Knowledge of Stroke Risk Factors, Warning Symptoms, and Treatment Among an Australian Urban Population

Sung Sug Yoon, BSN; Richard F. Heller, MD, FRCP; Christopher Levi, MD, FRCP; John Wiggers, PhD; Patrick E. Fitzgerald, PhD

Background and Purpose—Reduction in the risk of stroke and increase in the speed of hospital presentation after the onset of stroke both depend on the level of knowledge of stroke in the general population. The aim of the present study was to assess baseline knowledge regarding stroke risk factors, symptoms, treatment, and information resources.

Methods—A community-based telephone interview survey was conducted in the Newcastle urban area in Australia. A total of 1278 potential participants between the ages of 18 to 80 were selected at random from an electronic telephone directory. A trained telephone interviewer conducted a telephone survey using the Computer-Assisted Telephone Interviewing (CATI) program.

Results—A total of 822 participants completed the telephone interview. Six hundred three participants (73.4%) correctly identified the brain as the affected organ in stroke. The most common risk factors for stroke identified by respondents were smoking (identified by 324 [39.4%]) and stress (identified by 277 [33.7%]). The most common warning sign of stroke described by respondents was “blurred and double vision or loss of vision in an eye,” listed by 198 (24.1%). A total of 626 (76.2%) respondents correctly listed $1$ established stroke risk factor, but only 409 (49.8%) respondents correctly listed $1$ warning sign.

Conclusions—The level of knowledge in the community of established stroke risk factors, warning signs, and treatment as indicated by this survey suggests that a community-based education program to increase public knowledge of stroke may contribute to reducing the risk of stroke and to increasing the speed of hospital presentation after the onset of stroke. (Stroke. 2001;32:1926-1930.)

Key Words: community knowledge ■ education ■ stroke ■ survey ■ risk factors

Among Australians, stroke is the third most common cause of death and the leading cause of long-term disability. It places great demands on family members and caregivers. Stroke is an enormous financial burden not only for the families of patients but also for society as a whole.1

Early presentation at a hospital and improved control of stroke risk factors will provide greater opportunity for effective stroke treatment and prevention.2,3 Decreasing the time from stroke onset to hospital presentation and risk reduction depend on the knowledge of stroke of both patients and their family members and of the general population.4–6 However, many stroke patients present late at a hospital due to lack of knowledge about stroke.7

In a previous hospital-based study, fewer than half of the stroke patients knew the signs, symptoms, or risk factors of a stroke.8,9 Pancioli et al.10 in a population-based survey of 1880 adults, also found that only 57% of respondents were able to identify $\geq 1$ of 5 warning signs of stroke, whereas 68% listed $\geq 1$ established risk factor for stroke. A public education campaign can, however, be effective. Stern et al11 reported significant positive results from their community educational programs that included a 12-minute slide and audio program for stroke awareness and knowledge. There was a 10.9% increase in stroke awareness and knowledge between the preeducation group and the post-education group. Although this study and another11,12 suggest the potential of an educational approach to increase community knowledge, methodological limitations, including small sample size and the absence of control groups, limit the ability to draw a definitive conclusion about the efficacy of such an approach.

To increase public knowledge of stroke, a more widespread public education is required. Effective future community-based education programs rely on an accurate assessment of the baseline knowledge of a population. However, few studies have specifically examined stroke risk factors, symptoms, and treatment in the community. We conducted a community-based telephone survey to determine baseline knowledge regarding stroke risk factors, symptoms, treatment, and information resources.
Subjects and Methods

Sample and Setting
A random sample of 1773 households in Newcastle, Australia, a regional city of ~250,000 persons, was randomly selected from an electronic telephone directory between September 10 and October 13, 1999. Within each household, the person who was between 18 and 80 years of age and who had the next birthday was eligible to participate in the study.

Procedure
One week after mailing an information letter, a trained telephone interviewer contacted each selected household to conduct a telephone interview. If the eligible household member was not available to complete the interview, arrangements were made to call back later. Three contact attempts were made to contact each eligible household member during the survey period.

