RACIAL AND ETHNIC DISPARITIES ASSOCIATED WITH KNOWLEDGE OF SYMPTOMS OF HEART ATTACK AND USE OF 911: NATIONAL HEALTH INTERVIEW SURVEY, 2001

Henraya F. McGruder, PhD; Kurt J. Greenlund, PhD; Ann M. Malarcher, PhD; Theresa L. Antoine, MPH; Janet B. Croft, PhD; Zhi-Jie Zheng, PhD

Objective: Heart attacks are more prevalent among Hispanics and Blacks than among Whites. Bystanders must be able to recognize heart attack symptoms and activate the emergency response system in order to receive time-dependent therapies that increase survival. This study estimated racial/ethnic disparities in awareness of heart attack symptoms in a sample of the US population.

Methods: We evaluated data from 33,059 adult participants in the 2001 National Health Interview Survey. Respondents indicated their awareness of five heart attack symptoms and the need to call 911 in the presence of such symptoms.

Results: Hispanics and Blacks were less likely to recognize each heart attack symptom than were Whites ($P<.05$). Hispanics (25.6%), people aged 18–24 years (33.6%), men (39.1%), and those with less than a high school education (31.3%) were less likely to recognize all five heart attack symptoms and report that they would call 911 than were Whites (45.8%), Blacks (36.1%), respondents aged 45–64 years (47.7%) and >65 years (43.9%), and those with a high school education (41.0%) or more (45.6%). In multivariate logistic regression analyses, Blacks (OR .73, 95% CI .66–.80) and Hispanics (OR .49, 95% CI .45–.54) were less likely than were Whites to recognize all five heart attack symptoms and the need to call 911 if someone had these symptoms.

Conclusions: One *Healthy People 2010* goal is to eliminate health disparities. Racial/ethnic disparities exist in knowledge of heart attack symptoms and the need to call 911. Special educational efforts should focus on Black and Hispanic populations and highlight the importance of symptoms and time-dependent therapies. (*Ethn Dis*. 2008;18:192–197)

Key Words: Racial Differences, Heart Attack, Emergency Medical Care, Warning Symptoms, Education

From the Division for Heart Disease and Stroke Prevention (HFM, KJG, JBC, ZJZ), Office on Smoking and Health (AMM), National Center for Chronic Disease Prevention and Health Promotion; Division of Health Quality Promotion, Prevention and Evaluation Branch, National Center for Infectious Disease (TLA), Coordinating Center for Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia, USA.

INTRODUCTION

Every year, an estimated 700,000 Americans have a first heart attack, and 500,000 suffer a recurrent heart attack,[1] ≈40% of whom die as a result.[1] Heart attack can be treated effectively with time-dependent reperfusion therapies, provided that symptoms are recognized and appropriate emergency personnel are contacted quickly.[2] However, ≈22% of heart attack patients delay seeking care beyond the therapeutic window,[3] even though timely treatment with available therapies increases survival.[4,5] Greater recognition of the symptoms of heart attack and the need to call 911 may help improve time to treatment and outcomes. The American Heart Association describes the symptoms of heart attack as chest discomfort, discomfort in other areas of the upper body (eg, arms, back, jaw, or stomach), shortness of breath, and other signs (eg, cold sweat, nausea, or lightheadedness).[6]

One of the *Healthy People 2010* objectives is to increase the proportion of adults who are aware of heart attack symptoms and who call 911 immediately upon observing them. Another of the *Healthy People 2010* objectives is to decrease or eliminate health disparities, including those among racial and ethnic populations.[7] African American and Mexican American populations have a greater prevalence of heart disease and heart attacks than do Whites.[1] Previous studies have shown that awareness of the symptoms of heart attacks is low.[3,8] Among Behavioral Risk Factor Surveillance System (BRFSS) respondents in 18 states/territories, fewer than one in five accurately recognized the major symptoms of heart attack.[8] When heart attack symptoms are not recognized quickly enough, effective treatments may not be initiated in a timely manner to reduce death and disability. However, national estimates of awareness and examination of racial/ethnic differences in recognition of heart attack symptoms and the need to call 911 are lacking. To estimate racial/ethnic disparities within the US population concerning knowledge of heart attack symptoms and the need to call 911, we analyzed data from the 2001 National Health Interview Survey (NHIS) for non-Hispanic Blacks, non-Hispanic Whites, and Hispanics.

