoulders	36 (6.6) <sup>c</sup>	33 (17.7) <sup>b</sup>	57 (10.6) <sup>b,c</sup>	<.001	<.001
Right arm or shoulder	34 (6.2) <sup>c</sup>	24 (12.9) <sup>b</sup>	25 (4.6) <sup>c</sup>	<.001	.001
Jaw/teeth	26 (4.8) <sup>d</sup>	36 (19.4) <sup>b</sup>	54 (10.0) <sup>c</sup>	<.001	<.001

<sup>a</sup> Adjusted for cardiovascular risk factors listed in Table 1.

<sup>b, c, d</sup> Values with same superscript letter indicate nonsignificant post hoc difference (Bonferroni adjusted  $P \leq .003$ ).

**Table 7**  
**Women's 10 most frequent acute symptoms, by race**

Rank	Black (n = 545)		Hispanic (n = 186)		White (n = 539)	
	Symptoms	% (95% CI)	Symptoms	% (95% CI)	Symptoms	% (95% CI)
1	Shortness of breath	66.2 (62.1-70.2)	Any chest pain/discomfort <sup>a</sup>	72.0 (65.0-78.4)	Any chest pain/discomfort <sup>a</sup>	58.3 (54.0-62.5)
2	Any chest pain/discomfort <sup>a</sup>	61.8 (57.6-65.9)	Shortness of breath	66.7 (59.4-73.4)	Shortness of breath	58.1 (53.8-62.3)
3	Felt weak	54.1 (49.8-58.4)	Unusual fatigue	58.6 (51.2-65.8)	Felt weak	55.5 (51.2-59.7)
4	Unusual fatigue	50.8 (46.5-55.1)	Felt weak	55.4 (47.9-62.7)	Unusual fatigue	42.1 (37.9-46.4)
5	Dizziness	49.4 (45.1-53.6)	Chest pain/discomfort high chest	46.8 (39.4-54.2)	Cold sweat	39.7 (35.5-44.0)
6	Hot/flushed	46.2 (42.0-50.5)	Left arm sensations <sup>b</sup>	44.1 (36.8-51.5)	Dizziness	39.7 (35.5-44.0)
7	Left arm sensations <sup>b</sup>	42.0 (37.8-46.3)	Cold sweat	44.1 (36.8-51.5)	Left arm sensations <sup>b</sup>	38.2 (34.1-42.5)
8	Indigestion	41.1 (36.9-45.4)	Dizziness	40.9 (33.7-48.3)	Arms weak/heavy	35.8 (31.8-40.0)
9	Cold sweat	38.9 (34.8-43.1)	Discomfort back/shoulder blades	37.6 (30.7-45.0)	Nausea	35.3 (31.2-39.4)
10	Nausea	37.4 (33.4-41.6)	Arms weak/heavy	36.6 (29.6-43.9)	Arms ache	35.3 (31.2-39.4)

Abbreviation: CI, confidence interval.

<sup>a</sup>Includes at least 1 location of generalized chest pain, centered high in chest, and/or left breast pain/discomfort.

<sup>b</sup>Includes burning, numbness, and/or pain in at least 1 location: left shoulder, arm, and/or hand.

significantly more frequently than did Hispanic and white women. Hispanics and whites did not report any generalized symptoms significantly more often than blacks did. White women reported the fewest generalized symptoms except for indigestion. As with the racial differences in prodromal symptoms, Hispanic women had the highest rates of pain/discomfort in all locations, except for pain in the left breast. White women reported pain/discomfort in 4 locations (back, generalized chest area, both arms, and jaw/teeth) significantly more often than did black women, but less frequently than did Hispanic women.

