Public Perception of Stroke Warning Signs and Knowledge of Potential Risk Factors

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Context.—Decreasing the time from stroke onset to hospital arrival and improving control of stroke risk factors depend on public knowledge of stroke warning signs and risk factors.

Objective.—To assess current public knowledge of stroke warning signs and risk factors.

Design.—A population-based telephone interview survey using random digit dialing conducted in 1995.

Setting.—The Greater Cincinnati, Ohio, metropolitan area, the population of which is similar to that of the United States overall in age, sex, percentage of blacks, and economic status.

Participants.—Respondents with age, race, and sex that matched the population of patients with acute stroke.

Main Outcome Measures.—Knowledge of risk factors for stroke and warning signs of stroke as defined by the National Institute of Neurological Disorders and Stroke.

Results.—Telephone calls were made to 17 634 households, which yielded 2642 demographically eligible individuals. Interviews were completed by 1880 respondents (response rate, 71.2%). A total of 1066 respondents (57%) correctly listed at least 1 of the 5 established stroke warning signs, and all respondents, 1274 (68%) correctly listed at least 1 of the established stroke risk factors. Of the respondents, 469 (57%) of 818 respondents with a history of hypertension listed hypertension, 142 (35%) of 402 respondents who were current smokers listed smoking, and 32 (13%) of 255 respondents with diabetes listed diabetes as a risk factor for stroke. Compared with those younger than 75 years, respondents 75 years or older were less likely to correctly list at least 1 stroke warning sign (60% vs 47%, respectively; \(P<.001\)) and were less likely to list at least 1 stroke risk factor (72% vs 56%, respectively; \(P<.001\)).

Conclusion.—Considerable education is needed to increase the public’s awareness of the warning signs and risk factors for stroke. Respondents with self-reported risk factors for stroke are largely unaware of their increased risk. The population at greatest risk for stroke, the very elderly, are the least knowledgeable about stroke warning signs and risk factors.

METHODS

Households with a telephone were sampled at random from the Greater Cincinnati, Ohio, metropolitan area. The study population was defined as all residents of the Greater Cincinnati and northern Kentucky region, which includes 2 southern Ohio counties and 3 contiguous northern Kentucky counties that abut the Ohio River. This study population is similar to that of the United States in terms of age, sex, proportion of blacks, and economic status.2

This study was designed to ensure that respondents were randomly selected and that the demographic characteristics of the respondents approximately matched the population characteristics of patients with acute stroke within the study population with respect to age, race, and sex. The sampling methods included random digit selection of telephone numbers and random respondent selection within a household. Telephone numbers used for sampling were purchased from a survey sampling organization that systematically screens blocks of numbers (eg, 0000-9999) to eliminate unused blocks of numbers as well as business and governmental numbers. From these screened telephone numbers, a sample of telephone numbers was drawn by random selection. Random digit telephone sampling is more accurate than other telephone sampling techniques (eg, added digit dialing, directory dialing), because telephone numbers are selected randomly, and numbers that would not appear in a directory, such as unlisted numbers and recently activated numbers, are included.3 In the 1990 US census, 96.4% of all households in the Cincinnati standard metropolitan statistical area reported having telephone service; thus, only a small proportion of the population was omitted from the sample by using this survey technique.
If there was no answer at one of the selected telephone numbers, the number was called back repeatedly (a minimum of 5 callbacks) during the survey period. Callbacks were made during all possible times (ie, early and late morning, afternoon, early and late evening, and Saturdays and Sundays). Random respondent selection within households was accomplished by interviewing the adult person with the most recent birthday if that person fit the age, race, and sex requirements. No substitutions were permitted; persons other than the randomly selected individual within the household were not interviewed. If that person was unavailable, arrangements were made to call back at a time when he or she would be available. For all refusals, at least 1 additional attempt was made by a specially trained interviewer to gain cooperation.

The survey was administered by the professional telephone interviewers of the University of Cincinnati Institute for Policy Research. The 32 interviewers who performed the telephone interviews were monitored for quality and comparability. The supervisor randomly monitored 20% of the interviews by using special telephone lines or direct computer screen viewing.

To ensure that the demographics of the respondents approximated those of the acute stroke population within our region, we created a demographic table that contained the desired number of respondents in each of the demographic categories of age, sex, and race. The age and sex demographics were determined by extrapolating age- and sex-specific stroke incidence rates in Rochester, Minn, from 1974 to 1984 to the Greater Cincinnati population at the time of the 1990 US census.4 The racial distributions in Cincinnati population at the time of the 1990 US census. The racial distributions were estimated from a prior study of the Greater Cincinnati during 1988.5 To approximate the demographic table, only those respondents whose age, race, and sex matched an unfilled demographic category were interviewed.