Approximately 22% of heart attack patients delay seeking care beyond the therapeutic window,[3] even though timely treatment with available therapies increases survival.[4,5]

The findings and conclusions in this report are those of the authors and not necessarily those of the Centers for Disease Control and Prevention.

Address correspondence and reprint requests to: Henraya F. McGruder; Centers for Disease Control and Prevention; 4770 Buford Highway, NE; Mailstop K-47; Atlanta, GA 30341; 770-488-8266; 770-488-8151 (fax); hdd8@cdc.gov

METHODS

The NHIS is a continuous annual household interview survey that has been conducted since 1957 by the National Center for Health Statistics, Centers for Disease Control and Prevention. Since its inception, the NHIS has been a source of information about health and health care in the United States. The NHIS collects self-reported health information from a representative sample of the noninstitutionalized civilian US population. Our study included respondents aged ≥18 years who participated in the 2001 NHIS. More detailed information on the NHIS survey is available elsewhere.[9] The final response rate for the sample adult component in the 2001 NHIS was 73.8%.[10]

Respondents indicated their ability to recognize whether someone might be experiencing a heart attack by answering yes, no, or ''don't know'' to the following five symptoms: pain or discomfort in the jaw, neck, or back; feeling weak, lightheaded, or faint; chest pain or discomfort; pain or discomfort in the arms or shoulders; and shortness of breath. Respondents were also asked, ''If you thought someone was having a heart attack, what is the best thing to do right away?'' These choices were: advise them to drive to the hospital, advise them to call their physician, call 911 (or another emergency number), or call spouse or other family member. A variable was created to capture respondents who recognized all five symptoms and knew to call 911 if they observed them. These survey questions were found in the sample adult core component of the NHIS. Respondents who refused to answer any of the questions and missing responses were excluded from the analyses.

Other variables of interest included in our analyses were age (18–24 years, 25–44 years, 45–64 years, and ≥65 years), education (less than high school, high school, more than high school), employment within the past 12 months (employed, not employed), and family income (>$20,000, <$20,000, and refused/don't know). Race/ethnicity was stratified into four categories: Hispanic, non-Hispanic Black, non-Hispanic White, and non-Hispanic other. Questions concerning these variables were obtained from the family core component of the NHIS.

A total of 33,326 people participated in the 2001 NHIS. However, these analyses were limited to 33,059 survey participants (Hispanics [n=5568], non-Hispanic Whites [n=21,727], referred to hereafter as Whites, and non-Hispanic Blacks [n=4573], referred to hereafter as Blacks) who responded to the relevant survey questions. Data for respondents of ''other'' race/ethnicity (n=1191) were included in total estimates but are not presented separately as a major racial/ethnic group. Persons with missing responses to any survey questions were excluded from all analyses. Age-standardized racial/ethnic comparisons and unadjusted symptom comparisons were assessed by χ^2 statistics. In addition, multivariable logistic regression was performed to examine racial/ethnic differences for odds of recognizing each symptom, recognizing all five symptoms, and recognizing the need to call 911, adjusting for age, sex, and education. All calculations were performed using SUDAAN survey software (RTI International, Research Triangle Park, NC) to account for the complex multistage sampling design of the NHIS and to weight data so that estimates were representative of the US population.[9] Results were age-standardized to the year 2000 US population.[11] Statistical significance was determined at P<.05.

RESULTS

Several characteristics of the study population differed among the three racial/ethnic groups (Table 1). Most people in this study were aged 25–64. Approximately half of Hispanics were aged 25–44, while Whites were more likely to be older. Approximately three fourths of the study participants classified themselves as employed, while most survey participants had a family income >$20,000. A greater proportion of Black respondents were women, than were Whites and Hispanics. Age-adjusted proportions showed Hispanics were less educated than Blacks and Whites (P<.05).