As with prodromal symptoms, the 3 chest locations of acute pain/discomfort and the 3 arm locations were collapsed into inclusive symptoms, and a list of the 10 most frequent acute symptoms by race was developed (Table 7). Chest pain/dis-

comfort was the most frequent acute symptom for Hispanic (72%) and white (58%) women and the second most frequent symptom for black women (62%). Shortness of breath was the most frequently reported symptom for black women. The 3 groups differed significantly in chest symptoms ( $P = .004$ ); post hoc tests indicated that the white women differed significantly from the Hispanic women ( $P < .001$ ). These differences were still significant after adjustments were made for cardiovascular risk factors ( $P = .02$  and  $P = .006$ , respectively).

Approximately 41% of the women reported acute sensations in the left arm, whereas only 8.5% reported sensations in the right arm. Although the differences were not significant, Hispanic women (44%) reported more involvement of the left arm than did black women (42%) and white women (38%). Less than 13% of the women of any race reported having sensations in the right arm during the acute episode.

## Discussion

Our results provide the most comprehensive evidence-based description to date of women's symptoms of CHD and AMI. Additionally, comparisons of the intensity and/or frequency of the most common prodromal and acute symptoms reported by the women in the different ethnic/racial groups address major gaps in the literature on CHD and AMI symptoms in minorities and women.<sup>20,21</sup> Our descriptions of women's symptoms should help women from different racial groups recognize and interpret the onset of symptoms as possibly cardiac in origin and increase the likelihood that they will seek timely treatment. These data also provide valuable information to health care providers on CHD and AMI symptoms experienced by women in different racial groups.

We found that racial groups have both differences and similarities in prodromal and AMI symptoms. Minority women reported significantly more prodromal symptoms than did white women, although

**Unusual fatigue was the most frequently reported symptom, regardless of race.**

women in all racial groups (95%-97%) experienced prodromal symptoms. Unusual fatigue was the most common prodromal symptom regardless of race. Other researchers<sup>11,22,23,26,27</sup> have also implicated unusual fatigue as a prodromal symptom. The prodromal symptoms frequently reported by women in our study, including shortness of breath, indigestion, and unexplained anxiety, also have been reported by others<sup>9,23,28,29</sup> as symptoms of CHD. A multisite study<sup>30</sup> of 247 elders after myocardial infarction (66% women) indicated frequent prodromal symptoms of fatigue (76%), dyspnea (62%), and sleep disturbance (41%), similar to the symptoms reported by the women in our study.

In our study, black women reported significantly more prodromal symptoms than did white women, especially generalized symptoms such as unusual fatigue and episodes of heart racing. Further, black women reported significantly greater intensity and/or frequency of prodromal symptoms than did white women. The black women in our sample were younger than the Hispanic and white women and had a greater number of potent risk factors, such as diabetes mellitus, suggesting that younger black women with risk factors who have diffuse generalized, frequent, and often severe symptoms may require vigilant attention and diagnostic evaluation for CHD. Although little research is available on minority women's prodromal symptoms of CHD, in studies on black women's acute symptoms, black women reported more AMI symptoms<sup>15</sup> and more severe symptoms<sup>12</sup> than white women did. These racial differences may be influenced by multiple comorbid conditions or by cultural interpretation of symptoms.

The majority of the women in our study (63%) did not report prodromal chest discomfort, and this symptom was least common in white women. Lindgren et al<sup>30</sup> found that approximately 50% of patients had some type of prodromal chest symptoms, but those findings were based on a sample of predominantly white men and women and may not accurately reflect ethnically diverse women's prodromal chest symptoms. Because chest pain is often an essential symptom for preauthorization of cardiovascular diagnostic procedures, such as cardiac catheterization, women without chest pain may not be referred for definitive diagnostic procedures.<sup>31,32</sup> If our finding that chest pain is not a frequent prodromal symptom in women is replicated, revision of referral policies/procedures for diagnostic testing may be warranted.

