Background and Purpose—This study assessed public awareness of warning symptoms, risk factors, and treatment of stroke in Ludhiana, Punjab, North West India.

Methods—A hospital-based survey was conducted between February 2002 and September 2002 by the Stroke section of Christian Medical College. The study subjects were relatives of patients without history of stroke, attending the outpatient department of the hospital. Trained medical students, interns, and a nurse interviewed subjects using a structured, pretested, open-ended questionnaire.

Results—Nine hundred forty-two individuals were interviewed during the study period (56.4% men, mean age 40.1 years, age range 15 to 80 years). Forty-five percent of the subjects did not recognize the brain as the affected organ in stroke. In the multivariate analysis, higher education (P<0.001; odds ratio 2.6; 95% CI 1.8 to 3.8) and upper socioeconomic status (P<0.005; odds ratio 1.6; CI, 1.1 to 2.2) correlated with a better knowledge of which organ was affected in stroke. Twenty-three percent of the participants did not know a single warning symptom of stroke. Twenty-one percent of the study population believed that oil massage would improve stroke victims. A small proportion of subjects believed in witchcraft, faith healing, homeopathic, and ayurvedic treatment (3%).

Conclusions—This hospital-based survey reveals a better awareness of stroke warning signs and risk factors. However, knowledge regarding the organ involved, etiology, and treatment of stroke is lacking. Considerable education is needed to increase public awareness in modern concepts of stroke treatment. (Stroke. 2005;36:644-648.)

Key Words: awareness ■ stroke ■ warning symptoms

The prevalence of stroke in India varies in different regions of the country and ranges from 40 to 270 per 100,000 population.1-4 Approximately 12% of all strokes occur in the population <40 years of age.1 India will face an enormous socioeconomic burden to meet the costs of rehabilitation of stroke victims because the population is now surviving beyond the peak years (age 55 to 65) for risk of stroke.5 Despite recent advances in stroke therapy, the public remains uninformed about strokes, and few stroke patients present to hospital in time to receive treatment.6 Even in developed countries, like the United States,6-9 Australia,10 South Korea,11 and Canada,12 there is a recognized lack of knowledge in the community about established stroke risk factors and warning signs. In India, many centers have started using recombinant tissue plasminogen activator for acute ischemic stroke. The best way for patients to receive the most effective stroke treatment is to get to an emergency room as quickly as possible after they have had symptoms. Only 1 study from India has investigated the various factors that delay hospitalization in patients with acute ischemic stroke.13 However, there are no studies from India and other developing countries regarding public perception of stroke warning symptoms and risk factors. The awareness of these symptoms and risk factors are essential for the public to effectively use thrombolytic therapy for acute stroke in a timely manner. This study was undertaken to assess public awareness of warning symptoms, risk factors, and treatment of stroke.

Methods

The Stroke section of the Department of Neurology, Christian Medical College, Ludhiana, Punjab, India, conducted this prospective hospital-based survey between February 2002 and September 2002 at a tertiary referral center situated in northwestern India. Relatives of patients seen at the outpatient departments of the hospital formed the study subjects. The Institutional Research Committee approved this study. Subjects were selected in a quasi-random manner, from an eligible population, at the registration desk in each outpatient department. Individuals >15 years of age, who

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consented, were interviewed personally. Only the relatives of patients without a past history of stroke participated in the study. No 2 respondents were from the same family. A nurse, medical students, and medical interns who had undergone a 2-week orientation to the questionnaire conducted the interviews. The questions were asked during a 1-to-1 interview in the local vernacular language (either Punjabi or Hindi). The interviewer intervened only to clarify a question, if required. No attempt was made to prompt the respondents by suggesting answers directly.

Questionnaire
The survey questionnaire adapted from previous studies8,10 consisted of 22 questions, which were modified by the authors to suit local sociocultural practices. The first section gathered demographic information. Education was categorized into illiterates, primary (below 5th standard), secondary (6th standard to 12th standard), and college education. Income was classified into upper (>Rupees 5000 per month) and lower (<Rupees 5000 per month) income groups. Sections 2 and 3 covered awareness of stroke warning symptoms, risk factors, and treatment. The last section of the survey was aimed at finding out whether the respondents had any of the listed risk factors for stroke. All questions were open-ended with options for multiple responses. The survey instrument was pretested using a sample of 50 people. Changes were made in the questionnaire to various terms that are used for “stroke” in the local languages Punjab and Hindi. This was done entirely to differentiate heart attack and stroke in the local language.

