Trends in Community Knowledge of the Warning Signs and Risk Factors for Stroke

Alexander T. Schneider, MD
Arthur M. Pancioli, MD
Jane C. Khoury, MS
Eric Rademacher, PhD
Alfred Tuchfarber, PhD
Rosemary Miller, RN
Daniel Woo, MD
Brett Kissela, MD
Joseph P. Broderick, MD

HE INABILITY OF PATIENTS AND bystanders to recognize stroke symptoms and to quickly access the emergency medical system are the largest barriers to effective acute stroke therapy.1-9 Previous surveys have shown that knowledge of stroke warning signs among persons who have had a stroke and the general public is poor, with only 39% to 61% able to name at least 1 stroke warning sign.10-13 Knowledge of stroke risk factors is also limited, with only 57% to 76% able to name at least 1 stroke risk factor.11,12 In 1998, we reported results of a 1995 survey of public knowledge of stroke warning signs and risk factors.10 The current observational study, using the same methods and survey instrument within the same population, evaluates public knowledge of stroke warning signs and risk factors in 2000 and examines changes over the 5-year period.

METHODS
The study population was defined as all residents in a 5-county region around Cincinnati, Ohio. This population is similar to the United States in terms of age, sex, proportion of blacks, education level, and economic status.14

This study was designed to ensure a random selection of potential respondents who approximately matched the demographic characteristics (age, race, and sex) of patients with ischemic stroke. We used random-digit selection of telephone numbers and random respondent selection within a household. Details of this method have been previously described.10 Since 97.8% of residences in Cincinnati reported having telephone service in 2000, only a small proportion of the population would have been omitted from this sampling technique.14

The 64 professional telephone interviewers of the University of Cincinnati Institute for Policy Research who administered the survey were monitored for quality and comparability. The supervisors randomly monitored 20% of the interviews by using special telephone lines or direct computer screen viewing.

To ensure that the demographic characteristics of the respondents approximated those of the ischemic stroke population, we created a demographic table that contained the desired number of respondents in each of the demographic categories of age, race, and sex. To maintain consistency, the age, race, and sex demographics were determined by the

Context Poor public knowledge of stroke warning signs and risk factors limits effective stroke intervention and prevention.

Objective To examine temporal trends in public knowledge of stroke warning signs and risk factors.

Design and Setting Population-based random-digit telephone survey conducted in July-November 2000 among individuals in the greater Cincinnati, Ohio, region.

Participants A total of 2173 survey respondents (69% response rate) were randomly identified based on their demographic similarities to the ischemic stroke population with regard to age, race, and sex.

Main Outcome Measures Spontaneous recall of at least 1 important stroke warning sign and 1 established stroke risk factor in comparison with findings from the same survey in 1995.

Results In 2000, 70% of respondents correctly named at least 1 established stroke warning sign vs 57% in 1995 (P<.001), and 72% correctly named at least 1 established stroke risk factor vs 68% in 1995. Groups of individuals with the highest risk and incidence of stroke, such as persons at least 75 years old, blacks, and men, were the least knowledgeable about warning signs and risk factors. Television was the most frequently cited source of knowledge, 32% in 2000 vs 24% in 1995 (P<.001).

Conclusions Public knowledge of stroke warning signs within the greater Cincinnati region has significantly improved from 1995 to 2000, although knowledge of stroke risk factors did not improve significantly during the same time period. Public education efforts must continue and should focus on groups at the highest risk of stroke.

JAMA. 2003;289:343-346

Author Affiliations: Departments of Neurology (Drs Schneider, Woo, Kissela, and Broderick and Ms Miller), Emergency Medicine (Dr Pancioli), Environmental Health (Ms Khoury), and Institute for Policy Research (Drs Rademacher and Tuchfarber), University of Cincinnati, Cincinnati, Ohio.

Corresponding Author and Reprints: Alexander T. Schneider, MD, University of Cincinnati, Medical Science Bldg No. 0525, 231 Albert Sabin Way, Cincinnati, OH 45267 (e-mail: schneiar@ucmail.uc.edu).
same method used in 1995.10 We interviewed only those respondents whose demographic characteristics matched an unfilled category.

The survey instrument consisted of 29 questions divided into 3 sections. The first section contained open-ended questions designed to challenge respondents to spontaneously demonstrate their knowledge. Respondents were asked to name up to 3 stroke warning signs, then 3 stroke risk factors, and finally 3 sources of information about stroke. Those listing fewer than 3 were encouraged to complete the list. The second section contained questions designed to assess the prevalence of stroke risk factors. These questions were identical to questions used in the Third National Health and Nutrition Examination Survey.15 The third section contained questions regarding demographic variables and self-reported risk factors. The perceived stroke risk factors reported by at least 5% of respondents are shown in Table 2. Respondents with a specific self-reported risk factor were more likely to name that as a stroke risk factor than those without that risk factor. For example, of those with hypertension, 61% named hypertension as a stroke risk factor vs 43% without a history of hypertension (P < .001). This was also the case with those who ever smoked, had diabetes, and had hypercholesterolemia. Overall, 72% named at least 1 correct established stroke risk factor (Figure).

