Characteristics that identify Hispanic women likely to be ill informed about heart attack and stroke symptoms: an analysis of 2003–2005 Behavioral Risk Factor Surveillance Survey data

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Aim: The research question for this study was: Are there within-group disparities in Hispanic women's knowledge of heart attack and stroke symptomology? **Background:** Hispanics constitute the fastest growing group in the US and have surpassed other racial and ethnic groups to become the largest US minority. Hispanics make up about one-third of the US population, and hence are a group of significant interest for health care providers. Few studies have examined heart attack and stroke symptom awareness among adult Hispanic women, a group at high risk for delays in treatment. Research is needed to elucidate their knowledge of warning symptoms for these vascular events. **Methods:** Behavioral Risk Factor Surveillance Survey data from states using the 2003–2005 Heart and Stroke module were examined by multivariate techniques. To maximize the representativeness of the sample, three years of survey data (2003–2005) were amalgamated into a single dataset. If a given state administered the Heart and Stroke module in multiple years, only the data from the most recent year were included in the merged dataset. In the final analysis, data from 23 states, one territory and the District of Columbia were included in the combined 2003–2005 database. The unweighted sample size for the population of interest for the years 2003–2005 was 3146. For analysis these data were weighted to represent 2 641 024 Hispanic women aged 18 years and older who answered questions about heart attack and stroke symptoms. **Findings:** Adult Hispanic women earning low scores on the heart attack and stroke knowledge questions were more likely to have less than a high school education, be uninsured, live in a household with an annual income of <$35 000 and not have a primary care provider. **Discussion:** These results suggest that strategies to educate Hispanic women on signs and symptoms of heart attack and stroke might benefit from targeting women in these groups.

Key words: health disparities; heart attack and stroke symptom knowledge; Hispanic women; poverty and health

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Introduction

Hispanics – defined by the US Census Bureau as people whose origin is Mexican, Puerto Rican, Cuban, Spanish-speaking Central or South American countries, or other Hispanic/Latino, regardless of race – constitute the fastest growing group in the US and have surpassed other racial and ethnic groups to become the largest US minority, numbering an estimated 42.7 million (US Census Bureau, 2007). The reasons of this population increase are immigration and high fertility rates in this population (US Census

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Bureau, 2007). Cardiovascular disease (CVD) and stroke, respectively, are the first and third leading cause of mortality for Americans (Thom *et al.*, 2006) and in 2001, the proportion of deaths for people under the age of 65 due to heart disease was higher in Hispanics than in non-Hispanics (Panicioli *et al.*, 1998; Greenlund *et al.*, 2003; Thom *et al.*, 2006). In addition, Mexican-American women, the largest subgroup of Hispanics in the US (Morgenstern *et al.*, 2004), have a higher prevalence of risk factors for CVD than US Caucasian women (Thom *et al.*, 2006). Studies also demonstrate an increased prevalence of hypertension for Hispanics than for non-Hispanic whites and show that diabetes is more common in Mexican Americans.

In the US, although many individuals perceive CVD as disproportionately affecting males, more women than men die of CVD each year (Thom *et al.*, 2006). Despite an increasing trend among women in the awareness and knowledge of cardiovascular health, a gap in knowledge and awareness still persists for minority women, particularly those of Hispanic descent (Mosca *et al.*, 2004; 2006; Christian *et al.*, 2007). A recent study found that less than 10% of Hispanic women considered heart disease to be a major health problem for women, and were also more likely to admit that they did not consider themselves well informed about heart disease (Christian *et al.*, 2007).

Similar to decreased CVD knowledge, a lack of stroke knowledge among Hispanic women is evident as well (Stansbury *et al.*, 2001; Ferris *et al.*, 2005; Christian *et al.*, 2007), despite an increased incidence of stroke in Mexican Americans compared to non-Hispanic whites (Morgenstern *et al.*, 2004; Thom *et al.*, 2006). Mexican Americans are less able to recall stroke symptoms than non-Hispanic whites, and in one study, only 20% recognized stroke as the leading cause of disability (Morgenstern *et al.*, 2004).

