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Relationship between education status and cerebrovascular disease awareness in patients with ischemic stroke

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ABSTRACT

Objectives: This study aimed to present cross-sectional data on the awareness of stroke and educational status of patients with ischemic stroke from two hospitals.

Patients and methods: This cross-sectional study was conducted through face-to-face surveys with 208 patients (124 males, 84 females; mean age: 64.2±14.4 years; range, 28 to 108 years) with ischemic stroke at two centers between January 2024 and July 2024. The survey consisted of 15 questions that assessed demographic information, along with the patients' awareness of their first stroke, family history, known risk factors, and symptoms of stroke, as well as their understanding of whether they were experiencing a stroke and their behaviors during that time.

Results: Of the participants, 44% had primary school education, 83% reported this as their first stroke, and 61% had a family member who had experienced a stroke. Nearly half (49%) of the patients, including one-fourth of those who graduated from a university, were unaware of their stroke, only 42 patients knew that stroke is a preventable disease. One hundred and twenty patients arrived at the hospital on their own, while 20% used an ambulance. While half of university graduates arrived at the hospital by ambulance, this rate dropped to 9% for primary school graduates. The most frequently recognized risk factor for stroke was hypertension, and 86% of patients acknowledged insufficient knowledge about stroke.

Conclusion: Data from patients indicated that even those with higher educational levels lacked sufficient knowledge about stroke, highlighting the need for more patient and family education programs, as well as a greater availability of informational materials to increase awareness of stroke prevention and treatment.

Keywords: Awareness, cerebrovascular disease, education, ischemic stroke, stroke risk.

Stroke, or acute cerebrovascular disease (CVD), is an acute impairment of cerebral perfusion or vascular structure. Approximately 85% of strokes are ischemic, while the remaining are hemorrhagic.[1] Stroke, the second leading cause of death globally, is estimated to cost the USA $2.2 trillion USD from 2005 to 2050.[2] As a significant socioeconomic burden and cause of disability, one of the primary issues in stroke prevention is the lack of awareness regarding risk factors.[3] In a study with nearly 12,000 participants, 11% of the participants were unable to recognize any stroke symptoms, and one in five individuals reported that if they thought someone was having a stroke, they could only call an ambulance and would not know what else to do.[4] Another awareness study found that participants lacked basic knowledge about stroke, with approximately half having only a moderate level of understanding. Only 30% of patients could list three or more risk factors for stroke.[5]

Intravenous tissue plasminogen activator (tPA) is the only approved treatment for acute ischemic

stroke and can be administered to appropriate patients within the first 4.5 h of symptom onset.[6] Due to the lack of public recognition of stroke symptoms and failure of patients to quickly seek care at a nearby institution or activate emergency medical services, only approximately 5% of patients with stroke are treated, and most are treated beyond 2 h from symptom onset when tPA is less effective.[7] Studies have shown that even in patients treated with tPA, up to two-thirds of patients with large artery atherosclerosis fail to achieve recanalization. Apart from tPA treatment, particularly for those who come to hospitals after the time window for tPA, the clot is mechanically removed with a procedure called endovascular thrombectomy.[8] In selected patients with stroke, endovascular thrombectomy significantly reduced disability between 6 and 24 h from symptom onset.[9] Since these treatments are performed within a specific time window and in hospitals with stroke centers, it is crucial to increase stroke awareness so that patients can access treatment.

When examining the level of awareness of young adults regarding cardiovascular diseases and CVDs, it was found that hypertension education, knowing someone who had experienced a stroke, and adopting protective attitudes toward cardiovascular diseases influenced awareness of the warning symptoms of myocardial infarction. Moreover, maintaining healthy habits was also found to affect awareness of stroke warning symptoms.[10] Another study correlating stroke awareness with education level revealed that the knowledge of patients with stroke was not significantly different from that of patients who had not experienced a stroke.[11]

In this two-center study, the knowledge and awareness of patients with ischemic stroke regarding stroke were presented, and the responses received were evaluated according to their educational status.

PATIENTS AND METHODS

This cross-sectional study was conducted with 208 patients (124 males, 84 females; mean age: 64.2±14.4 years; range, 28 to 108 years) with ischemic stroke at the Ümraniye Training and Research Hospital and Haydarpaşa Training and Research Hospital between January 2024 and July 2024. Patients who were diagnosed with hemorrhagic CVD at the time of admission, had altered consciousness, presented with seizures, were sensory or motor aphasic and unable to respond to the questionnaire, or had experienced the ischemic event more than one week prior were excluded from the study due to concerns that they might have forgotten relevant information. Written informed consent was obtained from all participants. The study protocol was approved by the Ümraniye Training and Research Hospital Ethics Committee (Date: 7.12.2023; No: 482). The study was conducted in accordance with the principles of the Declaration of Helsinki.