In 2001, the most common heart attack symptoms recognized by US adults were chest pain or discomfort (89.9%), pain, discomfort in arms or shoulders (83.7%), and shortness of breath (82.1%). The two heart attack symptoms least likely to be recognized were pain or discomfort in the jaw, neck, or back (55.0%) and feeling weak or lightheaded (68.7%). Approximately 92.5% of respondents recognized that the best thing to do during an apparent heart attack was call 911; however, only 41.8% of NHIS respondents recognized all five heart attack symptoms and also knew to call 911 (combined variable). Across all demographic groups, pain in the jaw, neck, or back was the least recognizable heart attack symptom. Men, adults with less than a high school education, Hispanics, and Blacks were less likely to recognize each heart attack symptom than were women, people with more education, and Whites. The most commonly recognized heart attack symptom for all demographic groups was chest pain. Older people (88.1%), Hispanics (89.3%), and those with less than high school education (88.4%) were less likely to recognize that they needed to call 911 when someone reported these symptoms, although the proportion was >88% for all sociodemographic groups. Adults aged 18–24 (33.6%), Hispanics (25.6%), men (39.1%), and those with less than high school education (31.3%) were less likely to recognize all five heart attack symptoms and call 911 than were their counterparts (Table 2).

Table 1. Selected characteristics by race/ethnicity among adults: National Health Interview Survey, 2001

Characteristic	Total (*N*=33,059)	Black, non-Hispanic† (*n*=4,573)	Hispanic† (*n*=5,568)	White, non-Hispanic† (*n*=21,727)
Mean Age	45.0 (44.8–45.2)	42.0 (41.5–42.5)	39.6 (39.2–40.0)	46.5 (46.3–46.8)
	% (95% CI)	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**
Age Group				
18–24 years	13.2 (12.6–13.8)	16.4 (14.8–18.2)	18.9 (17.6–20.3)	11.8 (11.1–12.6)
25–44 years	40.0 (39.4–40.6)	44.1 (42.3–46.0)	48.3 (46.6–50.1)	37.6 (36.9–38.4)
45–64 years	30.7 (30.0–31.3)	27.8 (26.3–29.4)	23.5 (22.2–25.0)	32.3 (31.6–33.1)
≥65 years	16.1 (15.6–16.6)	11.6 (10.6–12.8)	9.2 (8.3–10.3)	18.2 (17.6–18.8)
Sex				
Women	52.1 (51.4–52.7)	55.5 (53.9–57.2)	50.9 (49.2–52.6)	51.9 (51.1–52.6)
Men	47.9 (47.3–48.6)	44.5 (42.8–46.1)	49.1 (47.4–50.8)	48.1 (47.3–48.9)
Education				
Less than high school	17.4 (16.8–17.9)	24.2 (22.6–26.0)	43.6 (41.6–45.6)	12.7 (12.2–13.3)
High school	26.8 (26.1–27.4)	28.4 (26.6– 30.3)	20.9 (19.5–22.4)	27.8 (27.0–28.6)
More than high school	55.0 (54.2–55.8)	46.3 (44.2–48.4)	33.4 (31.6–35.2)	58.8 (57.8–59.7)
Refused/don't know	.9 (.7–1.0)	1.0 (.7–1.5)	2.1 (1.6–2.7)	.7 (.5–.8)
Employment Status				
Employed*	72.8 (72.2–73.5)	73.1 (71.3–74.8)	73.3 (71.8–74.7)	72.6 (71.9–73.4)
Not employed	26.8 (26.2–27.4)	26.1 (24.4–27.9)	26.3 (24.8–27.7)	27.1 (26.4–27.9)
Refused/don't know	.3 (.3–.4)	.8 (.5–1.2)	.4 (.2–.8)	.2 (.1–.3)
Family Income				
>$20,000	75.5 (74.8–76.1)	64.0 (61.9–66.1)	65.5 (63.8–67.2)	78.5 (77.8–79.3)
<$20,000	18.6 (18.0–19.2)	29.2 (27.3–31.3)	28.3 (26.8–29.8)	15.7 (15.0–16.3)
Refused/don't know	5.9 (5.5–6.3)	6.7 (5.7–7.9)	6.2 (5.4–7.1)	5.8 (5.4–6.3)

* ''Employed'' variable is defined as employment within the past 12 months.
† Persons classified as ''other'' are not shown here.