The survey instrument was identical to our 199510 questionnaire. The 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.

Respondents’ knowledge of important warning signs of stroke was assessed with signs established by several national organizations (American Stroke Association,16 National Stroke Association,17 and National Institute of Neurological Disorders and Stroke18), which list the following as important warning signs of stroke in their educational materials: (1) sudden numbness or weakness of the face, arm, or leg, especially on one side of the body; (2) sudden confusion or trouble speaking or understanding speech; (3) sudden troubleseeing in one or both eyes; (4) sudden trouble walking, dizziness, or loss of balance or coordination; and (5) sudden severe headache with no known cause. Knowledge of risk factors was assessed using the following established risk factors19-26: hypertension, smoking, heart disease, diabetes, transient ischemic attack or prior stroke, heavy alcohol use, and hypercholesterolemia.

Descriptive and comparative statistical analyses were performed using SAS statistical software (SAS Institute, Cary, NC). The χ² test was used to assess the univariate relationship between each risk factor or warning sign and age, race, and sex. The effects of demographics and the presence of risk factors on the respondents’ knowledge were evaluated using multivariable logistic regression modeling. Variables considered in the modeling included age, race, sex, level of education, and self-reported risk factors of hypertension, hypercholesterolemia, diabetes, prior stroke or transient ischemic attack, prior heart attack, cigarette use, alcohol use, and use of nonsteroidal anti-inflammatory medication. Interactions between the demographic variables and self-reported risk factors were also considered in the model. Comparison of the demographics and risk factors between 1995 and 2000 were performed using χ² except for age where a t test was used. Comparisons of knowledge between 1995 and 2000 were made using multiple logistic regression.

## RESULTS

Between July 13 and November 21, 2000, a total of 25,056 households were called. Of 3151 persons identified as demographically eligible to participate, 826 (26.2%) did not complete the interview due to language barriers, illness, or unavailability despite multiple callbacks during the study period; another 152 (4.8%) refused. The remaining 2173 (69%) respondents completed telephone interviews. Due to the nature of the survey, demographics of the nonresponders are not known.

The mean (SD) age was 61 (17.3) years (range, 18-95 years), 26% were black, 61% were female, and 50% had more than a high school education (Table 1). Blacks had higher rates of hypertension (55% vs 42%) and diabetes (23% vs 16%) than whites. Whites had higher rates of ever smoking than blacks; however, 67% of whites who had ever smoked had quit vs 49% of blacks who had ever smoked.

The warning signs, regardless of correctness, named by at least 5% of the respondents are shown in Table 2. When using only established warning signs as correct responses, 70% of respondents correctly gave at least 1 stroke warning sign (Figure).

### Table 1. Comparison of Demographics and Prevalence of Risk Factors Between Survey Years

<table>
<thead>
<tr>
<th></th>
<th>2000 (N = 2173)</th>
<th>1995 (N = 1880)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD), y</td>
<td>61 (17.3)</td>
<td>63 (16)</td>
<td>.002</td>
</tr>
<tr>
<td>Women, No. (%)</td>
<td>1334 (61)</td>
<td>1121 (60)</td>
<td>.25</td>
</tr>
<tr>
<td>Black, No. (%)</td>
<td>554 (26)</td>
<td>507 (27)</td>
<td>.44</td>
</tr>
<tr>
<td>Education &gt;12 y, No. (%)</td>
<td>1092 (50)</td>
<td>765 (41)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Self-reported risk factors, No. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>983 (45)</td>
<td>818 (44)</td>
<td>.27</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>822 (38)</td>
<td>607 (32)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Past smoker</td>
<td>723 (33)</td>
<td>635 (34)</td>
<td>.73</td>
</tr>
<tr>
<td>Current smoker</td>
<td>433 (20)</td>
<td>402 (21)</td>
<td>.25</td>
</tr>
<tr>
<td>Diabetes</td>
<td>353 (16)</td>
<td>255 (14)</td>
<td>.02</td>
</tr>
<tr>
<td>Heart disease</td>
<td>207 (10)</td>
<td>185 (10)</td>
<td>.74</td>
</tr>
<tr>
<td>Prior stroke or TIA</td>
<td>156 (7)</td>
<td>129 (7)</td>
<td>.69</td>
</tr>
<tr>
<td>Heavy alcohol use (&gt;2 drinks per day)</td>
<td>71 (3)</td>
<td>64 (3)</td>
<td>.81</td>
</tr>
</tbody>
</table>

Abbreviation: TIA, transient ischemic attack.
years old and younger than 35 years having less knowledge. Table 3 lists the independent factors significantly associated with knowledge of at least 1 established stroke warning sign and risk factor.

The most frequently cited sources of knowledge about stroke were those of mass media, including television (32%), magazines (24%), and newspapers (22%). Other responses named by at least 5% of respondents included physicians (20%), family member with stroke (19%), medical books (9%), friend with stroke (7%), and “word of mouth” (5%).

The course of action in the event of a stroke was assessed with a single-response open-ended question. Most respondents (75%) indicated they would activate 911/emergency services. Only 1% answered that they would wait to see if symptoms went away.

