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ORIGINAL RESEARCH

Disparities in Awareness of Myocardial Infarction and Stroke Symptoms and Response Among United States– and Foreign-Born Adults in the National Health Interview Survey

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BACKGROUND: Atherosclerotic cardiovascular disease, defined as nonfatal myocardial infarction (MI), coronary heart disease death, or fatal or nonfatal stroke, is the leading cause of death in the United States. MI and stroke symptom awareness and response reduce delays in hospitalization and mortality.

METHODS AND RESULTS: We analyzed cross-sectional data from the 2014 and 2017 National Health Interview Surveys on US- and foreign-born adults from 9 regions of birth (Europe, South America, Mexico/Central America/Caribbean, Russia, Africa, Middle East, Indian subcontinent, Asia, and Southeast Asia). The outcomes were recommended MI and stroke knowledge, defined as knowing all 5 symptoms of MI or stroke, respectively, and choosing "call 9-1-1" as the best response. We included 63 059 participants, with a mean age 49.4 years; 54.1% were women, and 38.5% had a high school education or less. Recommended MI and stroke knowledge were highest in US-born people. In both 2014 and 2017, MI knowledge was lowest in individuals born in Asia (23.9%±2.5% and 32.1%±3.3%, respectively), and stroke knowledge lowest for the Indian subcontinent (44.4%±2.4% and 46.0%±3.2%, respectively). Among foreign-born adults, people from Russia and Europe had the highest prevalence of recommended MI knowledge in 2014 (37.4%±5.4%) and 2017 (43.5%±2.5%), respectively, and recommended stroke knowledge was highest in people from Europe (61.0%±2.6% and 67.2%±2.5%). Improvement in knowledge was not significant in all groups between 2014 and 2017.

CONCLUSIONS: These findings suggest a disparity in MI and stroke symptom awareness and response among immigrants in the United States. Culturally tailored public health education and health literacy initiatives are needed to help reduce these disparities in awareness.

Key Words: cardiovascular disease ■ disparities ■ health education ■ heart attack ■ immigrants ■ stroke

Atherosclerotic cardiovascular disease (ASCVD), defined as nonfatal myocardial infarction (MI), coronary heart disease (CHD) death, and fatal or nonfatal stroke, has been the leading cause of death globally and in the United States for over 15 years.[1,2] In 2016, an estimated 18.2 million US adults had CHD.[3] Of these, 8.4 million suffered from MI, and disparities by sex, age, race, and ethnicity have been identified.[3]

In 2016, stroke prevalence within the United States was 2.5%, and a death from stroke occurred every

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CLINICAL PERSPECTIVE

What Is New?

- There are disparities in awareness of recommended knowledge of myocardial infarction and stroke between foreign- and US-born individuals living in the United States.
- Myocardial infarction knowledge was lowest among individuals from Asia, and stroke knowledge was lowest among individuals from the Indian subcontinent.

What Are the Clinical Implications?

- Health educational initiatives with culture-specific materials and counseling could provide appropriate information for vulnerable populations and address disparities in awareness of myocardial infarction and stroke.

Nonstandard Abbreviations and Acronyms

NHIS	National Health Interview Survey
PR	prevalence ratio

3 minutes.[3] Studies have shown racial disparities in the prevalence and incidence of stroke among US adults. Additionally, MI and stroke awareness have been previously shown to be lowest in Asian American, Hispanic, and Black people and in geographic areas with neighborhood deprivation.[3,4] However, less attention has been paid to specific subgroups within these racial and ethnic groups or for immigrants from particular countries.

Findings from studies on the US population indicate a decline in the incidence of CHD. However, this decline is smaller in Asian American and Black men and women.[5,6] This decline has been attributed, in part, to increased primary prevention efforts and knowledge of risk factors.[3,5,7] Recent data suggest women's awareness of heart disease as the leading cause of death decreased from 65% to 44% in 2019, specifically in Hispanic and non-Hispanic Black women.[8] Additionally, many adults in the United States remain unaware of the symptoms of and appropriate actions to take in response to MI and stroke symptoms.[9,10] Studies show that the awareness of MI and stroke symptoms among US adults is significantly lower for individuals who have lower education levels and fall within lower income brackets. Moreover, individuals who are non-Hispanic Black, Hispanic, and foreign born also have lower knowledge of MI symptoms.[3,9]

With immigrants making up 14% of the US population and rising,[11] it is essential to explore this question among this subpopulation; however, not all prior studies have included racial and ethnic minority groups that make up a significant proportion of the immigrant population, such as the Asian American group. Additionally, it is well documented that the immigrant population in the United States has consistently been negatively impacted by the social determinants of health such as low income or limited access to education and health care.[12] Additional factors, such as language barriers, prejudicial views, and legal status further complicate health knowledge, access, and outcomes.[13]

Comparison of the awareness of MI and stroke symptoms and response among foreign- and US-born individuals could elucidate any existing disparities across specific immigrant groups and highlight aspects of CHD and stroke prevalence globally. This examination may also provide insight on subgroups that public health interventions should be directed toward and topics that need to be emphasized in strategies aimed at educating the public on stroke and MI.

METHODS

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Study Design and Population

The National Health Interview Survey (NHIS) is a cross-sectional study of the civilian noninstitutionalized population of the United States, administered by the National Center for Health Statistics, which provides information on health monitoring and is nationally representative.[14] The 2014 and 2017 NHIS questionnaires included supplemental content in the sample adult interview with questions on MI and stroke symptoms as well as appropriate actions to take in the event of an MI or stroke; hence we included data from these 2 years. We included respondents from 9 regions of birth as categorized in the NHIS, namely Mexico/Central America/Caribbean, South America, Europe, Russia, Africa, the Middle East, the Indian subcontinent, Asia, and Southeast Asia, who were 18 years of age or older. A list of countries included in these 9 regions is provided in the Table S1. All foreign-born respondents were classified as immigrants. This study was exempt from review by the first author's institutional review board committee because NHIS data are publicly available and deidentified. It is reported in accordance with the STROBE (*Strengthening the Reporting of Observational Studies in Epidemiology*) reporting guideline.