Minority women reported significantly more acute symptoms than did white women, but regardless of race, shortness of breath was the most

frequently reported individual acute symptom. Results from other studies<sup>9,11,31,33</sup> also support dyspnea as a major AMI symptom. The women in our study, like those in other studies,<sup>15,16,22,23,34</sup> also reported other generalized acute symptoms, such as unusual fatigue, dizziness, and indigestion. However, in contrast to our findings, in other studies,<sup>9,15,16</sup> women's key generalized AMI symptoms were neck and jaw pain and nausea. For white and black women in our study, nausea was among the top 10 symptoms of AMI, number 9 for black women and number 10 for white women. Our findings and those of others support the importance of assessing for non-chest pain and generalized symptoms in addition to chest pain in women with suspected AMI.

After we combined all locations of acute chest pain/discomfort into a single symptom, that symptom became the most frequent one for Hispanic and white women but not for black women. Although most of the women reported some type of chest symptoms during the actual AMI, 28% of Hispanic, 38% of black, and 42% of white women did not report any chest pain/discomfort. This lack of acute chest pain/discomfort is important because inappropriate or missed diagnosis in women is frequently attributed to lack of chest pain when the women seek health care.<sup>35,36</sup> Other studies<sup>29,32,36,37</sup> also suggest that lack of chest pain in patients with AMI is problematic. For instance, Brieger et al<sup>37</sup> compared the treatment and outcomes of patients with and without chest pain and found that those without chest pain received less effective treatment and experienced greater inpatient morbidity and mortality than did those with chest pain. Other investigators<sup>32,36</sup> have reported similar findings, suggesting that women, especially those without chest pain, have a higher proportion of unrecognized AMI events than men do.<sup>35</sup> This finding clearly indicates the need for health care providers to recognize the importance of assessing for non-chest pain, generalized symptoms so that women without chest pain during AMI events may receive optimal treatment.

Notably, the Hispanic women in our study reported more pain/discomfort in multiple locations than did black and white women. This result is similar to the findings of the Corpus Christi Heart Project,<sup>16</sup> in which Hispanic women experienced

Fewer than 21% of the women reported any prodromal left or right arm symptoms.

Shortness of breath was the most frequently reported acute symptom.

significantly more upper back pain than their white counterparts did. Results of other studies<sup>9,16,17,34</sup> also indicate that women, including minorities, have more back pain/discomfort than do men.

Limitations of our study include nonprobability sampling and retrospective data. Additionally, all the women in the study had experienced an AMI event; therefore, we do not know whether women who have not had AMI experience similar symptoms. However, in a study<sup>23</sup> of 515 women, women with CHD reported significantly more symptoms than did healthy women. In addition, women who did

not survive the AMI event or died before the interview might have reported different symptoms. Although the number of black and white women in our study was essentially equal, Hispanic women constituted only 15% of the sample.

A larger number of Hispanic women might have reported different symptoms or intensity and/or frequency of symptoms. Finally, although we performed a cognitive screen, women may not have accurately remembered their symptoms, although Green<sup>38</sup> found that patients have accurate recall after life-altering events.

## Conclusion

Our results substantially increase our understanding of racial differences and similarities in prodromal and acute symptoms of AMI. The 10 most frequent prodromal and acute symptoms of AMI experienced by the women in the study provide an evidence-based normative picture of racial symptom patterns. The pattern is especially important for black and Hispanic women who have multiple risk factors because these 2 groups are more likely than white women to have poor outcomes. Prodromal symptoms, especially unusual fatigue, sleep disturbance, anxiety, and dyspnea, even in the absence of chest pain/discomfort, should alert health care providers to the need for a differential diagnosis that includes CHD. Early recognition of prodromal symptoms by both patients and providers maximizes opportunities for risk stratification and diagnostic intervention before AMI occurs. Additionally, the description of women's AMI symptoms by race should help providers interpret women's symptoms, especially generalized non-chest pain symptoms. Earlier recognition, diagnosis, and treatment of AMI will increase the likelihood of improved outcomes for women with CHD.

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