Timely medical care and prompt initiation of optimal treatment are key factors for reducing the morbidity and mortality for both heart attack and stroke. Delays in acute treatments, such as thrombolysis and angioplasty, correlate with an increased risk of mortality from a heart attack (Berger *et al.*, 1999; De Luca *et al.*, 2004; Greenlund *et al.*, 2004; 2005). Similarly, administering intravenous recombinant tissue plasminogen activator (rt-PA) within three hours of onset of ischaemic stroke symptoms

for appropriate patients reduces morbidity and mortality (Lewandowski *et al.*, 1999; Lisboa *et al.*, 2002; Davalos, 2005). Though the benefits of early treatment for heart attack and stroke are well known, many individuals still wait for hours before seeking treatment.

Two variables, gender and race, are known to affect risk for cardiovascular events (Lacy *et al.*, 2001; Thom *et al.*, 2006). Both women and Hispanics have routinely been shown to delay seeking treatment after experiencing acute onset of symptoms of heart attack and stroke (Murphy *et al.*, 2002; Zerwic *et al.*, 2003; Rosenfeld, 2004; Mandelzweig *et al.*, 2006). Though overall, the majority of women can correctly identify the major symptoms of heart attacks, ethnic differences are nevertheless evident in women's perception of some symptoms indicative of heart attack, with non-Caucasian participants incorrectly identifying symptoms more often than Caucasians (Aslanian-Engoren, 2005). Additionally, Hispanic women were found to be less aware of the existence of acute therapy for stroke and that there is a narrow time-window for effective early stroke treatment (Morgenstern *et al.*, 2001; Ferris *et al.*, 2005). Moreover, Hispanics of both genders were more reticent to say that they would call 911 (the emergency service number in the USA) if stroke symptoms were encountered (Morgenstern *et al.*, 2001). However, most of these previous studies treated Hispanics as a homogeneous group rather than a heterogeneous one and did not take into account other factors such as income levels or having a primary care provider (PCP) that might influence their knowledge and treatment-seeking behaviour.

In this study we examined whether there were within-group disparities in Hispanic women's knowledge of heart attack and stroke symptomology. The analysis stratified Hispanic women by age, education, household income, health insurance status, having a PCP and deferring medical care because of cost, in order to examine whether these variables affected heart attack and stroke symptom knowledge among Hispanic women. Identifying differences in knowledge or symptom awareness among subgroups should be helpful in developing interventions targeting those adult Hispanic women at the highest risk for delaying treatment. We also sought to determine the degree of risk for heart attack and stroke in the adult Hispanic female population in the US and to identify where

Hispanic women, who were at a high risk for myocardial infarction (MI) and stroke, lived.

Methods

The database

To answer the research question, multivariate techniques were used to analyse a multi-year Behavioral Risk Factor Surveillance Survey (BRFSS) Heart and Stroke module database. BRFSS data are collected using a random-digit dial telephone survey targeting adults 18–99 years of age. These data are collected under the guidance of the Centers for Disease Control and Prevention in collaboration with all US states and most US territories. Once collected, BRFSS data are weighted such that they are representative of the non-institutional US population by surveyed state. The data are cross-sectional and are focused on health risk factors and behaviours. A detailed description of the BRFSS survey design and sampling measures can be found elsewhere (US Centers for Disease Control and Prevention, 1998). The population of interest for this research study was US Hispanic adult women.

The BRFSS is comprised of both optional and required modules. All states must complete the required modules and may choose to include any or none of the optional ones. Modules that are optional are selected by states for inclusion in their BRFSS surveys in a number of ways. Some states include specific modules on a yearly basis while others rotate modules on a schedule (eg, every two or every three years, a specific module is included in the administered survey). The data we were interested in analysing were collected by the optional Heart and Stroke module that states could select for inclusion in their BRFSS survey. To maximize the representativeness of the sample, three years of BRFSS data (2003–2005) were amalgamated into a single dataset. Only data from states using the Heart and Stroke module were selected for inclusion in the amalgamated database. If a given state administered the Heart and Stroke module in multiple years, only the data from the most recent year were included in the merged dataset. In the final analysis, data from 23 states, one territory and the District of Columbia were included in the amalgamated 2003–2005 database.

Ascertaining heart attack and stroke risk

To ascertain the degree of risk for heart attack and stroke in the adult Hispanic female population in the US, we calculated a risk factor variable from self-reported hypertension, hyperlipidemia, obesity and diabetes using the 2005 BRFSS data only. If a respondent reported having at least one of the above conditions, they were coded as having a risk factor for heart attack or stroke. These data were then mapped by percentages and US state using ArcView 9.0 GIS software (RockWare Inc., Golden, CO, USA) in order to depict where in the US Hispanic women at highest risk for heart attack and stroke lived in the US.