Outcomes

Awareness of MI Symptoms and Stroke Symptoms

Knowledge of MI symptoms was assessed based on responses to the question, "Which of the following would you say are the symptoms that someone may be having a heart attack?" Responses were 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 shoulder; and shortness of breath. Similarly, knowledge of stroke symptoms was assessed by an individual's response to the question, "Which of the following would you say are the symptoms that someone may be having a stroke?" Responses were sudden numbness or weakness of face, arm, or leg, especially on one side; sudden confusion or trouble speaking; sudden trouble seeing in one or both eyes; sudden trouble walking, dizziness, or loss of balance; and sudden severe headache with no known cause. Respondents who answered "yes" to the 5 queries on MI and stroke symptoms were classified as knowing the symptoms of MI and stroke. Those who answered "no," "don't know," or refused to answer were classified as not knowing the symptoms.

Response to Perceived MI and Stroke

Respondents were also asked the questions, "If you thought someone was having a heart attack, what is the best thing to do right away?" and "If you thought someone was having a stroke, what is the best thing to do right away?" Individuals who answered, "Call 9-1-1 (or another emergency number)" were categorized as having knowledge of the appropriate action to take in the event of MI or stroke. Individuals who responded with, "advise them to drive to the hospital," "advise them to call their physician," "call spouse of family member," "don't know," "other," or refused to answer were categorized as not knowing the best action to take. Having recommended MI or stroke knowledge was attributed to respondents who knew that calling 9-1-1 was the best action to take and were aware of all 5 MI symptoms or all 5 stroke symptoms, respectively.

Covariates

In addition to region of birth, demographic covariates included age, sex, education level (high school or less, some college, bachelor's degree or higher), marriage status (married or not married), socioeconomic status (poverty-income ratio: ≤1, 1–1.99, ≥2), employment status (employed or not employed), health insurance status (insured or not insured), years in the United States (<10 years, ≥10 years), language of interview, and access to a health professional (have a usual place to go when sick, talked to general doctor in the past 12 months). Other covariates were ASCVD risk factors, specifically history of hypertension, history of diabetes, alcohol use, obesity status (using Asian-specific cut-offs for individuals of Asian descent),[15] current smoker status, history of MI, and history of stroke.

Statistical Analysis

We included sampling weights for the years 2014 and 2017 to account for the complex survey design using guidelines from National Center for Health Statistics for combining NHIS data.[14] We merged the sample adult and person-level files for these years and adjusted the sampling weights to account for pooling the data. Using these data, we included 63 439 individuals 18 years of age and older who responded to supplemental content in the sample adult interview pertaining to MI and stroke knowledge, and we excluded 380 people whose responses to the question on region of birth was missing, "elsewhere," or "unknown." We compared the included and excluded sample to identify variable differences and potential sources of bias using survey-weighted *t* tests and χ^2 tests.

We examined differences in categorical and continuous variables between the US-born people and immigrants from the 9 regions of birth using survey-weighted χ^2 tests and linear regression, respectively. Survey-weighted generalized linear models with Poisson distribution and a logarithmic link with linearized variance estimation were used to estimate the prevalence of recommended knowledge of MI and stroke symptoms by region of birth, to assess disparities in knowledge between foreign- and US-born respondents and to compare responses from 2014 and 2017, and assess improvement in awareness. The prevalence of recommended knowledge (separately for MI and stroke) was estimated in combined multivariable models adjusting for year as the main effect (Table S2 and S3). We also adjusted for sociodemographic variables and ASCVD risk factors that differed significantly among the sample; namely, age, sex, marital status, education, income level, employment status, insurance status, overweight and obesity, history of hypertension, alcohol use, and smoking status. No adjustments were made for multiplicity across different outcomes. Statistical analyses were performed with Stata version 16 SE (StataCorp, College Station, TX). To account for the complex survey design, we used the svy and vce (unconditional) options in Stata. We considered an α of ≤0.05 to be statistically significant. The results represented in this article are survey-weighted results.

RESULTS

The sample consisted of 63 059 respondents, with a mean age of 49.4 years; 54.1% were women, and

38.5% had a high school education or less. Immigrants comprised 16.2% (10 261) of the sample. The largest proportion of immigrants were from Mexico, Central America, and the Caribbean (50.3%). There were significant differences in key sociodemographic characteristics examined across all immigrant groups (Table 1).

There was also significant variation in the prevalence of ASCVD risk factors by region of birth (Table 2). Hypertension was most prevalent among European immigrants (35.6%±1.7%), whereas diabetes was most prevalent in immigrants from Mexico, Central America, and the Caribbean (12.5%±0.6%). The highest prevalence of current smokers (19.9%±3.0%) and current drinkers (77.8%±3.4%) was among Russian immigrants, and overweight or obese status was most prevalent among immigrants from the Indian subcontinent (76.1%±1.8%). The highest prevalence of past MI (3.9%±0.1%) and stroke (3.6%±0.1%) was among individuals from the United States. Compared with the excluded sample, study participants were less likely to be married, to be immigrants, or to have a bachelor's degree or higher, and more likely to have talked to a doctor in the past 12 months, have a history of hypertension, and to be current smokers (Table S4).

Prevalence of Recommended Knowledge of MI or Stroke

Adjusting for age, sex, marital status, education, income level, employment status, insurance status, overweight or obesity, history of hypertension, alcohol use, and smoking status, we observed significant variations in recommended knowledge of MI and stroke among individuals from all regions of birth compared with those who were born in the United States (Table 3). In 2014 and 2017, US-born respondents had a higher prevalence of recommended knowledge of MI and stroke compared with all immigrants, with a significantly higher prevalence in all cases except in comparison to recommended stroke knowledge of European immigrants in 2017. Among US-born people, recommended knowledge of MI was 51.2%±0.5% in 2014 and 52.2%±0.5% in 2017, and recommended knowledge of stroke was 69.2%±0.4% in 2014 and 70.0±0.5% in 2017. Among immigrants alone, Russian-born individuals had the highest prevalence of recommended MI knowledge in 2014 (prevalence ratio [PR] compared with US born: PR, 0.73; 95% CI, 0.55–0.97; P=0.032), whereas individuals born in Asia had the lowest prevalence (PR, 0.47; 95% CI, 0.38–0.57; P<0.0005). In 2017, the highest prevalence of recommended MI knowledge was observed in European immigrants (PR, 0.84; 95% CI, 0.75–0.93; P=0.002), and the lowest in Asian immigrants (PR, 0.62; 95% CI, 0.50–0.75; P<0.0005).

Similarly, among immigrants, European-born individuals had the highest recommended stroke knowledge in 2014 (PR, 0.88; 95% CI, 0.81–0.96; P=0.003), and immigrants from the Indian subcontinent had the lowest (PR, 0.64; 95% CI, 0.58–0.71; P<0.0005). In 2017, a similar trend was observed where recommended stroke knowledge was highest among European immigrants (PR, 0.96; 95% CI, 0.89–1.03; P=0.27), and lowest among immigrants from the Indian subcontinent (PR, 0.66; 95% CI, 0.57–0.75; P<0.0005).