Statistical Analysis
All statistical analysis was performed using SPSS software version 11.5 (SPSS Inc.). \( \chi^2 \) tests were used to assess the univariate relationship between components of stroke knowledge, warning signs, risk factors, and demographic variables. Multivariable logistic regression was used to assess the predictors of knowing a single correct response to various questions. Variables included in the model were age (< or >40 years), gender, religion (Hindus versus others), education (illiterates and primary versus secondary and college education), and income. Variables were eliminated in a stepwise backward fashion if they failed to reach significance \( (P<0.05) \) until a final model resulted. Finally, odds ratios (OR) and 95% CI were generated for all the terms in the final models.

Results
A total of 1255 individuals were screened and 1146 subjects consented to participate in the study. We excluded 204 subjects who had seen someone with a stroke to avoid recall bias. In the final analysis only 942 subjects were included. There were 531 (56.4%) men and 411 (43.6%) women. The mean age was 40.1 years and SD was 12.9 (range 15 to 80 years). The demographic details are shown in Table 1. Forty-five percent of subjects could not name the organ that was affected in stroke. Twenty-two percent of them thought that stroke involved various organs, such as chest, stomach, heart, and the entire body. Occlusion of a vessel as the cause of stroke was correctly stated by 291 (30.8%) of the respondents. One hundred and thirty-nine (14.7%) participants mentioned that rupture of a vessel could lead to stroke. In the univariate analysis, a higher knowledge about the organ involved in stroke correlated with men \( (P<0.02) \), Hindus \( (P<0.03) \), persons belonging to a higher income category \( (P<0.001) \), and higher education \( (P<0.001); \) Table 2. In the multivariable logistic regression analysis, higher education \( (P<0.001; \) OR 2.6; 95% CI, 1.8 to 3.8) and upper socioeconomic status \( (P<0.005; \) OR 1.6; 95% CI, 1.1 to 2.2) correlated with a better knowledge about the organ affected in stroke.

Warning Symptoms of Stroke
The most common warning symptom in a stroke, as described by respondents, was paralysis of 1 side of the body, 586 (62.2%). The other symptoms identified by the participants were headache, 77 (8.1%); loss of consciousness, 57 (6.1%); loss of balance, 59 (6.3%); difficulty in speech, 47 (4.9%); loss of vision, 17 (1.8%); and tingling sensation on 1 side, 12 (1.3%). Two hundred and twelve subjects \( (23\%) \) did not know a single warning symptom of stroke. Five hundred and nineteen \( (55\%) \) respondents correctly identified 1 symptom, 153 \( (16.2\%) \) individuals identified 2 symptoms, and only 58 \( (6.2\%) \) knew 3 or more symptoms. Only upper socioeconomic status \( (P<0.05) \) correlated with knowing at least 1 stroke symptom in univariate analysis (Table 2). However, in multivariable logistic regression analysis none of the demographic variables, including income, reached any statistical significance.

Risk Factors for Stroke
Risk factors identified by subjects included hypertension, 425 (45.1%); stress, 385 (40.9%); diabetes, 101 (10.7%); high cholesterol, 63 (6.7%); heredity, 36 (3.8); obesity, 30 (3.2%); heart disease, 19 (2%); lack of exercise, 21 (2.2%); smoking, 11 (1.2%); and black magic, 5 (0.5%). One hundred and ninety-five \( (20.7\%) \) participants did not know a single risk factor. Only 482 (51.2%) individuals could name 1 risk factor correctly, 174 \( (18.5\%) \) subjects knew 2 risk factors, and only 91 \( (9.7\%) \) of them could name 3 or more risk factors. Higher education \( (P<0.05) \) and Hindus \( (P<0.05) \) were significantly associated with knowing a single risk factor in univariate analysis (Table 2). In multivariable logistic regression analysis, none of the variables attained statistical significance.

Self-Reported Risk Factors
Among respondents who reported that they had 1 recognized risk factor for stroke, the frequency of those identifying risk

### Table 1. Demographic Profile of the Subjects Compared With Punjab and National Data (Census 2001)

<table>
<thead>
<tr>
<th>Place</th>
<th>n=942 (%)</th>
<th>Punjab(^4) (%)</th>
<th>India(^4) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>531 (56.4)</td>
<td>53</td>
<td>52</td>
</tr>
<tr>
<td>Female</td>
<td>411 (43.6)</td>
<td>47</td>
<td>48</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–40</td>
<td>514 (54.6)</td>
<td>48</td>
<td>46.9</td>
</tr>
<tr>
<td>41–60</td>
<td>374 (39.7)</td>
<td>20</td>
<td>19</td>
</tr>
<tr>
<td>61–80</td>
<td>54 (5.7)</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Religion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hindus</td>
<td>507 (53.8)</td>
<td>37</td>
<td>80.4</td>
</tr>
<tr>
<td>Sikh</td>
<td>397 (42.1)</td>
<td>60</td>
<td>1.9</td>
</tr>
<tr>
<td>Others</td>
<td>38 (4.0)</td>
<td>3</td>
<td>17.7</td>
</tr>
<tr>
<td>Place</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Village</td>
<td>245 (26)</td>
<td>66</td>
<td>72</td>
</tr>
<tr>
<td>City</td>
<td>697 (74)</td>
<td>34</td>
<td>28</td>
</tr>
</tbody>
</table>