After controlling for age, sex, and education, Blacks and Hispanics were less likely than Whites (referent group) to know each heart attack symptom (Table 3). No difference was seen between Blacks and Whites, but Hispanics were 31% less likely than Whites to know to call 911 ($P<.05$) if someone were experiencing heart attack symptoms. Blacks and Hispanics were less likely to know all five heart attack symptoms and to call 911 than were Whites ($P<.05$).

DISCUSSION

An overarching goal of *Healthy People 2010* is to eliminate health disparities. This study demonstrates racial/ethnic disparities for Blacks and Hispanics, compared with Whites, in knowledge of heart attack symptoms and the need to call 911 during a suspected heart attack. Our findings in a nationally representative sample are consistent with those of several previous community and state-based studies in that awareness of heart attack symptoms and calling 911 is low among adults.[3,8,12] Even though chest pain was the most recognizable heart attack symptom for all participants in the current study, followed by pain or discomfort in the arms/shoulders and shortness of breath, Blacks and Hispanics were consistently less knowledgeable of these symptoms than were Whites. Only one third of Blacks in a recent study attributed cardiac symptoms to the heart.[13] The remaining two thirds attributed symptoms to indigestion, a breathing problem, or unknown causes. Attribution of potential cardiac symptoms to something other than a heart attack can delay treatment. Other studies revealed that time between onset of cardiac symptoms and arrival at the hospital for African Americans is three to six hours, compared with two hours for Whites.[13,14] These findings highlight the need for cardiovascular disease education and symptom recognition among African American and Hispanic populations.

Although increased knowledge of heart attack symptoms and improved public action to call 911 are ways to reduce death and disability, efforts in other areas could also improve heart attack survival. Prehospital emergency care, transport systems, and in-hospital systems are all key factors that affect survival.[8] The current findings suggest that educating people about heart attack

…Blacks and Hispanics were consistently less knowledgeable of these symptoms [chest pain, pain or discomfort in the arms/shoulders and shortness of breath] than were Whites.

Table 2. Proportion (unadjusted) of adults who recognized individual heart attack symptoms and the need to call 911, by sociodemographic characteristics: National Health Interview Survey, 2001