Among both US- and foreign-born individuals, a higher proportion of women had recommended stroke and MI knowledge compared with men. However, US-born men had higher recommended stroke (67.1%±0.4%) and MI (46.8%±0.5%) knowledge prevalence compared with foreign-born men (53.6%±0.8% and 31.1%±0.8%, respectively). US-born women had higher recommended stroke (71.7%±0.4%) and MI (56.0%±0.4%) knowledge compared with foreign-born women (57.4%±0.9% and 35.4%±0.9%, respectively).

Across all regions, the most known symptom of MI in 2014 and 2017 was chest pain or discomfort, and the least known symptom was pain or discomfort in the jaw, neck, or back. There were variations in the most known symptom of stroke by region of birth and by year; however, the least known symptom was sudden severe headache with no known cause in 2014 and 2017, except among individuals from Mexico, Central America, and the Caribbean, for whom the least known symptom was sudden trouble seeing in one or both eyes in 2017 (Table S5).

Improvement in Recommended Knowledge of MI and Stroke

The overall proportion of individuals with recommended MI knowledge across all regions of birth, including the United States was 48.3%±0.4% in 2014 and 49.5%±0.5% in 2017. Though there was an increase in knowledge, this change was not significant (PR, 1.02; 95% CI, 1.00–1.05; P=0.079). Similarly, the overall proportion of individuals with recommended stroke knowledge was lower in 2014 (66.9%±0.4%) than in 2017 (67.9%±0.4%), though the difference was not significant (PR, 1.01; 95% CI, 1.00–1.03; P=0.075).

There was improvement in the prevalence of recommended knowledge of MI from 2014 to 2017 among all regions of birth except Russia, where prevalence dropped by 1.4%. The prevalence of recommended knowledge of stroke from 2014 to 2017 also increased across all regions, except the Middle East, where it dropped by 0.3%. Among individuals born in Asia, recommended MI and stroke knowledge improved by 8.2% and 8.5%, respectively (Table 3). The overall average change in MI and stroke knowledge from

Table 1. Sociodemographic Characteristics of US-Born and Foreign-Born Populations in the 2014 and 2017 National Health Interview Survey (n=63 059)

Characteristic	US born, n=52 798, 83.7%, mean (SE)	Foreign born, n=10 261, 16.3%, mean (SE)	Foreign-born sending region, mean (SE)								
			Europe n=1060, 10.3%	South America n=626, 6.1%	Mexico, Central America, Caribbean, n=5159, 50.3%	Russia, n=192, 1.9%	Africa, n=441, 4.3%	Middle East, n=250, 2.4%	Indian subcontinent, n=684, 6.7%	Asia, n=781, 7.6%	Southeast Asia, n=1068, 10.4%
Mean age, y*	49.8 (0.1)	47.4 (0.3)	54.4 (0.7)	46.0 (0.9)	46.8 (0.3)	46.7 (1.4)	43.2 (0.9)	45.0 (1.3)	41.4 (0.8)	47.3 (1.0)	50.0 (0.6)
Men*	45.6 (0.3)	45.2 (0.5)	43.4 (1.7)	45.8 (2.5)	47.2 (0.8)	49.4 (3.7)	56.5 (2.9)	62.6 (3.5)	59.8 (2.4)	41.0 (2.0)	41.9 (1.7)
Married*	41.7 (0.3)	54.35 (0.7)	51.8 (1.7)	53.6 (2.4)	51.9 (0.9)	52.5 (4.3)	50.4 (2.9)	52.7 (3.5)	72.2 (2.2)	53.5 (2.3)	60.6 (1.7)
Education*											
High school or less	35.0 (0.4)	46.97 (0.8)	30.4 (1.8)	31.9 (2.4)	70.0 (0.8)	17.6 (2.9)	28.2 (2.6)	25.1 (3.0)	15.9 (1.6)	26.3 (2.0)	32.4 (1.6)
Some college	32.8 (0.3)	19.74 (0.5)	27.8 (1.5)	30.9 (2.3)	17.7 (0.7)	18.1 (3.1)	25.2 (2.4)	18.2 (2.9)	7.0 (1.2)	16.4 (1.6)	21.7 (1.4)
Bachelor's degree or higher	32.2 (0.4)	33.29 (0.7)	41.8 (1.8)	37.2 (2.2)	12.3 (0.6)	64.4 (3.8)	46.6 (3.2)	56.7 (3.5)	77.0 (2.0)	57.3 (2.2)	45.9 (0.4)
Race and ethnicity*											
NH White	77.4 (0.4)	20.13 (0.6)	91.3 (0.9)	9.0 (1.4)	1.07 (0.2)	97.3 (1.3)	18.5 (2.2)	94.3 (1.4)	2.8 (0.8)	5.7 (1.0)	3.8 (0.7)
Hispanic	6.9 (0.3)	47.24 (0.9)	3.5 (0.6)	83.6 (2.0)	89.1 (0.6)	0.6 (0.6)	0.3 (0.2)	0.1 (0.1)	0.2 (0.2)	0.3 (0.2)	0.7 (0.3)
NH Black	13.2 (0.3)	9.00 (0.4)	3.8 (0.7)	4.4 (1.1)	9.2 (0.6)	0.4 (0.4)	78.4 (2.4)	1.7 (0.8)	0.6 (0.4)	1.4 (0.6)	0.3 (0.2)
NH Asian	1.4 (0.1)	23.45 (0.7)	1.1 (0.3)	2.6 (0.7)	0.6 (0.1)	1.8 (1.1)	2.9 (1.0)	4.0 (1.2)	95.0 (1.0)	92.6 (1.1)	95.0 (0.8)
Other races	1.0 (0.1)	0.19 (0.1)	0.2 (0.2)	0.4 (0.3)	0.02 (0.02)	0	0	0	1.4 (0.5)	0	0.2 (0.2)
Poverty-income ratio*											
<1	14.2 (0.3)	21.81 (0.6)	8.8 (1.2)	18.9 (2.2)	29.2 (0.8)	17.9 (3.2)	24.0 (2.4)	19.0 (2.8)	12.6 (1.4)	20.4 (1.8)	13.8 (1.3)
1–1.99	17.6 (0.2)	24.07 (0.6)	14.8 (1.2)	21.8 (2.0)	33.1 (0.8)	11.8 (2.4)	19.2 (2.1)	17.5 (2.5)	12.7 (1.5)	14.6 (1.4)	17.7 (1.3)
≥2	68.3 (0.4)	54.13 (0.8)	76.4 (1.6)	59.3 (2.6)	37.6 (0.9)	70.3 (4.2)	56.8 (2.7)	63.5 (3.3)	74.7 (2.1)	65.0 (2.1)	68.5 (1.7)
Interview in English	99.3 (0.1)	70.57 (0.8)	96.8 (0.8)	67.6 (2.4)	48.4 (1.1)	85.0 (3.0)	97.4 (0.8)	93.8 (1.7)	97.6 (0.8)	82.6 (1.9)	90.6 (1.1)
Employed*	63.9 (0.3)	65.25 (0.6)	60.0 (1.9)	68.6 (2.3)	65.4 (0.8)	75.2 (3.4)	71.3 (2.5)	61.1 (3.4)	70.8 (2.0)	57.2 (2.0)	66.8 (1.8)
Insured*	91.3 (0.2)	21.80 (0.6)	93.4 (0.9)	79.9 (1.9)	65.3 (1.0)	87.9 (2.6)	81.5 (2.1)	89.8 (2.1)	92.9 (1.0)	91.6 (1.3)	89.8 (1.2)
Years in the United States, ≥10	…	79.1 (5.8)	89.2 (1.1)	77.6 (2.2)	84.5 (0.7)	77.4 (3.7)	59.5 (2.8)	65.3 (3.5)	57.9 (2.6)	69.4 (2.1)	79.6 (1.5)
Have a usual place to go when sick, yes*	87.7 (0.2)	79.9 (0.5)	87.9 (1.1)	79.7 (1.9)	76.3 (0.8)	75.0 (3.6)	78.6 (2.3)	81.0 (2.7)	80.2 (2.0)	83.8 (1.6)	85.4 (1.2)