The sample population

The unweighted sample size for the population of interest for the years 2003–2005 was 3146. For analysis these data were weighted to represent 2 641 024 Hispanic women aged 18 years and older who answered questions about heart attack and stroke symptoms. The weighting, calculated by the Centers for Disease Control and Prevention, uses the most recently available census data to provide a stratified representation of the surveyed state's Hispanic female population.

BRFSS Heart and Stroke module

For the years in question, the BRFSS Heart and Stroke module included 13 questions focused on ascertaining knowledge of early symptoms of heart attack and stroke. Respondents were asked whether the following were warning signs of stroke: sudden confusion, trouble speaking or understanding; sudden numbness or weakness of face, arm, or leg; sudden trouble seeing in one or both eyes; sudden trouble walking, dizziness, or loss of balance or coordination; or sudden, severe headache with no known cause. An incorrect sign (ie, sudden chest pain) was included to examine the possibility that respondents would answer 'yes' for all the symptoms. Likewise, respondents were asked whether the following were warning signs of a heart attack: 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; or shortness of breath. Just as was the case with stroke symptoms, an incorrect sign (ie, trouble seeing in one or both eyes) was included to examine the possibility

that respondents would answer 'yes' for all the symptoms.

Preparing data for analysis

We chose to group the questions for heart attack and stroke symptomology together for analysis because these disorders are both vascular events that share in common the need for prompt recognition of symptoms and pre-hospital action by either the patient or bystanders. Any costly public health campaign will likely need to address both these vascular diseases together and strokes are often referred to as 'brain attacks' since many aspects of early stroke management mimic heart attack management. However, to confirm the assumption that knowledge among Hispanic women for these vascular disorders was similar, we also examined heart attack and stroke questions separately and compared the scores for each to validate that knowledge scores for both diseases paralleled one another.

For analysis we computed a *Heart Attack and Stroke Knowledge Score* for each respondent. Correct answers received 1 point and were categorized according to the following scale: low score 2–8 points, mid-range score 9–10 points, and high score 11–13 points. Although this scale, like most, is arbitrary, it served the purpose of allowing for the standardized comparison of knowledge levels among groups. Correspondingly, for the descriptive analysis on the heart attack and stroke knowledge questions conducted separately from one another, a knowledge score was computed for each respondent for each distinct set of knowledge questions. As with the composite knowledge scores, for the individual knowledge components (heart attack and stroke separately) correct answers received 1 point. These scores were then categorized as either low or high scores according to the following scale: low scores 0–3 points (≤50%) and high score 4–6 points (>50%).

Three original BRFSS variables – age, education and annual household income – were re-coded for this analysis. Since the data were collected in multiple categories, in order to have a more meaningful analysis this approach required collapsing the multiple response categories into fewer categories. In the 2003–2005 BRFSS six possible categorical answers were included for the questions regarding educational attainment. These were:

(1) never attended school or only kindergarten, (2) grades 1–8 (Elementary), (3) grades 9–11 (Some high school), (4) grade 12 or GED (High school graduate), (5) college one to three years (Some college or technical school) and (6) college four years or more (College graduate). An examination of 2005 census data revealed that 59.0% of Hispanic female adults graduated from high school and that only 12.12% graduated from college with a four-year degree. In order to calculate a bivariate odds ratio we reduced the educational attainment categories to <high school and ≥high school (Weinick *et al.*, 2004).

Similarly, the BRFSS originally collected household income according to the following eight possible categories/ranges: (1) <\$10 000, (2) \$10 000 to <\$15 000, (3) \$15 000 to <\$20 000, (4) \$20 000 to <\$25 000, (5) \$25 000 to <\$35 000, (6) \$35 000 to <\$50 000, (7) \$50 000 to <\$75 000 and (8) ≥\$75 000. Analysing the heart attack and stroke knowledge data using a bivariate odds ratio also required reducing income to two categories. An examination of the 2005 census data revealed that Hispanic women who were high school graduates earned on average \$18 471, non-high school graduates earned less at \$13 000 and college graduates \$37 900. Hispanic women with some college education earned on average \$24 515 annually. As a result of this information, we chose to collapse the categories for income into <\$35 000 and ≥\$35 000 (US Census Bureau, 2007).