	Pain/discomfort in the jaw, neck, or back % (95% CI)	Feeling weak, light-headed, or faint % (95% CI)	Chest pain or discomfort % (95% CI)	Pain, discomfort in arms or shoulder % (95% CI)	Shortness of breath % (95% CI)	Calling 911 % (95% CI)	Knowledge of all 5 heart attack symptoms and calling 911 % (95% CI)
Total Study	55.0 (54.1–55.8)	68.7 (68.0–69.4)	89.9 (89.4–90.4)	83.7 (83.1–84.3)	82.1 (81.5–82.7)	92.5 (92.0–92.9)	41.8 (40.9–42.6)
Age Group							
18–24 years	45.0 (42.9–47.2)	67.2 (65.1–69.2)	87.5 (85.9–88.9)	76.9 (75.0–78.6)	78.9 (77.0–80.8)	93.5 (92.3–94.5)	33.6 (31.5–35.7)
25–44 years	50.2 (49.1–51.3)	69.3 (68.3–70.3)	90.7 (90.1–91.4)	84.0 (83.2–84.9)	82.8 (81.9–83.7)	93.6 (93.0–94.1)	39.0 (37.9–40.2)
45–64 years	62.4 (61.2–63.6)	71.1 (70.0–72.1)	91.6 (90.8–92.2)	87.9 (87.1–88.7)	85.2 (84.4–86.0)	92.8 (92.2–93.4)	47.7 (46.5–49.0)
≥65 years	60.7 (59.1–62.3)	64.2 (62.6–65.7)	86.6 (85.5–87.7)	80.6 (79.3–81.9)	77.2 (75.7–78.6)	88.1 (87.0–89.1)	43.9 (42.2–45.5)
Race/Ethnicity							
Hispanic	37.0 (35.2–38.8)	49.4 (47.6–51.2)	72.0 (70.4–73.5)	62.8 (61.0–64.5)	62.9 (61.0–64.7)	89.3 (88.2–90.3)	25.6 (23.9–27.3)
Non-Hispanic Black	48.0 (45.6–50.4)	63.0 (61.1–64.8)	87.3 (85.9–88.6)	78.3 (76.7–79.9)	79.7 (78.1–81.2)	92.9 (91.9–93.8)	36.1 (33.9–38.4)
Non-Hispanic White	59.5 (58.6–60.4)	73.2 (72.4–74.0)	93.6 (93.1–94.0)	88.8 (88.2–89.4)	86.0 (85.4–86.7)	93.1 (92.6–93.5)	45.8 (44.8–46.7)
Sex							
Women	57.5 (56.6–58.3)	69.5 (68.6–70.3)	90.8 (90.3–91.3)	85.3 (84.6–85.9)	83.7 (83.0–84.4)	92.9(92.3–93.4)	44.1 (43.2–45.1)
Men	52.2 (51.0–53.5)	67.9 (67.0–68.9)	88.9 (88.2–89.6)	82.0 (81.2–82.9)	80.3 (79.4–81.2)	92.0 (91.5–92.6)	39.1 (38.0–40.3)
Education							
Less than high school	45.0 (43.3–46.6)	54.7 (53.1–56.2)	78.3 (76.8–79.7)	69.4 (67.8–71.0)	68.2 (66.5–69.9)	88.4 (87.3–89.4)	31.3 (29.8–32.9)
High school	54.8 (53.4–56.2)	67.0 (65.7–68.3)	89.7 (88.9–90.5)	83.6 (82.7–84.6)	82.0 (80.9–83.0)	92.0 (91.3–92.7)	41.0 (39.6–42.4)
More than high school	58.3 (57.3–59.3)	74.3 (73.5–75.1)	93.9 (93.5–94.4)	88.6 (88.0–89.2)	87.0 (86.3–87.6)	94.2 (93.7–94.6)	45.6 (44.5–46.6)

symptoms may not be enough. Results from the Rapid Early Action for Coronary Treatment (REACT) study were mixed; despite improvement in knowledge of heart attack symptoms, reperfusion therapy rates did not change significantly after the intervention period. Researchers concluded that the intervention messages may have been flawed, thus contributing to the suboptimal effect. Other studies have shown that mass media interventions have not been effective because of methodologic issues, such as inappropriate study design and sample size.[15] Therefore, targeted education efforts that are developed with sound scientific rigor focusing on awareness and appropriate actions are needed to increase survival.[16]

This study also confirmed disparities in the knowledge of heart attack symptoms within the Hispanic population that have been noted elsewhere.[12,17] Between 1990 and 2000, the number of Hispanics or Latinos who did not speak English grew 48%, from 32 to 47 million.[18] Moreover, based on data from the 2000 US Census, ≈6 million adults aged 18–64 years and ≈650,000 adults aged ≥65 did not speak English well or at all.[19] Seven percent of Spanish-speaking Hispanics (compared with 23% of English-speaking Hispanics) in one study recognized all five heart attack symptoms; knowledge of chest pain as a hallmark warning sign of heart attack was significantly lower among Spanish-speaking Hispanics than among English-speaking Hispanics, Whites, and Blacks.[17] Although the 2001 NHIS was administered in Spanish and English, disparities in knowledge persist. Education campaigns should target the broader Hispanic population to increase the awareness of heart attack symptoms.