Measures
A literature review of previous studies concerning stroke knowledge and hospital presentation was conducted to identify potential items for the survey instrument. From this review, a draft instrument was developed that addressed the knowledge of stroke risk factors, warning signs and symptoms, treatment, and information resources. A draft instrument was developed and pretested with 25 people. The final survey instrument contained 28 items that divided into 4 sections: (1) knowledge about stroke (5 items). These items addressed knowledge regarding risk factors, warning signs, and treatment of stroke; information resources; and recognition of any community stroke organization. Response options for each of these items were open-ended questions. The other 3 sections concerned (2) planned response to acute stroke (open-ended question) and planned response to 6 stroke warning signs (close-ended questions) (ie, dizziness; tingling/numb or dead sensation; weakness or paralysis on one side of body; blurred or double vision; difficulty speaking, reading, or understanding; and severe headache), (3) respondents’ demographic details (age, sex, marital status, country of origin, education, income), and (4) respondents’ presence of stroke risk factors (high blood pressure, angina, heart attack, previous stroke, diabetes, high cholesterol, smoking, alcohol, and family history of stroke). This study was approved by the Newcastle University and Hunter Area Research Ethics Committees.

Data Analysis
Descriptive and comparative statistical analyses were performed with the use of the statistical program SAS version 6.12. χ² Tests were used to assess the univariate relationships among components of stroke-related knowledge, planned responses to various warning signs, demographic characteristics and self-reported risk factors. All variables were included in a multivariate analysis as main effects. The effects of demographics and the presence of risk factors on the participants’ knowledge of stroke were evaluated separately using logistic regression analyses. For each model, response options for the dependent variable were categorized as either “know” (listed ≥1 of established stroke risk factors and stroke warning signs) or “do not know.” Response options for the dependent variable (planned response) were aggregated into 2 groups: (1) call an ambulance or visit hospital emergency department/casualty or (2) other (all the remaining response options). All variables were subsequently included in a stepwise logistic regression analysis as main effects. P values from Wald statistics were used to assess the significance of predictor variables. Missing data were excluded. Two-tailed significance tests were used, and P=0.05 was considered significant in both univariate and multivariate analyses. The possibility of chance associations is increased by the simultaneous reporting of large numbers of P values. Thus, these results should be treated with caution. However, due to the paucity of literature on this topic, we believe that the probability value should be taken as a reasonable indicator of the existence of an association.

Results

Sample
A total of 1773 telephone calls were made, and of those, 1325 households were eligible. The remainder of the calls were ineligible (due to facsimile number, business telephone number, disconnection, or no answer). A total of 1278 potential respondents were telephoned to take part in the study, and of these, 822 participants completed the questionnaire, for a response rate 62%. Demographic characteristics of the respondents are presented in Table 1. Respondents were asked whether they had been told by health care professionals that they had a stroke risk factor. Of the respondents, 258 (31.4%) respondents had been told that they had high blood pressure (hypertension); 48 (5.8%), diabetes; 24 (2.9%), previous history of stroke; 35 (4.3%), angina; and 206 (25.1%), high cholesterol; and 356 (43.3%), family history of stroke.

A high proportion of respondents (73.4%) identified the brain as an organ of the body where a stroke occurs. However, 129 (15.9%) respondents still thought of stroke as a heart problem. The most common risk factors of stroke listed by respondents were “smoking,” identified by 324 respondents (39.4%); “stress,” identified by 277 respondents (33.7%); and “bad diet,” identified by 265 respondents (32.2%). A smaller proportion of respondents (31.8%) listed high blood pressure as a risk factor for stroke (Table 2).

The most common warning signs of stroke listed by respondents were “blurred and double vision or loss of vision in an
**TABLE 2. Respondents’ Knowledge of Stroke Risk Factors**

<table>
<thead>
<tr>
<th>Response</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>324 (30.4)</td>
</tr>
<tr>
<td>Stress</td>
<td>277 (33.7)</td>
</tr>
<tr>
<td>Bad diet</td>
<td>265 (32.2)</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>261 (31.8)</td>
</tr>
<tr>
<td>Obesity</td>
<td>220 (26.8)</td>
</tr>
<tr>
<td>Genetics</td>
<td>182 (22.1)</td>
</tr>
<tr>
<td>Lack of exercise</td>
<td>181 (22.0)</td>
</tr>
<tr>
<td>Alcohol</td>
<td>171 (20.8)</td>
</tr>
<tr>
<td>Unhealthy lifestyle</td>
<td>128 (15.6)</td>
</tr>
<tr>
<td>High cholesterol</td>
<td>111 (13.5)</td>
</tr>
<tr>
<td>Do not know</td>
<td>102 (12.3)</td>
</tr>
</tbody>
</table>

n=822.