The survey instrument was a questionaire designed to assess information about stroke warning signs and risk factors and contained 29 questions subdivided into 3 sections. The first section of the survey contained open-ended questions. The respondents were asked, in sequence, to list up to 3 stroke warning signs, 3 stroke risk factors, and 3 sources of their information regarding stroke warning signs and risk factors. If the respondent listed fewer than 3, he or she was encouraged to try to complete the list. The second section of the survey contained a series of questions to determine whether the respondent had any of a list of risk factors for stroke and to determine whether the respondent was taking related medications. These questions were identical to questions used in the third National Health and Nutrition Examination Survey. The third section of our survey contained questions about demographic characteristics. The survey instrument was pretested using a sample size of 25 people. Wordings changes for question clarity were made as a result of the pretest. This survey study was approved by the University of Cincinnati Medical Center Institutional Review Board. A copy of the questionnaire is available on request from the authors (A.M.P., J.B.).

Descriptive and comparative statistical analyses were performed using SAS statistical software (SAS Institute, Cary, NC). The \( \chi^2 \) tests were used to assess the univariate relationships between risk factors or warning signs and race, sex, and age. Multivariable logistic regression was used to more stringently characterize the age effect. Data are presented as number (percentage) or mean (SD). We used the Bonferroni correction to adjust for the multiple statistical comparisons and considered a \( P \) value of less than .003 as statistically significant.

The effects of demographics and the presence of risk factors on the respondents’ knowledge of stroke warning signs and risk factors were evaluated using multivariable logistic regression modeling. Variables considered in the modeling included age, race, sex, and level of education, as well as self-reported risk factors of current smoking, past smoking, hypertension, diabetes, and history of stroke or transient ischemic attack (TIA). Interactions between the demographic variables and self-reported risk factors were also considered in the model. When screening for interactions, the associated main effects (age, hypertension, etc) were forced into the model. The first stepwise backward elimination procedure retained interaction variables at a significance level of \( P \) less than .20. Those interactions significant at \( P \) less than .20 and the main effects were then entered into another model subsequently retaining only those variables significant at \( P \) less than .05. One final iteration of this procedure yielded the final model.

**RESULTS**

Between March 29 and September 13, 1995, a total of 17,634 telephone calls were made using random digit dialing. Of these calls, 2,542 were to households with eligible respondents. The remainder of the calls were to ineligible households (because of the age, race, and sex subgroup quotas that were required for the sample).
A total of 1880 interviews were completed for a response rate of 71.2%. Fifteen percent refused an interview, and 13.7% were too ill to be interviewed, or could not communicate in English.

The demographic distribution of the respondents is presented in Table 1. A total of 1120 respondents (60%) were women, 759 (40%) were male, 1348 (72%) were white, 507 (27%) were black, and 25 (1%) did not identify their race. The respondents had an overall mean (SD) age of 63 (16) years (range, 18-95 years). A total of 492 respondents (26%) had less than a high school education, 623 (33%) completed high school, 412 (22%) had fewer than 4 years of college, and 341 (18%) had completed at least a 4-year college education.

Self-reported risk factors by age and race are shown in Table 2. Of the 1880 respondents, 818 (45.5%) reported that they had been told by their physician that they had high blood pressure (hypertension), 635 (33.8%) were past smokers, 402 (21.4%) were current smokers, 255 (13.6%) had been told that they had diabetes, and 128 (6.9%) had been told that they had suffered a stroke or TIA.

The most common warning signs of stroke listed by respondents were “dizziness,” identified by 445 respondents (24%), “numbness” identified by 355 (19%), “headaches” identified by 309 (16%), and “weakness” identified by 285 (15%). A smaller portion of the respondents specified unilateral numbness (206 (11%) or unilateral weakness (119 (6%)) as a stroke warning sign (Table 3).

The National Institute of Neurological Disorders and Stroke has defined important warning signs of a stroke: sudden weakness or numbness of the face, arm, or leg; sudden dimness or loss of vision, particularly in 1 eye; sudden difficulty speaking or understanding speech; sudden severe headache with no known cause; and unexplained dizziness, unsteadiness, or sudden falls, especially with any of the other signs. When we accepted only these 5 established warning signs of stroke, only 1066 respondents (57%) correctly listed at least 1 established warning sign, 518 (28%) correctly listed 2 or more warning signs, and only 144 (8%) correctly listed 3 established warning signs of stroke.

The respondents’ age was significantly associated with knowledge about established stroke warning signs. Of respondents younger than 75 years, 865 (60%) correctly listed at least 1 stroke warning sign compared with 201 respondents (47%) 75 years or older (P<.001). In logistic regression analysis, the association between age and knowledge of stroke warning signs was significant and nonlinear (Figure). Univariate comparisons showed that men were more likely to list pain and shortness of breath as warning signs of stroke than were women, but showed no significant differences by racial group.