Compared with the baseline characteristics of 1995 respondents, the 2000 respondents were younger (mean age, 61 vs 63 years [P < .001]), more highly educated (50% reporting at least some college vs 41% [P < .001]), and had higher prevalence of diabetes (16% vs 14% [P = .02]) and hypercholesterolemia (38% vs 32% [P < .001]).

A significantly higher number of respondents correctly named at least 1 established warning sign in the 2000 survey compared with 1995 after controlling for age, education, and hypercholesterolemia (70% vs 57%; P < .001) (Figure). No statistically significant difference was seen regarding knowledge of at least 1 stroke risk factor between 2000 and 1995 (72% vs 68%). However, a significantly higher number of year 2000 respondents named 2 or more stroke risk factors than in 1995 (32% vs 25% [P < .001]).

Methods of mass media were the most commonly cited source of knowledge in both survey years. There was a significant increase in television cited as the primary source between 1995 and 2000 (24% vs 32% [P < .001]). There was no significant difference regarding physicians being cited as the source of knowledge. A family member having a stroke as the source of knowledge was cited more frequently by year 2000 respondents compared with 1995 (19% vs 12% [P < .001]).

**COMMENT**

Public knowledge of stroke warning signs significantly improved in the Greater Cincinnati/Northern Kentucky region between 1995 and 2000, while knowledge of risk factors remained relatively constant. Although public knowledge of stroke has increased, significant gaps continue to exist, with lack of knowledge most apparent in the elderly, blacks, and men—groups that have higher incidence rates of stroke.27−30 Continued and intensified educational efforts to promote knowledge of stroke, particularly among high-risk groups, are needed by policymakers, as well as local and national organizations.

Most respondents reported they would use 911/emergency services if they identified themselves or someone else as having a stroke. However, this may represent an overestimate given the nature of this survey. Recognition of possible stroke does not necessarily lead to the proper course of action. In a study of 152 patients seeking emergency department care for stroke-like symptoms, median delay in hospital arrival was less in cases where a witness recognized the seriousness of the symptoms.1 Public education promoting awareness of the seriousness of stroke, the urgency of stroke evaluation, and the narrow therapeutic time window may lead toward changes in behavior.

Mass media, especially television, was reported to be the source of stroke knowledge for most respondents, although physicians were reported as the primary source of information by 20%. Of patients recalling being informed by their physician that they are at increased risk of
Table 3. Multivariable Logistic Regression: Factors Related to Knowledge of at Least 1 Stroke Warning Sign or Risk Factor in 2000 Survey

<table>
<thead>
<tr>
<th>Factor</th>
<th>Odds Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of 1+ warning sign</td>
<td></td>
</tr>
<tr>
<td>Age ≥75 y</td>
<td>0.66 (0.52-0.83)</td>
</tr>
<tr>
<td>Black</td>
<td>0.72 (0.58-0.90)</td>
</tr>
<tr>
<td>Female</td>
<td>1.71 (1.40-2.09)</td>
</tr>
<tr>
<td>Education (some college)</td>
<td>1.80 (1.48-2.20)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.36 (1.11-1.67)</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>1.28 (1.04-1.56)</td>
</tr>
<tr>
<td>Knowledge of 1+ risk factor</td>
<td></td>
</tr>
<tr>
<td>Age ≥75 y</td>
<td>0.51 (0.41-0.66)</td>
</tr>
<tr>
<td>Black</td>
<td>0.72 (0.58-0.91)</td>
</tr>
<tr>
<td>Female</td>
<td>1.54 (1.25-1.90)</td>
</tr>
<tr>
<td>Education (some college)</td>
<td>1.75 (1.42-2.18)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.98 (1.60-2.46)</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>1.28 (1.04-1.59)</td>
</tr>
<tr>
<td>Alcohol use (&gt;2 drinks per day)</td>
<td>1.25 (1.02-1.54)</td>
</tr>
</tbody>
</table>

In summary, some improvement in stroke knowledge over the 5-year period was observed, but gaps exist, especially in those at the highest stroke risk. The modest progress that has occurred thus far should act as an incentive to what can be further achieved by redoubled, organized, and focused efforts to educate the public about stroke.

Author Contributions: Study concept and design: Pancioli, Tuchfarber, Miller, Woo, Broderick. Acquisition of data: Pancioli, Rademacher, Tuchfarber, Woo, Broderick. Analysis and interpretation of data: Schneider, Pancioli, Khoury, Tuchfarber, Woo, Kissela, Broderick. Drafting of the manuscript: Schneider, Pancioli, Woo, Kissela. Critical revision of the manuscript for important intellectual content: Tuchfarber, Schneider, Khoury, Rademacher, Miller, Woo, Kissela, Broderick. Administrative, technical, or material support: Pancioli, Miller, Broderick. Study supervision: Pancioli, Kissela, Broderick. Funding/Support: This study was funded by grant NINDS-R01-N330678-04 from the National Institute of Neurological Disorders and Stroke.

Acknowledgment: We thank Edward Jauch, MD, and Dawn Kleindorfer, MD, for their valuable contributions.

REFERENCES