#### Notes

1. Punjabi or Hindi
2. Survey was conducted in the local language
3. Multivariable logistic regression analysis
4. Punjab and National Data (Census 2001)

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factors for stroke was low: diabetes, 8/19 (42.1%); hypertension, 8/46 (17.4%); heart disease, 4/12 (33.3%); high cholesterol, 3/31 (9.7%); and smoking, 1/68 (1.5%).

Sources of Information About Stroke
A majority of subjects had heard about stroke through friends, 302 (32.1%), and relatives, 376 (39.9%), the rest heard through television, 85 (9%); radio, 10 (1.1%); and the newspaper, 60 (6.4%). Surprisingly, only 34 (3.6%) individuals had received information about stroke from doctors.

Respondent’s Reaction to Stroke Symptoms
Seventy-one percent of subjects reported that they would visit a hospital emergency department if they or one of their relatives experienced symptoms suggesting a stroke (Table 3). Less than 1% of the subjects thought that they would buy medicines from the shop instead of taking the person to a doctor. Younger age (<40 years; \( P < 0.01; \) OR 1.8; 95% CI, 1.1 to 3.0) and higher education (\( P < 0.04; \) OR 1.7; 95% CI, 1.0 to 2.8) correlated with a correct response to stroke symptoms.

Knowledge of Stroke Treatment
Only 70 (7.4%) of respondents described “blood clot–dissolving drugs” like aspirin as an appropriate therapy for the treatment of stroke (Table 3). Sixty-seven respondents (7.1%) believed that an oil massage would help stroke victims. The number of subjects who believed in indigenous treatments included ayurvedic treatment 13 (1.4%), homeopathy 7 (0.7%), faith healers 7 (0.7%), witchcraft 2 (0.2%), and magician’s treatment 6 (0.6%). Men (\( P < 0.02; \) OR 1.3; 95% CI, 1.0 to 1.8) and younger age (\( P < 0.02; \) OR 0.7; 95% CI, 0.5 to 0.9) correlated with better knowledge about stroke treatment.

Respondents and Indigenous Treatment
There were 413 (43.7%) respondents who gave a valid response to treatment of stroke. We compared the knowledge of stroke of the 102 (10.7%) respondents who believed in indigenous treatment to the 311 (33%) respondents who believed in modern treatment. Respondents who believed in indigenous treatment were less aware about stroke warning symptom (\( P < 0.001 \)) and risk factor (\( P < 0.001 \)).

Discussion
This survey was conducted among relatives of outpatients presenting to the hospital and therefore may be more biased toward an increased accuracy of responses, given that the population that seeks medical care is more knowledgeable in recognizing a problem than someone who is completely unaware. A population-based survey and telephonic interviews in the community are not readily feasible in developing countries, owing to the lack of financial resources and other logistic issues. The demographic profiles in this study are representative of the population of India and Punjab (urban more than rural), except in age group aged 41 to 60 years and religion (Table 1). However, age did not influence our results in both univariate and in multivariate analysis. The religion did not match with the Indian data because the dominant religion in Punjab is Sikhism. Even though this is a hospital-based survey, the findings indicate that there is lack of awareness among the general public about stroke warning symptoms and risk factors. A minority of subjects correctly identified the brain as the affected organ in stroke, and ignorance of the warning symptoms and risk factors for
The awareness of stroke risk factors among high-risk individuals was poor in our study and did not differ significantly from those of respondents who had no risk factors. Future educational efforts need to focus not only on the general public, but also among high-risk individuals. Most studies from developed countries have found that knowledge about stroke varies positively by income and education but is lower in men than women.8,10 In this study, the knowledge about the organ involved in stroke and treatment of stroke was better among men. In countries such as India, which is strongly paternalistic in cultural practices, educational status, opportunities, and income are greater among men than women, which may account for a higher knowledge of stroke among men. Hindus were more knowledgeable than the other religious factions as regards to the organ affected in stroke and risk factors of stroke. Access to proper education is affected because of the lower socioeconomic status prevalent among the minorities. This could explain the inadequate knowledge about stroke treatment and organ affected in stroke among the other religious groups.