This study is subject to several limitations. Unfortunately, the NHIS has not repeated questions related to knowledge of heart attack symptoms

Table 3. Adjusted odds ratios (OR) and 95% confidence intervals (CI)* for knowledge of heart attack symptoms, knowledge of calling 911 as the best thing to do, comparing Blacks and Hispanics with Whites: National Health Interview Survey, 2001

Heart Attack Symptom†	Black, non-Hispanic OR (95% CI)	Hispanic OR (95% CI)
Pain or discomfort in the jaw, neck, or back	.69 (.62–.76)	.49 (.45–.54)
Feeling weak, lightheaded, or faint	.66 (.60–.72)	.42 (.38–.46)
Chest pain or discomfort	.52 (.45–.60)	.23 (.20–.25)
Pain or discomfort in arms or shoulder	.50 (.45–.56)	.28 (.25–.30)
Shortness of breath	.69 (.63–.77)	.34 (.31–.38)
Best thing to do: call 911	.99 (.85–1.16)	.69 (.61–.78)
Knowledge of all symptoms and calling 911	.73 (.66–.80)	.49 (.45–.54)

* Logistic regression model adjusting for age, sex, and education. White, non-Hispanics are the comparison group.
† An answer of no or ''don't know'' constitutes no knowledge of symptoms.

since 2001. A follow-up survey to compare the prevalence and disparities in knowledge of heart attack symptoms will help assess whether recent campaigns to increase knowledge and action to call 911 have been beneficial. Secondly, the NHIS does not survey institutionalized adults. Therefore, we cannot assess knowledge of heart attack symptoms from those in nursing homes or other institutions. This survey asks respondents to answer yes or no to determine whether the listed symptoms are those of heart attack. Respondents may answer yes for symptoms that sound familiar, rather than basing their choice on knowledge. Other studies have demonstrated that when knowledge of symptoms was ascertained in a different way (ie, respondents asked to list stroke and heart attack symptoms), awareness was much lower.[20–22] Therefore, our results may overestimate the extent of awareness of symptoms. Finally, these data may differ from previously reported estimates of heart attack symptom awareness in *Healthy People 2010* reports because of methodologic and sampling issues that result in more strict exclusion criteria. For example, our analyses combined ''no'' and ''don't know'' responses when ascertaining knowledge of heart attack symptoms.[8]

In conclusion, overall awareness of heart attack symptoms is low, with less than half of all respondents knowing all symptoms and to call 911. Additionally, we found racial/ethnic disparities in knowledge of heart attack symptoms and the need to call 911, after adjusting for age, sex, and education. The uniqueness of this study is that it provides national estimates of knowledge of heart attack symptoms. Other similar studies have provided estimates from select states/territories or from research studies with various methods.[3,8,16] Knowledge of heart attack symptoms is necessary if heart disease mortality and morbidity are to be reduced. In addition to overall awareness campaigns among the general population, special educational efforts should focus on Black and Hispanic populations, which have more risk factors that could lead to a cardiovascular event.[23] Therefore, educational campaigns that highlight the cultural uniqueness of these populations should be developed and delivered in all types of media outlets. Effective campaigns should increase awareness of symptoms, state the importance of rapid activation of the 911 system, and educate people about opportunities to receive time-dependent treatment that could save lives.