The results in this table are survey-weighted.
NH indicates non-Hispanic. "Other races" consists of non-Hispanic North American natives and those whose race was not releasable due to issues of confidentiality, or who identify with multiple racial categories.
*$P<0.001$.

Table 2. Atherosclerotic Cardiovascular Disease Risk Factors Among US-Born and Foreign-Born Populations in the 2014 and 2017 National Health Interview Survey (n=63 059)

	United States, n=52 798, mean (SE), %	Foreign born, n=10 261, mean (SE), %	Europe, n=1060, mean (SE), %	South America, n=626, mean (SE), %	Mexico, Central America, Caribbean, n=5159, mean (SE), %	Russia, n=192, mean (SE), %	Africa, n=441, mean (SE), %	Middle East, n=250, mean (SE), %	Indian subcontinent, n=684, mean (SE), %	Asia, n=781, mean (SE), %	Southeast Asia, n=1068, mean (SE), %
Overweight or obese status[a], *	67.4 (0.3)	67.6 (0.6)	60.3 (1.7)	60.3 (2.4)	74.5 (0.7)	54.1 (3.8)	70.3 (2.6)	56.6 (3.5)	76.1 (1.8)	48.8 (2.1)	62.0 (2.0)
History of hypertension*	34.9 (0.3)	26.4 (0.5)	35.6 (1.7)	21.7 (2.1)	26.4 (0.7)	31.5 (3.5)	22.6 (2.4)	23.5 (3.0)	17.3 (1.8)	21.3 (1.8)	30.1 (1.7)
History of diabetes	10.3 (0.2)	9.9 (0.4)	7.8 (0.9)	6.8 (1.2)	12.5 (0.6)	3.7 (1.4)	8.0 (1.4)	4.9 (1.2)	8.7 (1.2)	5.8 (0.9)	11.0 (1.1)
Current drinker*	68.6 (0.3)	54.9 (0.7)	73.6 (1.6)	65.9 (2.4)	51.1 (0.9)	77.8 (3.4)	47.0 (2.9)	48.6 (3.4)	44.8 (2.2)	50.6 (2.1)	51.4 (2.1)
Current smoker*	17.1 (0.2)	9.2 (0.3)	14.0 (1.2)	7.1 (1.2)	8.6 (0.5)	19.1 (3.0)	5.5 (1.1)	15.4 (2.7)	5.0 (0.9)	8.2 (1.0)	8.8 (1.0)
History of MI	3.9 (0.1)	2.1 (0.2)	3.2 (0.6)	1.0 (0.4)	2.0 (0.2)	3.7 (1.4)	2.0 (0.7)	2.9 (1.2)	1.8 (0.5)	1.4 (0.5)	1.8 (0.5)
History of stroke	3.6 (0.1)	2.0 (0.2)	2.1 (0.5)	2.4 (0.7)	2.2 (0.3)	1.9 (1.0)	1.8 (0.7)	0.9 (0.6)	0.6 (0.3)	2.3 (0.6)	1.9 (0.6)

[a]Asian-specific cutoffs were used for individuals from the Indian subcontinent, Asia, and Southeast Asia. The results presented in this table are survey weighted. MI indicates myocardial infarction.
*$P<0.001$.

2014 to 2017 was 3.06%±1.02% and 3.13%±0.93%, respectively.

Prevalence of Recommended Knowledge Among Individuals With a History of ASCVD

Among respondents with a history of ASCVD (MI or stroke), the prevalence of recommended stroke knowledge was 53.2%, and the prevalence of recommended stroke knowledge was 66.2%. Even so, when compared with US-born people with a history of ASCVD, immigrants with a history of ASVCD had lower levels of recommended knowledge of MI (PR, 0.69; 95% CI, 0.59–0.81; $P<0.0005$) and stroke (PR, 0.84; 95% CI, 0.74–0.94; $P=0.003$). Additionally, respondents with a history of ASCVD had significantly higher prevalence of recommended knowledge of MI in 2014 and 2017, compared with those without a history of ASCVD; however, there was no statistical significance in the prevalence of recommended knowledge of stroke. For instance, in 2014, recommended MI knowledge prevalence was 53.75% versus 47.96% ($P=0.012$), and recommended stroke knowledge prevalence was 66.95% versus 66.45% ($P=0.677$).

Prevalence of Recommended Knowledge Among US-Born Individuals by Race and Ethnicity

Among US-born individuals, there were statistically significant differences in recommended knowledge of MI and stroke symptoms by race and ethnicity, with individuals identifying as Hispanic having the lowest recommended knowledge of MI and stroke, and those identifying as non-Hispanic White and non-Hispanic Asian having the highest recommended knowledge of MI and stroke, respectively (Table 4).