The respondents’ knowledge regarding established stroke risk factors was better than that for the warning signs of stroke. Six hundred twenty-six (76.2%) respondents correctly listed ≥1 established stroke risk factor, 412 (50.2%) correctly listed 2 risk factors, and 198 (24.1%) correctly listed ≥3 established risk factors for stroke. In contrast, only 409 (49.8%) respondents could correctly list ≥1 stroke warning sign, 215 (26.2%) correctly listed 2 warning signs, and 72 (8.8%) correctly listed ≥3 established stroke warning signs. In the univariate comparison, younger age (P=0.01), female sex (P=0.03), higher level of education (P=0.002), history of heart disease (P=0.02), and family history of stroke (P=0.009) predicted better knowledge about stroke risk factors. Knowledge of stroke warning signs was associated with younger age (0.001), higher level of education (P=0.001), and higher level of income (P=0.001). There was no difference in terms of country of origin, high blood pressure, diabetes, angina, current smoking, alcohol, previous history of stroke, and high cholesterol between those who did not know any stroke risk factors or warning signs and those who knew ≥1.

Table 4 gives the respondents’ planned response to the event of a stroke and each stroke warning sign. When asked how they would respond if they thought that they were having a stroke, a high proportion (89.9%) reported that they would call an ambulance or visit a hospital emergency department. In contrast, when asked how they would respond to each stroke warning sign without reference to stroke, markedly fewer (3% to 42%) reported that they would call an ambulance or go to a hospital emergency department. Respondents were more likely to respond in these ways if they experienced weakness/paralysis (42%) and least likely if they experienced dizziness (3%).

In the final logistic regression model, higher family income, high blood pressure, history of high cholesterol, and family history of stroke were associated with knowledge of stroke risk factors. Only higher educational level and family income were significant predictors of the knowledge of stroke warning signs (Table 5). Older age, marital status (married), history of high cholesterol, angina, and country of origin (Australia) were significantly associated with calling an ambulance or visiting a hospital emergency department in response to the stroke symptoms. No clinically significant interactions were found between demographic factors and self-reported risk factors or the knowledge of stroke risk factors, and warning signs.

The most common sources of stroke information reported by respondents were general life experiences and personal acquaintances (family members 32.2%, television 21.2%, friends 19.8%, magazines 15.7%, newspapers 15.3%) rather than professionals (physicians 7.4%, hospital personnel 5.4%) or health aspects of formal school programs (12.3%). With reference to awareness of stroke organizations such as community stroke services, stroke clubs, and rehabilitation facilities, 501 (60.9%) respondents could not recall or did not know any of these organizations.

**Discussion**

This community-based study indicates the desirability of improving the level of public knowledge of stroke risk factors, symptoms, and treatment. Half of the respondents were not aware of any established stroke warning signs, and one fourth were not aware of any stroke risk factors. When asked how they would respond if they recognized that they were having a stroke, most respondents (89.9%) said they would either call an ambulance or visit a hospital casualty or emergency department. However, when asked how they would respond to particular symptoms, without reference to...
stroke, fewer than half would call an ambulance, whereas 3% would visit a hospital casualty or emergency department.

“Smoking” was listed as the most common risk factor of stroke in this study. It is of interest that only 261 (31.8%) respondents identified “high blood pressure” as a risk factor for stroke. This may reflect a recent intensive Australian risk awareness campaign that focused on smoking.27 These findings contrast with a previous population-based telephone interview survey in the greater Cincinnati, Ohio,10 metropolitan area. In this study, high blood pressure was the risk factor most frequently identified, and smoking was fourth. Population-based studies in South Korea28 and Hong Kong29 also reported that high blood pressure was the risk factor most frequently identified risk factor of stroke. A smaller proportion of respondents (4.3% to 5.1%) identified “diabetes” and “heart disease” as stroke risk factors. These results suggest that community-based stroke prevention strategies should focus on the established stroke risk factors.