A majority of the respondents (71%) preferred to take a person to the hospital when they or someone close to them had experienced symptoms of stroke. Comparable responses were seen in other studies,15,16 except in Korean subjects11 where only 46% of them mentioned that they would visit a hospital. This figure may be an overestimation, because we did not study the response to individual stroke symptoms. Only 8.7% of subjects would visit a neurologist and ~14.8% would contact an MBBS or an MD doctor in our study. Physicians and family doctors need to be educated about referring patients to stroke centers within the window period of intervention. This is true for developing countries, where the number of neurologists available to any population is proportionately much less than that in developed countries.

The majority did not know about the appropriate treatment for stroke (56.1%). Approximately 10.7% of them believed in indigenous treatment modalities, including, oil massage, faith healing, and magic. This could be an underestimation, because the majority of study subjects were from urban areas (74%). The sample size of the rural respondents was too small for any meaningful comparisons. Ayurvedic, homeopathic, and other native systems of medicine are deeply rooted in Indian culture, more so among the village dwellers.

**Summary**

In conclusion, this hospital-based survey among the general public reveals an awareness of stroke warning signs and risk factors comparable with studies from developed countries. However, knowledge regarding the organ involved, etiology, and treatment of stroke is lacking. India is a vast country with diverse sociocultural and linguistic practices. The findings from this study are limited in generalizability to the entire Indian population. Future studies are needed which focus on community surveys including both rural and urban populations. Efforts should be made to educate the public about modern concepts of stroke treatment, so that people make more rational and beneficial health care decisions.
TABLE 4. Comparison With Other Studies

<table>
<thead>
<tr>
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<td>None</td>
<td>27</td>
<td>35.9</td>
<td>3.2</td>
<td>31</td>
<td>...</td>
<td>23</td>
</tr>
<tr>
<td>Dizziness</td>
<td>24</td>
<td>20.7</td>
<td>...</td>
<td>...</td>
<td>47.6</td>
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<tr>
<td>Headache</td>
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<td>22.3</td>
<td>0.2</td>
<td>14.7</td>
<td>25</td>
<td>8.2</td>
</tr>
<tr>
<td>Weakness (any)</td>
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<td>3.9</td>
<td>...</td>
<td>45.7</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Weakness (1 side)</td>
<td>6</td>
<td>3.6</td>
<td>59.4</td>
<td>9.2</td>
<td>92</td>
<td>62.2</td>
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<td>S. speech</td>
<td>8</td>
<td>14.2</td>
<td>2.4</td>
<td>29.9</td>
<td>89.9</td>
<td>5</td>
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<tr>
<td>Vision</td>
<td>7</td>
<td>24.1</td>
<td>0.7</td>
<td>14.1</td>
<td>41.6</td>
<td>1.8</td>
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<td>9.9</td>
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<td>9.2</td>
<td>23.7</td>
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<td>None</td>
<td>14</td>
<td>12.3</td>
<td>30.4</td>
<td>20</td>
<td>...</td>
<td>21</td>
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<tr>
<td>HT</td>
<td>49</td>
<td>31.8</td>
<td>28.7</td>
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<td>94.4</td>
<td>45.1</td>
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<td>Stress</td>
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<td>40.9</td>
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<td>32.2</td>
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<tr>
<td>Smoking</td>
<td>19</td>
<td>39.4</td>
<td>2</td>
<td>29.2</td>
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<td>1.2</td>
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<td>HC</td>
<td>16</td>
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<td>18.4</td>
<td>76.3</td>
<td>6.7</td>
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<tr>
<td>Obesity</td>
<td>16</td>
<td>26.8</td>
<td>...</td>
<td>18.1</td>
<td>66.2</td>
<td>3.2</td>
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<tr>
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<td>5</td>
<td>...</td>
<td>0.1</td>
<td>5.3</td>
<td>51.4</td>
<td>2.0</td>
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<td>4</td>
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<td>1.1</td>
<td>6</td>
<td>60.7</td>
<td>5.1</td>
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<tr>
<td>Diabetes</td>
<td>3</td>
<td>...</td>
<td>0.2</td>
<td>2.4</td>
<td>0.5</td>
<td>10.7</td>
</tr>
</tbody>
</table>

S. speech indicates slurred speech; Vision, loss of vision; HT, hypertension; HC, high cholesterol; HD, heart disease.

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Public Awareness of Warning Symptoms, Risk Factors, and Treatment of Stroke in Northwest India

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In the March issue of Stroke, the article entitled, “Public Awareness of Warning Symptoms, Risk Factors, and Treatment of Stroke in Northwest India” by Pandian et al.¹ contained the following errors: Douglas J. Lincoln (D.J.L.) should have been affiliated with the Royal Brisbane and Women’s Hospital Research Foundation, Brisbane, Queensland, Australia; and in Table 2, the footnote symbol next to 18.8 in the Symptoms, Not Aware column, Upper Income row should have been ‡ associating it with $P<0.05$, and the footnote symbol next to Income should have been †. The publisher apologizes for these errors.


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