In the final multivariable logistic regression model, younger age, female sex, higher level of education, history of hypertension, previous smoking, and a history of previous stroke or TIA were significantly associated with knowledge of stroke warning signs (Table 4). No significant interactions were found between demographic characteristics and self-reported risk factors on the knowledge of stroke warning signs.

Of those surveyed, 926 (49%) listed “high blood pressure” as a risk factor for stroke; “stress” was identified by 427 (23%), “poor eating” by 380 (20%), and “smoking” by 352 (19%) (Table 3).

Of the respondents with a self-reported history of hypertension, 469 (57%) identified hypertension as a risk...
factor for stroke compared with 455 respondents (43%) without hypertension. Similarly, 142 current smokers (35%) identified smoking as a stroke risk factor compared with 210 nonsmokers (14%). Of patients with diabetes, 32 (13%) identified diabetes as a risk factor for stroke compared with 210 nonsmokers (14%).

The respondents’ age was statistically associated with knowledge about established stroke risk factors. Of all respondents in our study, 1274 (68%) correctly listed at least 1 stroke risk factor. Of respondents younger than 75 years, 1034 (72%) correctly listed at least 1 stroke risk factor compared with 240 respondents (56%) in our respondents’ age was statistically associated with knowledge about established stroke risk factors. Of all respondents in our study, 1274 (68%) correctly listed at least 1 stroke risk factor. Of respondents younger than 75 years, 1034 (72%) correctly listed at least 1 stroke risk factor compared with 240 respondents (56%) 75 years or older (P < .001).

In logistic regression analysis, the association between age and knowledge of stroke risk factors was significant and nonlinear (Figure). Univariate comparisons demonstrated that women were more likely than men to list heart disease as a stroke risk factor and that white respondents were more likely than black respondents to list smoking, cholesterol, and obesity as stroke risk factors, and less likely to list drinking alcohol.

In the final multivariable logistic regression model, age, female sex, white race, higher level of education, and history of hypertension were significantly associated with knowledge of stroke risk factors (Table 4). No significant interactions were found between demographic characteristics and self-reported risk factors on the knowledge of stroke risk factors.

Methods of mass media were the most commonly cited sources of respondents’ information about stroke, with “television” identified by 454 (24%), “newspapers” by 389 (21%), and “magazines” by 350 (19%). “Doctors” was the fourth most commonly cited source of information, identified by 341 (18%), and was the most commonly cited source of information among all individuals 75 years or older and among blacks (Table 5).

**COMMENT**

This large study of the public’s knowledge concerning stroke warning signs and risk factors demonstrates major gaps in the public’s knowledge of stroke. Notably, only 1066 (57%) of 1880 respondents were able to name at least 1 stroke warning sign, and only 1274 (68%) were able to name at least 1 stroke risk factor. The lack of knowledge of stroke warning signs and risk factors was greatest in the very elderly, the group at highest risk for stroke. Two other groups at increased risk for stroke, men and blacks, also were less knowledgeable about stroke risk factors.

Contact with the medical community (ie, respondents who were told by their physician that they had hypertension or diabetes) and current smoking were associated with better respondent knowledge of these individual stroke risk factors. It is discouraging, however, that self-reported risk factors had such a modest association with the knowledge of stroke risk factors. In the multivariable logistic regression model, a history of hypertension was the only self-reported risk factor that was an independent predictor of increased overall knowledge of stroke risk factors.

In a study of patients with acute stroke who were interviewed within 48 hours of hospital admission, Kothari et al reported that the most commonly documented stroke warning signs, as noted by the patient at the time of stroke onset, were weakness and numbness. If we accepted any reference to “weakness” or “numbness,” only 597 (32%) of our respondents listed either as a stroke warning sign. More respondents listed “chest pain” as a warning sign of stroke than listed unilateral weakness.

In a population-based stroke incidence study in Rochester, Minn, between 1985 and 1989, 55% of all strokes occurred in persons 75 years or older. In our study, respondents 75 years or older were the least likely to be able to list a single stroke warning sign (P < .001) (Figure). Of respondents 75 years or older, 201 (47%) correctly listed at least 1 established stroke warning sign, 76 (18%) correctly listed 2 or more warning signs, and only 22 (5%) correctly listed 3 established warning signs of stroke.

Public knowledge of stroke warning signs was similarly poor in a survey conducted by the Gallup Organization for the National Stroke Association. This unpublished survey included 750 Americans older than 50 years. Respondents answered open-ended questions regarding the symptoms that they associate with stroke, factors that increase the chances of stroke, and where a stroke occurs in the body. Of the symptoms listed by the respondents, 31% listed numbness of the face, arm, or leg, 31% listed paralysis of the face, arm, or leg, 18% listed slurred speech, 18% listed difficulty speaking or understanding, 12% listed headaches, 10% listed dizziness, and 9% listed blurred vision or a loss of vision as symptoms of stroke.