Age was recoded from a continuous variable to a categorical one with three factors/levels (18–34 years, 35–54 years and ≥55 years). We re-coded age into these three categories in order to ascertain if knowledge of heart attack and stroke symptoms differed by age group and if so how. For example, the majority of strokes and heart attacks occur in individuals over age 55, suggesting that this age group might have greater personal experience leading to greater knowledge. On the other hand, identifying marked deficiencies in knowledge in a younger age group is also important. Even though younger individuals may be at lower risk personally, they might be a bystander to an event that requires their recognition to assure prompt action. Additionally, they may be caregivers to aging parents and having knowledge of heart attack and stroke symptomology could be important.

Statistical analysis

A regression model was performed using *low scores* on the combined heart attack and stroke knowledge questions as the dependent variable. All adult Hispanic women population ≥18 years were considered. The independent variables entered into the model were: age, education, household income, health insurance status in the past 12 months and deferring medical care in the past 12 months because of cost. Alpha was set at 0.05 for all tests of statistical significance. To further reduce bias, a constant was entered into the model. Statistical Package for Social Scientists Complex Samples Version 15.0 (SPSS, Chicago, IL, USA) was used to complete the analyses to account for the complex survey design. The research was approved by the Institutional Review Board of the University of Illinois, Chicago College of Medicine at Rockford.

Results

Figure 1 is a map of the US displaying the proportions of Hispanic women at risk for heart attack and stroke by state, based on whether or not they self-reported having one or more of the four risk factors for heart attack and/or stroke (hypertension, hyperlipidemia, obesity or diabetes). By state, the proportions of Hispanic women at risk for heart attack and/or stroke ranged from 31.3% to 74.4%. The largest number of US states had 45.1–55.0% of the adult Hispanic female population at risk for heart attack and/or stroke.

The adult Hispanic female population is described in Table 1. These data offer that a little over 20% of the population was aged 55 years or older, 73.1% had at least a high school education and 65.5% lived in households with annual incomes <$35 000. In almost equal proportions, 65.5% and 67.8%, respectively, the population of interest had health insurance as well as an identified PCP. Almost 25.3% reported having deferred medical care because of cost sometime in the past 12 months.

Table 2 presents the proportion of correct answers to the heart attack and stroke symptomology questions for all adult Hispanic female respondents. For questions on heart attack symptoms, 56.9% of the respondents did not recognize that pain or discomfort in the jaw, neck or back were symptoms of heart attack. In addition, 30.6% responded incorrectly to the question regarding feeling weak, lightheaded or faint as symptoms of heart attack. They also incorrectly attributed sudden trouble seeing in one or both eyes as a symptom of heart attack 48.1% of the time. For questions regarding stroke symptomology, respondents incorrectly identified sudden chest pain or discomfort as symptoms of stroke 59.9% of the time. A high proportion of respondents (43.4%) also incorrectly identified severe headache with no known cause as not being a
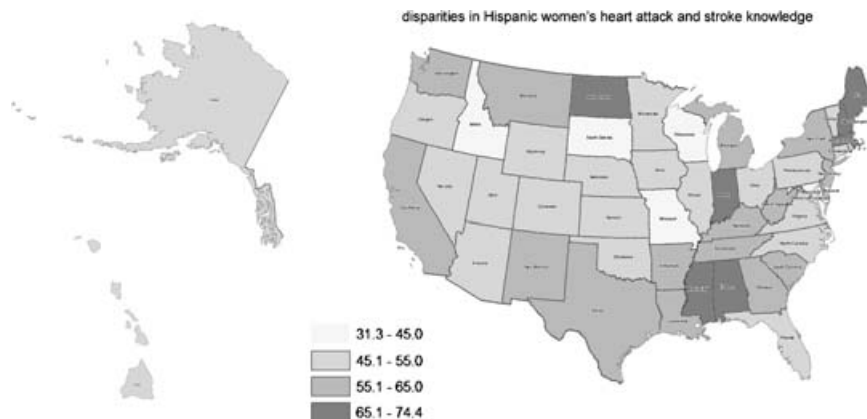

disparities in Hispanic women's heart attack and stroke knowledge

	31.3 - 45.0
	45.1 - 55.0
	55.1 - 65.0
	65.1 - 74.4

Figure 1 Percentage of Hispanic adult women ≥18 years of age with at least one Heart Attack and Stroke Risk Factor[*], 2005 Behavioral Risk Factor Surveillance Data. [*]Risk factors are hypertension, hyperlipidemia, obesity and diabetes