DISCUSSION

This study was conducted to highlight disparities in awareness of recommended knowledge of MI and stroke between foreign- and US-born individuals living in the United States. Considerable variations in awareness of the common symptoms of MI and stroke as well as the best action to take in the event of an MI or stroke were observed by region of birth. Overall, US-born people had the highest prevalence of recommended knowledge of MI and stroke (52.2% and 70.0%, respectively) in 2017. These results show that many people are still unaware of stroke and MI symptoms and what to do in a medical emergency, indicating a need for improved public health awareness initiatives on ASCVD presentation and outcomes.

Table 3. Comparison of Stroke and MI Symptom Knowledge Among US- and Foreign-Born People

		United States	Europe	South America	Mexico, Central America, Caribbean	Russia	Africa	Middle East	Indian subcontinent	Asia	Southeast Asia
Awareness of all 5 MI symptoms+call 9-1-1 compared with United States											
2014	Prev (SE)	51.2 (0.5)	37.6 (2.4)	29.6 (2.8)	33.9 (1.3)	37.4 (5.4)	36.3 (4.2)	34.8 (4.8)	30.7 (2.4)	23.9 (2.5)	31.8 (2.5)
	PR [95% CI]	1.00	0.73 [0.65–0.83]*	0.58 [0.48–0.70]*	0.66 [0.61–0.71]*	0.73 [0.55–0.97]*	0.71 [0.57–0.89]*	0.68 [0.52–0.89]*	0.60 [0.51–0.70]*	0.47 [0.38–0.57]*	0.62 [0.53–0.73]*
2017	Prev (SE)	52.2 (0.5)	43.5 (2.5)	32.9 (3.4)	34.9 (1.6)	36.0 (5.2)	38.0 (4.9)	37.9 (4.6)	32.6 (3.2)	32.1 (3.3)	33.0 (2.7)
	PR [95% CI]	1.00	0.84 [0.75–0.93]*	0.63 [0.52–0.77]*	0.67 [0.61–0.73]*	0.69 [0.52–0.92]*	0.73 [0.56–0.94]*	0.73 [0.57–0.92]*	0.63[0.52–0.76]*	0.62 [0.50–0.75]*	0.63 [0.54–0.74]*
Awareness of all 5 stroke symptoms+call 9-1-1 compared with United States											
2014	Prev (SE)	69.2 (0.4)	61.0 (2.6)	58.4 (3.0)	55.6 (1.3)	51.7 (5.5)	55.4 (3.5)	52.8 (4.5)	44.4 (2.4)	53.1 (2.8)	55.3 (2.3)
	PR [95% CI]	1.00	0.88 [0.81–0.96]*	0.84 [0.76–0.93]*	0.80 [0.77–0.84]*	0.75 [0.60–0.92]*	0.80 [0.71–0.91]*	0.76 [0.64–0.90]*	0.64 [0.58–0.71]*	0.77 [0.69–0.85]*	0.80 [0.74–0.87]*
2017	Prev (SE)	70.0 (0.5)	67.2 (2.5)	62.9 (3.6)	57.0 (1.7)	55.9 (5.4)	58.5 (4.3)	52.5 (4.8)	46.0 (3.2)	61.6 (3.3)	58.0 (2.7)
	PR [95% CI]	1.00	0.96 [0.89–1.03]	0.90 [0.80–1.01]	0.81 [0.77–0.86]*	0.80 [0.66–0.96]*	0.84 [0.72–0.97]*	0.75 [0.63–0.90]*	0.66 [0.57–0.75]*	0.88 [0.79–0.98]*	0.83 [0.75–0.91]*

Estimates are percent prevalence (Prev) with SE and prevalence ratio (PR) with 95% CI. Adjusted for age, sex, marital status, education, income level, employment status, insurance status, overweigh or obesity, history of hypertension, alcohol use, and smoking status. The results presented in this table are survey weighted. MI indicates myocardial infarction.

*$P<0.05$.

Across all regions of birth, the prevalence of recommended stroke knowledge was higher than that of MI. Furthermore, though the results point to an increase in awareness from 2014 to 2017, the change was not statistically significant. It is unclear why more people have recommended stroke knowledge compared with MI, though the prevalence of MI is higher both among the sample and in the US population. Differences between public education on MI and stroke may provide insight on the disparity in recommended stroke and MI knowledge. When creating a culturally sensitive program for immigrants, it is important to consider beliefs about stroke causes, prevention measures, and education needs.[16]

Among immigrants, recommended stroke knowledge was lowest among individuals born in the Indian subcontinent in 2014 and 2017 (44.4% and 46.0%). Individuals born in this region were also the most educated, with 77% having a bachelor's degree or higher. However, they had the shortest length of stay in the United States, with 57.9% living in the United States for >10 years. With respect to ASCVD risk factors, individuals born in the Indian subcontinent had the highest obese and overweight status (using Asian-specific cutoffs) but the lowest prevalence of hypertension, stroke, alcohol intake, and smoking. It is plausible that the low prevalence of stroke (0.6%) among this population contributed to lower recommended stroke knowledge, despite individuals from this region being the most educated.

Additionally, immigrants from Asia had the lowest prevalence of recommended MI knowledge in 2014 and 2017 (23.9% and 32.1%, respectively). Our findings are similar to a previous study in Japan where only 11.6% of participants responded that they would call emergency medical services after onset of an acute MI during the day.[17] The most cited reason for participants not calling emergency medical services was unawareness of the symptoms associated with an acute MI.[17] Previous studies on MI awareness among the US population showed similar results among Asian immigrants.[4,18]

Our findings on Asian immigrants are different than some previous studies on stroke awareness in Asia. Reports in Korea showed that participants demonstrated a lower awareness of the 5 symptoms associated with stroke (42.2%) than what we found in Asian immigrants from 2014 and 2017 (53.1% and 61.6%, respectively).[19] This may suggest that residency in the United States contributes to increased stroke awareness. However, there have been notable efforts to increase stroke awareness among Asian students and their parents.[20,21] These strategies might contribute to the higher awareness in stroke symptoms as compared with MI awareness seen in this population. It should be noted that Asian immigrants are

Table 4. Comparison of Stroke and MI Symptom Knowledge Among US-Born People by Race or Ethnicity

Race/ethnicity	Awareness of all 5 MI symptoms, %	Awareness of all 5 MI symptoms+call 9-1-1, %	Awareness of all 5 stroke symptoms, %	Awareness of all 5 stroke symptoms+call 9-1-1, %
NH White	57.05	54.60	73.03	71.21
Hispanic	41.2	39.83	63.45	61.95
NH Black	44.39	42.79	65.90	64.66
NH Asian	48.22	45.45	75.44	73.04
Other races	50.54	47.52	63.72	62.12

MI indicates myocardial infarction; and NH, non-Hispanic.