“Blurred and double vision or loss of vision in 1 eye” was the most common stroke warning sign listed by respondents. A lower proportion of respondents recognized “weakness and paralysis on 1 side of body” as a stroke warning sign. In contrast, in a study of patients with acute stroke, Kothari et al30 reported that the most commonly documented stroke warning sign was “weakness.” In the present study, more respondents listed “chest pain or chest tightness” as a stroke warning sign than listed unilateral weakness or paralysis. This result is similar to the results of Pancioli et al30 in a US population-based telephone survey.

In a population-based telephone interview survey, Pancioli et al30 reported that the most common stroke warning signs listed by respondents were dizziness and numbness. Similarly, in a study of patients with acute stroke, Kothari et al30 reported that the most common stroke warning signs, as noted by the patient at the time of onset, were weakness and numbness. In the present study, however, when asked how they would respond to each of 6 stroke warning signs, few respondents (3.2% to 30.3%) said they would call an ambulance or visit a hospital emergency department for the symptom of dizziness and numbness. This variation could be a function of differences in the perceptions of the importance or severity of symptoms. This finding suggests that a community education program should include teaching the warning signs of stroke as well as the appropriate responses.

Educational levels were not associated with responses to consideration of calling an ambulance or visiting a hospital emergency department in response to the each stroke warning sign. However, higher educational level was a significant predictor of better knowledge of stroke warning signs. In a population-based telephone survey, Pancioli et al30 also reported that respondents who have a high level of education were more likely to know stroke warning signs. A similar result was found for acute myocardial infarction, where <10 years of education is associated with a delayed hospital arrival for heart attack symptoms.30 These data may be explained by a previous study that reported knowledge alone is not sufficient to change care-seeking behavior.31 Another study regarding acute myocardial infarction supports that cognitive and psychological factors are also associated with patient responses and delays in seeking medical treatment.32

In the multivariate logistic regression model, high blood pressure and family history of stroke among the respondents were independent predictors of increased knowledge of stroke risk factors. However, respondents who had been told by a physician that they had a high cholesterol level were less likely to know about risk factors for stroke. Even among respondents who had a risk factor for stroke, knowledge of stroke warning signs did not differ from that of respondents who had no risk factors. The respondents who had a history of hypertension and experiences with stroke in their family were less likely to call an ambulance or go to a hospital emergency department when experiencing symptoms of sudden difficulty in speaking, reading or understanding and of tingling, numbness, or dead sensation. These results may be influenced by use of the term “difficulty” in describing a warning sign, because “difficulty” is a relative