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Table 1 Selected characteristics of Hispanic women ≥18 years of age responding to the Heart and Stroke module[*] 2003–2005 Behavioral Risk Factor Surveillance Data (weighted $n = 2\,641\,024$)

Variables and factors	Hispanic women (%)
Age (years)	
18–34	42.7
35–54	35.2
≥55	22.1
Education	
<High school	26.9
≥High school	73.1
Health insurance	
Yes	65.5
No	34.5
Household income	
<$35 000	65.5
≥$35 000	34.5
Medical care deferred because of cost	
Yes	25.3
No	74.7
Primary care provider	
Yes	67.8
No	32.2

[*] 25 states/territories were included in this analysis. By year of data collection these were:
2003 – Arkansas, Georgia, Nebraska, North Carolina, North Dakota, South Carolina;
2004 – Colorado, Connecticut, Kentucky, Ohio;
2005 – Alabama, DC, Florida, Iowa, Louisiana, Maine, Minnesota, Mississippi, Missouri, Montana, Oklahoma, Tennessee, US Virgin Islands, Virginia, West Virginia.

Table 2 Heart attack and stroke knowledge questions with correct responses by Hispanic women 2003–2005 Behavioral Risk Factor Surveillance Data (weighted $n = 2\,641\,024$)

Prologue: Now I would like to ask you about your knowledge of the signs and symptoms of a heart attack and stroke. Which of the following do you think is a symptom of a heart attack (or stroke)?
For each, tell me 'Yes', 'No', or you're 'Not sure'

Survey questions	Correct answers (%)
Heart attack symptoms (*correct answer*)	
Do you think pain or discomfort in the jaw, neck, or back are symptoms of a heart attack? (Yes)	43.1
Do you think feeling weak, lightheaded, or faint are symptoms of a heart attack? (Yes)	69.4
Do you think chest pain or discomfort are symptoms for a heart attack? (Yes)	90.9
Do you think sudden trouble seeing in one or both eyes is a symptom of a heart attack? (No)	51.9
Do you think pain or discomfort in the arms or shoulders are symptoms of a heart attack? (Yes)	84.9
Do you think shortness of breath is a symptom of a heart attack? (Yes)	87.2
Stroke symptoms (*correct answer*)	
Do you think sudden confusion or trouble speaking are symptoms of a stroke? (Yes)	85.6
Do you think sudden numbness or weakness of face, arm, or leg, especially on one side are symptoms of a stroke? (Yes)	92.7
Do you think sudden trouble seeing in one or both eyes is a symptom of a stroke? (Yes)	75.8
Do you think sudden chest pain or discomfort are symptoms of a stroke? (No)	40.1
Do you think sudden trouble walking, dizziness, or loss of balance are symptoms of a stroke? (Yes)	87.0
Do you think severe headache with no known cause is a symptom of a stroke? (Yes)	56.6
Proper response to heart attack or stroke (*correct answer*)	
If you thought someone was having a heart attack or a stroke, what is the first thing you would do? (call 911)	87.3

symptom of stroke. Finally, 12.7% failed to recognize that calling 911 was the appropriate first response to these acute events.

Descriptive statistics of heart attack and stroke knowledge scores are presented in Table 3. This table presents the composite heart attack and stroke knowledge of symptomology scores as well as the heart-attack-alone and stroke-alone knowledge scores. Cumulative scores on the heart attack and stroke knowledge questions ranged from 3 to 13 points with a mean score of 9.11 and a standard deviation of 2.03. Overall, the majority of adult Hispanic women scored in the moderate range for the composite heart attack and stroke knowledge scores (50.9%). Twenty-seven per cent of the respondents were low scorers while 22.3% were high scorers. When examining the heart-attack-alone and stroke-alone knowledge scores, there was no difference in the proportions of Hispanic adult women who earned low scores on the composite heart attack knowledge questions in comparison to the composite stroke knowledge questions (26.4% vs. 26.6%).