REFERENCES

1. Thom T, Haase N, Rosamond W, et al. Heart disease and stroke statistics—2006 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation*. 2006;113:85–151.
2. Rogers WJ, Canto JG, Lambrew CT, et al. Temporal trends in the treatment of over 1.5 million patients with myocardial infarction in the US from 1990 through 1999: the National Registry of Myocardial Infarction 1, 2 and 3. *J Am Coll Cardiol*. 2000;36:2056–2063.
3. Goff DC Jr, Sellers DE, McGovern PG, et al. Knowledge of heart attack symptoms in a population survey in the United States: the REACT Trial. *Arch Intern Med*. 1998;158:2329–2338.
4. Goldberg RJ, Mooradd M, Gurwitz JH, et al. Impact of time to treatment with tissue plasminogen activator on morbidity and mortality following acute myocardial infarction (the second national Registry of Myocardial Infarction). *Am J Cardiol*. 1998;82:259–264.
5. Cannon CP, Gibson CM, Lambrew CT, et al. Relationship of symptom onset-to-balloon time and door-to-balloon time with mortality in patients undergoing angioplasty for acute myocardial infarction. *JAMA*. 2000;283:2941–2947.
6. The American Heart Association. Available at: www.americanheart.org. Accessed 4/24/06.
7. Centers for Disease Control and Prevention. About Healthy People 2010. Available at: www.cdc.gov/nchs/about/otheract/hp-data2010/abouthp.htm. Accessed 3/13/06.
8. Greenlund KJ, Keenan NL, Giles WH, et al. Public recognition of major signs and symptoms of heart attack: seventeen states and the US Virgin Islands, 2001. *Am Heart J*. 2004;147:1010–1016.
9. National Health Interview Survey. National Center for Health Statistics, Division of Data Services. Available at: http://www.cdc.gov/nchs/nhis.htm. Accessed 3/13/06.
10. National Center for Health Statistics. Data File Documentation, National Health Interview Survey, 2001 (machine readable data file and documentation). National Center for Health Statistics, Centers for Disease Control and Prevention, Hyattsville, MD.
11. Klein RJ, Schoenborn CA. Healthy People 2010 statistical notes: age-adjustment using the 2000 projected US population. Number 20; January 2001.
12. Arslanian-Engoren C. Black, Hispanic, and White women's knowledge of the symptoms of acute myocardial infarction. *J Obstet Gynecol Neonatal Nurs*. 2005;34(4):505–511.
13. Banks AD, Dracup K. Factors associated with prolonged prehospital delay of African Americans with acute myocardial infarction. *Am J Critical Care*. 2006;15:149–157.
14. Clark LT, Bellam SV, Shah AH, et al. Analysis of prehospital delay among inner-city patients with symptoms of myocardial infarction:

implications for therapeutic intervention. *J Nat Med Assoc*. 1992;84:931–937.
15. Caldwell MA, Miaskowski. Mass media interventions to reduce help-seeking delay in people with symptoms of acute myocardial infarction: time for a new approach? *Patient Educ Counsel*. 2002;46:1–9.
16. Hedges JR, Feldman HA, Bittner V, et al. Impact of community intervention to reduce patient delay time on use of reperfusion therapy for acute myocardial infarction: rapid early action for coronary treatment (REACT) trial. REACT Study Group. *Acad Emerg Med*. 2000;7(8):862–872.
17. DuBard CA, Garrett J, Gizlice Z. Effect of language on heart attack and stroke awareness among US Hispanics. *Am J Prev Med*. 2006; 30(3):189–196.
18. US Census data. Twenty languages most frequently spoken at home by English ability for the population 5 years and over: 1990 and 2000. Available at: www.factfinder.census.gov. Accessed 2/11/08.
19. US Census Bureau. Detailed table. PCT62H. Age by language spoken at home by ability to speak English for the population 5 years and over (Hispanic or Latino). Available at: http://factfinder.census.gov/servlet/DTTable. Accessed 3/1/07.
20. Kothari R, Sauerbeck L, Jauch E, et al. Patients' awareness of stroke signs, symptoms, and risk factors. *Stroke*. 1997;28:1871–1875.
21. Schneider AT, Pancioli AM, Khoury JC, et al. Trends in community knowledge of the warning signs and risk factors for stroke. *JAMA*. 2003;289:343–346.
22. Weltermann BM, Homann J, Rogalewski A, et al. Stroke knowledge among stroke support group members. *Stroke*. 2000;31:1230–1233.
23. McGruder HF, Malarcher AM, Antoine TL, et al. Racial and ethnic disparities in cardiovascular risk factors among stroke survivors; United States 1999–2001. *Stroke*. 2004;35:1557–1561.

AUTHOR CONTRIBUTIONS

Design concept of study: McGruder, Malarcher, Croft, Zheng
Acquisition of data: McGruder, Antoine, Croft
Data analysis and interpretation: McGruder, Greenlund, Malarcher, Antoine, Croft, Zheng
Manuscript draft: McGruder, Greenlund, Croft
Statistical expertise: McGruder, Greenlund, Antoine, Croft
Acquisition of funding: Croft
Administrative, technical, or material assistance: Antoine, Zheng
Supervision: Malarcher, Croft, Zheng