In the study by Kothari et al, only 61% of patients interviewed within the first 48 hours of hospital admission for an acute stroke could list at least 1 symptom or sign of a stroke. Modified factors that increase the risk for stroke include hypertension, cigarette smoking, heart disease, diabetes mellitus, TIA, hypercholesterolemia, heavy alcohol use, carotid bruits, and atrial fibrillation, although the magnitude of stroke risk associated with each factor, described in terms of relative risk or odds ratio, varies. Another expression of risk, the attributable risk, is the proportion of patients with a stroke in a given population that can be attributed to exposure to a given risk factor. Using multivariable modeling, Whisnant showed that the attributable risk for various stroke risk factors in the Rochester, Minn, population, after accounting for relationships between the various risk factors for ischemic stroke (expressed as the
percentage and 95% confidence intervals) were hypertension, 26% (12%-41%); TIA, 14% (11%-17%); cigarette smoking, 16% (8%-16%); ischemic heart disease, 12% (7%-17%); atrial fibrillation, 8% (4%-12%); diabetes, 5% (2%-9%); and mitral valve disease, 3% (0.6%-5%). When we include risk factors from the Rochester study that have an attributable risk of at least 3%, 1274 respondents (68%) in our study correctly listed at least 1 of these risk factors, 472 (25%) correctly listed 2 or more risk factors, and 67 (4%) correctly listed 3 of these risk factors for stroke.

In the National Stroke Association survey, 43% of interviewees listed hypertension, 21% listed stress, 14% listed cholesterol, 11% listed smoking, and 1% listed diabetes as factors that increase a person's chances of having a stroke. In the study by Kothari et al, only 57% of patients could list at least 1 stroke risk factor; 27% listed hypertension, 22% listed stress, 17% listed high cholesterol, 11% listed smoking, and 8% listed alcohol use.

In our survey, "doctors" was the most commonly cited source of information about stroke among all individuals 75 years or older and among blacks. Data from Rochester, Minn, indicate that 55% of all strokes occur in individuals 75 years or older. Initial data from the Greater Cincinnati/Northern Kentucky Epidemiologic Stroke Study indicate that the stroke incidence rates among blacks in Greater Cincinnati were 2 to 3 times greater than the rates among whites in Rochester for all age categories except for the group 65 years or older, in which they were similar. Thus, "doctors" is the most commonly cited source of stroke information for 2 populations at increased risk for stroke, suggesting that primary care physicians could provide stroke information to educate their patients about stroke, with specific emphasis on high-risk patient groups.

One potential bias of our study is that hospitals in the Greater Cincinnati metropolitan area have participated in a number of high-profile acute stroke therapy trials. To encourage rapid transport of patients with acute stroke to area hospitals, the Greater Cincinnati/Northern Kentucky Stroke Team has carried out continuing, small-scale public education projects through the local media and has conducted seminars during the last decade. This population may have been exposed to more information about stroke warning signs and risk factors than the general US population. Thus, our results may underestimate the lack of knowledge about stroke warning signs and risk factors within the US population. Finally, although we achieved a 71% response rate, we do not know whether the knowledge of the nonresponders was greater or less than that of the survey participants.

Tissue-type plasminogen activator (t-PA) was approved as an effective therapy for acute ischemic stroke in 1996. However, t-PA currently must be administered within 3 hours of stroke onset. Prior community studies of patients with acute stroke have indicated that patients who use the 911 emergency telephone system arrive at the hospital significantly earlier than patients who do not use the 911 system. Thus, any public education concerning the signs and symptoms of stroke must include the message that when a person identifies stroke symptoms in himself or herself or in another individual, he or she should activate the 911 system. Our study addresses only the baseline public knowledge of stroke warning signs and risk factors. Equally important are behavioral patterns based on this knowledge. Educational programs must focus on risk factor modification and actions to take if stroke symptoms occur. Our data indicate that stroke education efforts should target the elderly, who have the greatest stroke risk but who appear to be the least informed group regarding stroke warning signs and risk factors. However, stroke education will not be effective if directed only toward those at greatest risk for stroke. Patients with acute stroke often have impaired ability to communicate or are unable to recognize their symptoms. Therefore, persons of all age groups must be able to recognize the signs and symptoms of stroke to facilitate rapid identification and transport of the patient to the hospital. Based on our respondents' specified sources of information about stroke, it may be appropriate to focus educational efforts in the mass media and to encourage primary care physicians to expand their patient education of stroke, especially to those groups at increased risk.

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References


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