Table 3 Descriptive statistics of heart attack and stroke knowledge scores of Hispanic women ⩾18 years of age 2003–2005 Behavioral Risk Factor Surveillance Data

	Weighted (*n* = 2 641 024)		
	Composite heart attack and stroke knowledge score	Heart attack knowledge score	Stroke knowledge score
Score category[*]			
Low score	26.8%	26.4%	26.6%
Mid-range score	50.9%		
High score	22.3%	73.6%	73.4%
Range of knowledge scores	3–13	1–7	1–7
Mean knowledge scores	9.11	4.19	4.01
Std. deviation	2.03	1.32	1.01

[*]Correct answers received 1 point and were categorized according to the following scale for the composite scores: Low score = 0–8 points or ⩽60%, mid-range score = 9–10 points or 69–77%, high score = 11–13 points or 85–100%.
For the heart attack and stroke knowledge scores calculated separately, a low and a high score was calculated using the following scale: Low score = 0–4 or ⩽50%, high score = 5–7 or >50%.
The composite heart attack and stroke knowledge score included the first responder question. This was also included in the calculations for each domain's separate knowledge score.

Table 4 Bivariate analysis of Hispanic women ⩾18 years of age by independent variables and heart attack and stroke knowledge score level 2003–2005 Behavioral Risk Factor Surveillance Data

Variables and factors	Contingency coefficient and unadjusted odds ratio (95% CI)		
	High score	Low score	
Age categories (years)			
18–34	27.9%	39.7%	
35–54	54.7%	40.0%	Contingency coefficient = 0.149, *P* < 0.01
⩾55	17.5%	20.3%	
Education			
<High school	Odds ratio for education (<high school ⩾high school).		
⩾High school	Low score = 1.916 (95% CI = 1.907, 1.924)		
Have primary care provider			
Yes	Odds ratio for have primary care provider (Yes/No).		
No	High score = 1.687 (95% CI = 1.671, 1.704)		
Annual household income			
<$35 000	Odds ratio for annual household income (<$35 000/⩾$35 000).		
⩾$35 000	Low score = 2.032 (95% CI = 2.014, 2.050)		
Was medical care deferred because of cost			
Yes	Odds ratio for was medical care deferred because of cost (Yes/No).		
No	Low score = 1.098 (95% CI = 1.091, 1.170)		
Have health insurance			
Yes	Odds ratio for have health insurance (Yes/No).		
No	High score = 1.977 (95% CI = 1.957, 1.997)		

Bivariate analysis of the independent variables stratified by high/low composite heart attack and stroke knowledge scores were conducted and the results are displayed in Table 4. All of the relationships between the independent and dependent variables by score range proved to be statistically significant and were subsequently entered into a logistic regression model that used low scores on the heart attack and stroke knowledge questions as the dependent variable.

The multivariate logistic regression results are presented in Table 5. This analysis yielded that

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Table 5 Multivariate logistic regression results for heart attack and stroke low knowledge score for Hispanic women ⩾18 years of age 2003–2005 Behavioral Risk Factor Surveillance Data

Variables	Factors	Adjusted odds ratio (95% CI)
Age categories (vs. 18–34)	35–54	0.523 (0.514, 0.532)
	⩾55	0.420 (0.410, 0.431)
Education (vs. ⩾High School)	<High school	3.718 (3.623, 3.815)
Have health insurance (vs. Yes)	No	1.575 (1.541, 1.608)
Annual household income (vs. ⩾$35 000)	<$35 000	2.918 (2.868, 2.970)
Was medical care deferred because of cost (vs. No)	Yes	0.585 (0.573, 0.597)
Have primary care provider (vs. Yes)	No	1.113 (1.091, 1.136)

Hispanic women aged ⩾18 years who earned low scores on the composite heart attack and stroke knowledge questions (range 0–8 points) were more likely to: have less than a high school education (OR 3.718, CI 3.623, 3.815), be uninsured (OR 1.575, CI 1.541, 1.608), live in a household with an annual income <$35 000 (OR 2.918, CI 2.868, 2.970) and not have a PCP (OR 1.113, CI 1.091, 1.136). Additionally, they were less likely to be aged 35–54 (OR 0.523, CI 0.514, 0.532) and >55 (OR 0.420, CI 0.410, 0.431) years. Finally, Hispanic women who earned low scores on the heart attack and stroke symptomology questions were less likely to have deferred medical care because of cost (OR 0.585, CI 0.573, 0.597).

Discussion

This study both ascertained heart attack and stroke risk and assessed symptom awareness of acute heart attack and stroke in the adult US Hispanic female population using nationally representative data. Various interesting trends were revealed in this study of Hispanic women 18–99 years of age.

First, risk for heart attack and/or stroke for Hispanic adult women varied by state from 31.3% to 74.4%. In all but five states, at least 45% of the state's Hispanic adult women population had at least one risk factor for heart attack and/or stroke underscoring the importance of heart attack and stroke symptom knowledge to this population.