"Other races" consists of non-Hispanic North American natives and those whose race was not releasable due to issues of confidentiality, or who identify with multiple racial categories.

not a monolithic group; there are socioeconomic and linguistic disparities among Asian immigrant groups.[22] A study on the prevalence of CHD and stroke in the United States from 2006 to 2014 showed considerable heterogeneity among foreign-born groups by region of birth. Specifically, it showed that CHD prevalence was lowest among foreign-born adults from Asia and Africa, whereas stroke prevalence was lowest among foreign-born adults from the Indian subcontinent and South America.[23] These findings may indicate that a lower prevalence of CHD or stroke may contribute to the lower awareness of recommended knowledge of MI and stroke among the foreign-born groups from Asia and the Indian subcontinent, respectively. More studies are needed to determine the relationship between lower awareness of recommended knowledge of MI and stroke and mortality among immigrants.

The highest prevalence of stroke and MI was among the US-born population, which also had the highest awareness of stroke and MI symptoms and the appropriate action to take. Among immigrants, Russian-born individuals had the highest prevalence of MI history (3.7%) and the highest prevalence of recommended MI knowledge (37.4%) in 2014. These findings suggest that prevalence of MI or stroke within a population may be a factor in recommended knowledge of MI and stroke.

Among immigrants, those from Europe had the highest prevalence of recommended knowledge of MI in 2017 and recommended knowledge of stroke in 2014 and 2017. Across all groups, they also had the largest proportion of individuals in the highest income bracket, who were insured, stayed in the United States for 10 years or more, had stable housing to go to when sick, and communicated with a health care provider in the past 12 months. This finging is consistent with other studies that found that acculturation, high income, and insurance contributed to higher awareness of MI symptoms.[9,24,25]

There are mixed findings on Europeans and prevalence of stroke awareness. In contrast to our results, some studies in Europe suggest a rather low awareness of stroke. A study published in 2014 in Sweden found that only 13% of participants could successfully identify ≥3 stroke symptoms and that <65% would call emergency services when witnessing or experiencing a stroke symptom.[26] However, it should be noted that Sweden promoted a national stroke campaign from 2011 to 2013, which led to an increase in stroke awareness for men and women.[27]

The decline in prevalence of recommended knowledge among immigrants from Russia and the Middle East might be attributed to the small sample size. The increase in prevalence among individuals from Asia is impressive compared with that observed among other regions of birth, and provides some indication that awareness is malleable in a short period of time, making such approaches attractive for other groups. There might be valuable teaching practices or approaches to education on stroke and MI that would improve the effect of awareness campaigns.

The disparities in recommended knowledge of MI and stroke among US-born people by race and ethnicity are similar to those found in other studies, where non-Hispanic White people had higher awareness of MI and stroke symptoms compared with Hispanic and non-Hispanic Black people.[4,9] These findings mirror racial and ethnic disparities in prevalence and incidence of ASCVD in the United States.[3] In contrast, we found that non-Hispanic Asian people had higher stroke awareness, which differs from previous findings where Asian and Hispanic people showed lower awareness rates compared with White and Black people.[9] This may be attributable to differences in classification of Asian people and other races which include people who identify with multiple racial categories. Of note, because race is a social construct and not a biological construct, categorization may disguise significant heterogeneity and is subject to variation based on observer-selected categories.[28,29]

Our study should be evaluated in light of some limitations. One limitation of this study is that foreign-born naturalized citizens are classified as immigrants. Additionally, though our sample is large, when disaggregated by region of birth, the statistical power for regions with smaller sample sizes (Russia, Middle East, Africa) is reduced. The study also excludes participants who did not state a specific region of birth, contributing to possible selection

bias. Furthermore, individuals who responded to the survey may be more likely to have more secure immigration status. Also, since the NHIS is conducted in English and Spanish only, it is possible immigrants with lower English proficiency and lower education levels may have been excluded, which limits the generalizability to all immigrants. Finally, although the NHIS oversampled for Asian, Black, Hispanic, and older adults until 2016, it does not specifically oversample for immigrants. Because the sampling weights used by the survey do not account for immigrant status, the results may not be generalizable to all foreign-born people in the United States.

One strength of this study is that it builds on previous literature on awareness of MI and stroke symptoms and the best action to take in the event of an MI or stroke in different ways. Whereas other studies aggregate data on immigrants, this study analyzes disparities in awareness by region of birth and highlights the heterogeneity in responses based on region of origin. Additionally, the demographic characteristics of the sample are representative of the US population.[30] Furthermore, by assessing the prevalence of recommended knowledge of stroke and MI, and associations with sociodemographic characteristics and ASCVD risk factors, this study underscores subpopulations that awareness campaigns could be tailored toward.

CONCLUSIONS

This study demonstrates that there is considerable variation in awareness of stroke and MI symptoms as well as the appropriate reaction among different groups in the United States. Individuals born in Asia had the lowest prevalence of recommended MI knowledge, whereas individuals born in Russia and Europe had the highest prevalence in 2014 and 2017, respectively. Additionally, individuals born on the Indian subcontinent had the lowest prevalence of recommended stroke knowledge, whereas individuals born in Europe had the highest prevalence. Additional studies analyzing data across various regions may further elucidate the existing disparities and provide insight into narrowing potential barriers that decrease awareness of stroke and MI. Future implementation of public health educational initiatives may include culture-specific education materials to provide the appropriate information for vulnerable populations.

ARTICLE INFORMATION

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Disclosures

None.