### TABLE 4. Respondents’ Reactions to Various Stroke Symptoms

<table>
<thead>
<tr>
<th>Planned Response</th>
<th>Acute Stroke, n (%)</th>
<th>Dizziness, n (%)</th>
<th>Tingling/Numbness, Dead Sensation, n (%)</th>
<th>Weakness/Paralysis, n (%)</th>
<th>Blurred/Double Vision, n (%)</th>
<th>Speaking Difficulty, n (%)</th>
<th>Headache, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call general practitioner/family physician</td>
<td>82 (10.0)</td>
<td>24 (2.9)</td>
<td>58 (7.1)</td>
<td>55 (6.7)</td>
<td>42 (5.1)</td>
<td>56 (6.9)</td>
<td>26 (3.2)</td>
</tr>
<tr>
<td>Visit general practitioner/family physician</td>
<td>77 (9.4)</td>
<td>173 (21.0)</td>
<td>314 (38.2)</td>
<td>288 (35.1)</td>
<td>460 (56.0)</td>
<td>367 (44.7)</td>
<td>267 (32.5)</td>
</tr>
<tr>
<td>Visit other health care provider</td>
<td>2 (0.2)</td>
<td>1 (0.1)</td>
<td>2 (0.2)</td>
<td>2 (0.2)</td>
<td>53 (6.4)</td>
<td>8 (1.0)</td>
<td>1 (0.1)</td>
</tr>
<tr>
<td>Wait and observe symptoms to see if they subside</td>
<td>12 (1.5)</td>
<td>480 (58.4)</td>
<td>85 (10.3)</td>
<td>20 (2.4)</td>
<td>65 (7.9)</td>
<td>40 (4.9)</td>
<td>357 (43.4)</td>
</tr>
<tr>
<td>Call an ambulance</td>
<td>553 (67.3)</td>
<td>9 (1.1)</td>
<td>120 (14.6)</td>
<td>164 (20.0)</td>
<td>41 (5.0)</td>
<td>129 (15.7)</td>
<td>19 (2.3)</td>
</tr>
<tr>
<td>Go to hospital casualty/emergency department</td>
<td>186 (22.6)</td>
<td>17 (2.1)</td>
<td>129 (15.7)</td>
<td>180 (21.9)</td>
<td>153 (18.6)</td>
<td>209 (25.3)</td>
<td>36 (4.4)</td>
</tr>
<tr>
<td>Do not know</td>
<td>20 (2.4)</td>
<td>118 (14.4)</td>
<td>114 (13.7)</td>
<td>113 (13.8)</td>
<td>8 (1.0)</td>
<td>13 (1.6)</td>
<td>116 (14.2)</td>
</tr>
</tbody>
</table>

n = 822.

### TABLE 5. Significant Predictors of Knowing at Least One Risk Factor or Stroke Warning Sign in the Multivariate Logistic Regression Model

<table>
<thead>
<tr>
<th>Factor</th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk factor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family history</td>
<td>1.98</td>
<td>1.33–2.95</td>
<td>0.0007</td>
</tr>
<tr>
<td>Income</td>
<td>1.31</td>
<td>1.28–1.33</td>
<td>0.005</td>
</tr>
<tr>
<td>High cholesterol</td>
<td>0.50</td>
<td>0.36–0.87</td>
<td>0.009</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>1.95</td>
<td>1.23–3.09</td>
<td>0.005</td>
</tr>
<tr>
<td>Warning sign</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>1.56</td>
<td>1.22–2.01</td>
<td>0.005</td>
</tr>
<tr>
<td>Income</td>
<td>1.22</td>
<td>1.04–1.42</td>
<td>0.01</td>
</tr>
</tbody>
</table>
term that may affect respondents’ perceptions of the urgency or severity.

These results suggest that methods used by health care providers to inform patients about stroke risk factors and warning signs might be revised to ensure effective transmission and retention, along with appropriate responses. Furthermore, increasing public awareness of stroke prevention and warning signs and symptoms is desirable, particularly in the at-risk population.

The majority of respondents (87.1%) rely on general life experiences or family members as their primary source of stroke knowledge rather than on professionals or as part of their formal school programs. These interpersonal contacts can be a very effective means of disseminating medical information. Ensuring the retention of simple and accurate information regarding the warning signs, symptoms, and treatment of stroke in both patients and families as they go through stroke rehabilitation may be an effective means of promulgation of this information to the general public.

There has been no high-profile national stroke education campaign in Australia. It is likely, therefore, that interregional deficiencies in awareness occur. No comparative data, however, are presently available for Australia. In light of this, the results may not be generalizable across Australia. We suggest, given the similarities between our results and those in other westernized countries, that the lack of knowledge we have identified would be similar elsewhere in Australia.

In conclusion, in the present study, we assessed the baseline knowledge of stroke and planned response to stroke warning signs. Fewer than half of the respondents are aware of and would have appropriate responses to stroke warning signs. Fewer than half are aware of stroke services in the community. Respondents in the present study who had a risk factor of stroke did not have better knowledge than did those without a risk factor. To increase public knowledge of stroke and to reduce the time taken by patients to call emergency services when stroke symptoms occur, community-based educational strategies based on the results of this study should focus on high-risk populations such as elderly persons and persons with risk factors for stroke.

Acknowledgment

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