Second, with risk for heart attack and/or stroke almost as high as 75% in some states, almost one in three or 27% of the adult female Hispanic respondents were low scorers on the composite heart attack and stroke symptom questions. There was an overall confusion when it came to correctly identifying symptoms for both stroke and heart attack. For instance, Hispanic women had difficulty identifying pain or discomfort in the jaw, neck or back as well as feeling weak, light-headed or faint as symptoms of a heart attack. They were also confused about whether or not sudden trouble seeing in one or both eyes was a symptom of heart attack, although 75.8% were able to correctly identify such as a symptom of stroke. Although one might argue that correctly identifying between stroke and heart attack symptoms is less critical as long as the symptoms are recognized as serious enough to seek care, it is alarming that while the majority of women recognized chest pain as a heart attack symptom, more than half of the respondents failed to recognize less typical symptoms of a heart attack. Since women are more likely to present with atypical symptoms failing to recognize these as heart attack symptoms may be an important contributor to delays in treatment for Hispanic women.

Third, there was no significant difference between the levels of knowledge on stroke symptoms when compared to heart attack symptoms. In fact, equal proportions of Hispanic women (26%) earned low scores on both the heart attack and stroke symptom knowledge questions.

Fourth, although the majority of patients recognize that calling 911 is the correct response to an acute event, this is still a distressingly high number of participants that failed to recognize that activating the emergency response by calling 911 is the appropriate first response. More than one in 10 individuals did not know to call 911 and given importance of timely response and the absolute number of heart attack patients targeting educational programmes to empower Hispanic women to call 911 would likely yield benefit.

Finally, a substantial gap in knowledge of heart attack and stroke among Hispanic women was identified. Younger women, those between 18 and 34 years of age, who constitute the highest proportion of Hispanic women in the US, were more likely to be ill informed about heart attack and stroke symptoms. While women in this age group may not be at immediate risk for heart attack and stroke, it is still important to increase awareness in this age group since they may be the first ones to interact with an older family member or other individuals at high risk for heart attack and stroke. Further, Hispanic women with less than a high school education had greater difficulty in correctly identifying heart attack and stroke symptoms as did those in lower income households and those who did not have either health insurance or a personal physician.

Several potential limitations to this study should be noted. First, the survey is based on telephone-derived data and may be skewed if those who did not participate were less likely to recognize symptoms. For example, persons of lower socioeconomic status are less likely to be included because of poorer phone access. Since lower socioeconomic status correlates with lower symptom awareness, our findings could underestimate knowledge or the gap between lower socioeconomic status Hispanic women. However, the fact that the vast majority of Americans live in households with phones minimizes this bias. A second limitation is that the survey consists of close-ended questions and this may result in an overestimation of knowledge. A different format to the survey may have yielded very different results. Third, it is possible that the non-responders to the BRFSS might have scored differently on the questions skewing the results (Morgenstern et al., 2004). Fourth, after reviewing the source of the database, it was still unclear whether the survey for this module was available to participants who did not speak English. New immigrant Hispanic women who may not speak English, have access to a phone or health insurance could have inflated the selection bias. Also, a number of newly arrived immigrants may not be willing to participate in a phone survey if they fear their immigration status could be jeopardized. On the positive side, a strength of this study is the large number of individuals surveyed yielding a nationally representative sample.

The findings of this study support the need to analyse the differences within a population group and to avoid treating, in this instance, Hispanics as a monolithic population lacking within-group diversity (Weinick et al., 2004). As the results revealed, three-fourths of the sample had at least a high school education and 67% of the sample had a PCP. However, the multivariate analysis of the group shows there were significant within-group differences. Many of these differences provide suggestions for where low levels of health literacy exist in the female adult Hispanic population. Low health literacy is widely known to be a major problem in today's health care environment (Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs, 1999; Institute of Medicine, 2004) with a growing number of studies linking low patient literacy with poor health outcomes (Schillinger et al., 2002). Since the research reported on here has focused on a population whose growth is partially tied to immigration, the findings might be informative to researchers and health care providers anywhere who struggle with health care issues of immigrant and/or minority groups. In the US, these findings suggest that targeting educational efforts towards female adult Hispanics with less than a high school education, those who do not have a PCP and whose income is less than $35 000 a year would perhaps be ways of improving the outcome of acute vascular events among the Hispanic adult female population.

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