Supplementary Material

Tables S1–S5
Reference 31

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SUPPLEMENTAL MATERIAL

Table S1: Countries in various Regions of Birth[31]	
Category	**Countries Included**
United States	All persons born in one of the 50 United States or the District of Columbia
Mexico, Central America, Caribbean Islands	Mexico, all countries in Central America and the Caribbean, Island area, including Puerto Rico
South America	All countries on the South American continent
Europe	Albania, Austria, Azores Islands, Belgium, Bosnia, Bulgaria, Corsica, Crete, Croatia, Czechoslovakia, Denmark, Finland, France, Germany, Great Britain, Greece, Herzegovina, Holland, Hungary, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Macedonia, Majorca, Malta, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Prussia, Romania, Scotland, Serbia, Sicily, Slovakia, Spain, Sweden, Switzerland, Yugoslavia
Russia (and former USSR areas)	Russia, Lithuania, Latvia, Ukraine, and all places formerly a part of the USSR
Africa	All countries on the African continent, plus the Canary Islands, Comoros, Madagascar, Madeira Islands
Middle East	Aden, Arab Palestine, Arabia, Armenia, Bahrain, Cyprus, Gaza Strip, Iran, Iraq, Israel, Jordan, Kuwait, Syria, Lebanon, “Middle East,” Oman, Palestine, Persia, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates, West Bank, Yemen
Indian Subcontinent	Afghanistan, Bangladesh, Bhutan, British Indian Ocean Territory, Ceylon, East Pakistan, India, Maldives, Nepal, Pakistan, Sri Lanka, Tibet, West Pakistan
Asia	Asia, Asia Minor, China, Japan, Mongolia, North Korea, South Korea
SE Asia	Borneo, Brunei, Burma, Cambodia, Christmas Island, Hong Kong, Indonesia, Laos, Malaysia, Myanmar, North Vietnam, Philippines, Singapore, South Vietnam, Taiwan, Thailand

Table S2: Comparison of Stroke and MI Symptom Knowledge among US and Foreign-Born Persons (Model 1)

		US	Europe	South America	Mexico, C. Amer, Caribbean	Russia	Africa	Middle East	Indian Sub.	Asia	SE Asia
Awareness of all 5 MI Symptoms + Call 911 (compared to US)											
2014	**Prev (SE)**	51.1 (0.4)	37.1 (2.3)	28.9 (2.7)	33.5 (1.3)	38.2 (5.5)	33.6 (4.0)	35.0 (4.3)	30.2 (2.4)	23.8 (2.4)	32.7 (2.3)
	PR (95% CI)	1.00	0.73 [0.64-0.82]*	0.57 [0.47-0.68]*	0.66 [0.61-0.70]*	0.75 [0.56-0.99]*	0.66 [0.52-0.83]*	0.68 [0.53-0.87]*	0.59 [0.51-0.69]*	0.46 [0.38-0.57]*	0.64 [0.56-0.74]*
2017	**Prev (SE)**	52.0 (0.5)	44.2 (2.5)	33.2 (3.3)	34.4 (1.5)	35.8 (5.0)	38.5 (4.8)	37.3 (4.5)	33.3 (3.2)	32.3 (3.2)	33.7 (2.6)
	PR (95% CI)	1.00	0.85 [0.76-0.95]*	0.64 [0.53-0.77]*	0.66 [0.61-0.72]*	0.69 [0.52-0.91]*	0.74 [0.58-0.95]*	0.72 [0.56-0.91]*	0.64[0.53-0.77]*	0.62 [0.51-0.75]*	0.65 [0.56-0.76]*
Awareness of all 5 Stoke Symptoms + Call 911 (compared to US)											
2014	**Prev (SE)**	69.2 (0.3)	60.5 (2.4)	57.2 (3.0)	54.9 (1.2)	51.9 (5.3)	54.5 (3.1)	52.4 (4.3)	44.4 (2.4)	52.0 (2.7)	55.7 (2.2)
	PR (95% CI)	1.00	0.87 [0.81-0.95]*	0.83 [0.75-0.92]*	0.79 [0.76-0.83]*	0.75 [0.61-0.92]*	0.79 [0.70-0.88]*	0.76 [0.65-0.89]*	0.64 [0.58-0.71]*	0.75 [0.68-0.83]*	0.80 [0.75-0.87]*
2017	**Prev (SE)**	69.9 (0.5)	67.9 (2.4)	61.7 (3.5)	56.1 (1.7)	54.9 (5.4)	58.0 (4.1)	52.2 (4.8)	45.0 (3.1)	60.6 (3.1)	57.7 (2.6)
	PR (95% CI)	1.00	0.97 [0.90-1.04]	0.88 [0.79-0.99]*	0.80 [0.76-0.85]*	0.79 [0.65-0.95]*	0.83 [0.72-0.95]*	0.75 [0.62-0.89]*	0.64 [0.56-0.74]*	0.87 [0.78-0.96]*	0.83 [0.75-0.90]*

Estimates are Prevalence (%) with Standard Errors (SE) and Prevalence Ratios (PR) with 95% Confidence Intervals.

Prev: prevalence; PR: prevalence ratio; CI: confidence interval; US-United States * p< 0.05

Adjusted for age, sex and education

Table S3: Comparison of Stroke and MI Symptom Knowledge among US and Foreign-Born Persons (Model 2)											
		US	**Europe**	**South America**	**Mexico, C. Amer, Caribbean**	**Russia**	**Africa**	**Middle East**	**Indian Sub.**	**Asia**	**SE Asia**
Awareness of all 5 MI Symptoms + Call 911 (compared to US)											
2014	**Prev (SE)**	51.1 (0.5)	36.9 (2.3)	29.1 (2.7)	34.0 (1.3)	38.8 (5.4)	34.6 (4.1)	35.9 (4.5)	29.9 (2.3)	24.0 (2.5)	32.4 (2.4)
	PR (95% CI)	1.00	0.72 [0.64-0.82]*	0.57 [0.48-0.68]*	0.67 [0.62-0.72]*	0.76 [0.57-1.00]	0.68 [0.54-0.85]*	0.70 [0.55-0.90]*	0.58 [0.50-0.68]*	0.47 [0.38-0.57]*	0.63 [0.55-0.73]*
2017	**Prev (SE)**	52.0 (0.5)	43.7 (2.5)	33.3 (3.3)	35.0 (1.5)	35.7 (5.1)	39.0 (4.8)	37.1 (4.5)	32.6 (3.1)	32.1 (3.2)	33.1 (2.6)
	PR (95% CI)	1.00	0.84 [0.75-0.94]*	0.64 [0.53-0.77]*	0.67 [0.62-0.73]*	0.69 [0.52-0.91]*	0.75 [0.59-0.96]*	0.71 [0.56-0.90]*	0.63[0.52-0.76]*	0.62 [0.51-0.75]*	0.64 [0.55-0.74]*
Awareness of all 5 Stoke Symptoms + Call 911 (compared to US)											
2014	**Prev (SE)**	69.1 (0.4)	60.4 (2.5)	57.8 (3.0)	55.8 (1.3)	52.7 (5.4)	55.7 (3.3)	53.5 (4.3)	44.4 (2.4)	52.9 (2.7)	55.6 (2.2)
	PR (95% CI)	1.00	0.87 [0.81-0.95]*	0.83 [0.76-0.93]*	0.81 [0.77-0.84]*	0.76 [0.62-0.93]*	0.81 [0.72-0.90]*	0.77 [0.66-0.91]*	0.64 [0.58-0.71]*	0.76 [0.69-0.85]*	0.80 [0.74-0.87]*
2017	**Prev (SE)**	69.8 (0.5)	67.4 (2.4)	62.0 (3.5)	56.9 (1.7)	54.8 (5.4)	58.6 (4.2)	52.3 (4.8)	44.9 (3.1)	60.7 (3.1)	57.5 (2.6)
	PR (95% CI)	1.00	0.97 [0.90-1.04]	0.89 [0.79-0.99]*	0.81 [0.77-0.86]*	0.78 [0.65-0.95]*	0.84 [0.73-0.97]*	0.75 [0.63-0.90]*	0.64 [0.56-0.74]*	0.87 [0.79-0.96]*	0.82 [0.75-0.90]*

Estimates are Prevalence (%) with Standard Errors (SE) and Prevalence Ratios (PR) with 95% Confidence Intervals.
Prev: prevalence; PR: prevalence ratio; CI: confidence interval; US-United States * p< 0.05
Adjusted for age, sex, marital status education, income level, employment status, insurance status

Table S4: Socio-demographic Characteristics of Included and Excluded Populations in the 2014 and 2017 National Health Interview Survey (NHIS); N = 63,439			
Mean, *n* (%)	**Included N = 63,059**	**Excluded N = 380**	**p-value**
Mean age, years*	49.4	49.8	-
Male	45.9	46.3	0.9038
Married	43.7	49.7	0.0487
Education			
≤ High School	36.9	27.0	<0.0001
Some College	30.8	26.4	
≥ Bachelor's Degree	32.3	46.7	
Race/Ethnicity			
NH White	68.4	70.5	<0.0001
Hispanic	13.3	5.3	
NH Black	12.6	3.7	
NH Asian	4.9	10.8	
Other races	0.9	9.7	
Poverty-Income Ratio			
PIR <1	15.4	11.1	0.0772
PIR 1-1.99	18.6	16.6	
PIR ≥2	66.0	72.3	
Employed	64.1	68.6	0.1192
Insured	89.3	86.7	0.1979
Have a Usual Place to go When Sick? (Yes)	86.5	86.3	0.9356
Talked to General Doctor in Past 12 Months (Yes)	71.4	65.3	0.0325
Immigrants	15.7	94.3	<0.0001
History of Hypertension	33.6	20.8	<0.0001
Current Drinker	66.4	65.7	0.9701
Current Smoker	15.9	9.3	0.0027

Table S5: Awareness of symptoms by birthplace																				
Mean, *n* (%)	**US-born N= 52798,** 83.7**%**		**Foreign-born, N = 10,261,** 16.3%																	
	United States		**Europe N=1060,** 10.3%		**South America N=626,** 6.1%		**Mexico, C. Amer Caribbean N=5159,** 50.3%		**Russia N=192,** 1.9%		**Africa N=441,** 4.3%		**Middle East N=250,** 2.4%		**Indian Sub. N=684,** 6.7%		**Asia N=781,** 7.6%		**SE Asia N=1068,** 10.4	
	2014	2017	2014	2017	2014	2017	2014	2017	2014	2017	2014	2017	2014	2017	2014	2017	2014	2017	2014	2017
"Which of the following would you say are the symptoms that someone may be having a heart attack?":																				
Pain or discomfort in the jaw, neck or back	64.68	64.75	54.58	60.27	41.03	45.89	42.7	42.67	53.3	43.68	43.81	49.73	50.92	51.87	45.41	48.34	40.67	46.79	47.06	50.22
Feeling weak, lightheaded, or faint	77.39	77.8	71.58	72.66	54.49	62.48	57.84	57.7	62.01	67.08	56.02	65.27	59.39	62.47	53.21	60.26	58.72	61.38	57.76	61.94
Chest pain or discomfort	93.15	93.15	90.59	89.56	81.53	80.2	78.16	77.97	78.78	84.83	74.95	87.45	87.06	83.26	84.09	86.78	79.02	79.61	75.93	76.56
Pain or discomfort in the arms or shoulder	88.22	87.96	83.22	83.37	72.13	72.86	69.36	69.96	64.8	70.27	63.99	69.16	72.81	72.61	67.8	69.08	51.51	52.23	61.07	60.36
Shortness of breath	87.19	87.67	79.24	83.45	70.48	70	70.39	71.84	73.88	77.06	73.75	78.3	79.09	75.55	72.8	75.69	70.02	73.48	71.4	72.46
Best thing to do when having a MI	94.05	95.23	91.66	93.84	92.18	95.58	88.47	92.47	90.51	86.46	88.89	91.42	95.58	94.78	94.79	94.93	88.19	91.52	86.93	88.67
"Which of the following would you say are the symptoms that someone may be having a stroke?":																				
Sudden numbness or weakness of face, arm, or leg, especially on one side	95.58	95.99	92.57	93.66	83.54	86.31	81.14	83.5	87.02	87.24	82.45	88.89	86.61	86.72	86.58	87.83	82.59	84.08	82.73	88.69
Sudden confusion or trouble speaking	95.12	95.76	91.59	93.78	80.96	85.39	78.7	79.69	87.01	89.92	80.07	86.19	83.02	83.86	79.19	84.71	80.43	82.86	82.83	82.79
Sudden trouble seeing in one or both eyes	85.15	85.66	80.63	85.85	71.79	72.82	69.18	68.85	71.89	76.19	72.99	77.44	69.71	78.33	70.31	70.32	72.41	76.02	72.38	73.38
Sudden trouble walking, dizziness, or loss of balance	92.23	92.6	87.44	87.85	81.04	80.99	77.25	78.47	82.07	88.58	80.32	82.98	81.36	80.05	80.82	85.44	79.22	85.64	81.05	83.96
Sudden severe headache with no known cause	77.86	78.2	73.1	76.79	71.77	71.97	68.16	70.22	65.2	67.27	68.27	68.3	65.56	61.54	58.31	55.8	66.22	72.95	70.57	70.52
Best thing to do when having a stroke	96.2	96.87	93.56	96.27	94.02	95.67	89.83	93.55	92.01	89.67	89.93	93.4	94.62	96.12	93.58	94.25	90.81	94.03	90.1	91.82
SE Asia = South East Asia, C. Amer = Central America																				