This study was planned as a face-to-face survey. A 15-item questionnaire was administered to the patients during the first week of their hospitalization. The questionnaire included demographic information such as age, sex, and educational background, as well as details on whether the patients had previously experienced a stroke, their family history, their general knowledge about stroke, risk factors, interventions performed during stroke, and their sources of information.

Statistical analysis

G*power version 3.1.9.4 software (Heinrich-Heine Universität Düsseldorf, Düsseldorf, Germany) was used to calculate the sample size, and the effect size was determined to be 0.6 based on an allocation ratio of 1, which was calculated from previous studies. With power set to 0.80, we planned to include a minimum of 196 patients in the study.[12]

In this study, demographic information, as well as responses to both open-ended and closed-ended questions, were statistically analyzed. The data was processed and analyzed using Microsoft Excel (Microsoft Corp., Redmond, WA, USA). Responses to closed-ended questions were calculated as percentages and presented accordingly. Statistical analyses were performed using IBM SPSS version 21.0 software (IBM Corp., Armonk, NY, USA). The chi-square test was used to compare categorical variables between groups created for each survey question and the method of arrival to the hospital. Multivariate logistic regression analysis was performed. A p-value <0.05 was considered statistically significant.

RESULTS

Among the patients, 92 (44%) were elementary school graduates, and 32 (15%) patients had a bachelor's degree or higher educational

	n	%	Mean age	Illiterate		Primary school		Middle school		High school		Bachelor's degree and above	
				n	%	n	%	n	%	n	%	n	%
Sex													
Female	84	40.39	63.9	12	5.76	38	18.26	8	3.84	16	7.69	10	4.80
Male	124	59.61	64.5	4	1.92	54	25.96	16	7.69	28	13.46	22	10.57
Total	208	100	64.2	16	7.69	92	44.23	24	11.53	44	21.15	32	10.57

TABLE 1
Demographic information of the patients — Education level

level (Table 1). It was observed that females were statistically significantly more illiterate than males (p=0.039), and no difference was found between other educational levels.

One hundred seventy-four (83%) patients reported that they had experienced a stroke for the first time. Among the patients, 127 (61%) did not have a family history of stroke. For patients who had multiple strokes, 12 (35%) patients had a family history of stroke, while this rate was 39% (n=69) among those who had experienced a stroke for the first time. In addition, patients in the multiple strokes group were significantly more likely to understand that they had a stroke compared to those who had a stroke for the first time (p=0.0001).

Nearly half of the patients (n=103, 49%) did not realize they were having a stroke during the event, and 68% (n=71) of these patients were primary school graduates or illiterate. Patients were more likely to recognize that they were having a stroke as their level of education increased. The inability of illiterate individuals to recognize a stroke was statistically significantly more frequent compared to other education groups (p=0.0001). Only 20% (n=42) of the patients knew that stroke was a preventable disease. As education level increased, the rate of patients who knew stroke is a preventable disease increased. A significant difference was found in the illiterate group compared to all other groups (p=0.009). Group analyses based on education level also revealed a significant difference between university graduates and primary and secondary school graduates (primary school *vs.* university, p=0.016; secondary school *vs.* university, p=0.046).

Half of the patients stated that stroke is a treatable disease. Fifty-two percent (n=55) of those who said it was treatable had a high school degree or higher education level. The rate of patients who knew stroke is a treatable disease increased with increasing education level. A significant difference was found in the illiterate group compared to all other groups (p=0.0001). Among the other groups, there was also a significant difference between university and high school graduates and primary school graduates (primary school *vs.* university, p=0.034; primary school vs. high school, p=0.001).

Fifty-seven percent (n=120) of the patients presented to the hospital on their own, while only 42 patients arrived via emergency services. While half of university graduates arrived at the hospital by ambulance, this rate dropped to 9% for primary school graduates. It was found that high school and university graduates preferred an ambulance to reach the hospital. The most significant difference in ambulance use was observed between university graduates and primary and secondary school and illiterate groups (p=0.0001). Furthermore, a significant difference was found between high school graduates and primary and secondary school graduates in terms of ambulance use, favoring the high school graduates (high school *vs.* middle school, p=0.041; high school *vs.* primary school, p=0.026). Thirty-seven patients were brought to the hospital by their relatives, and 31 (83%) were primary school graduates or illiterate. Twenty-six patients reported that they took a shower, and 31 patients mentioned that they rested for symptom relief. It was noted that in both groups, the majority of patients were illiterate or primary school graduates. Twenty-two patients stated that they had taken their antiplatelet or antihypertensive medication. Patients' information about stroke and the behaviors exhibited during the stroke event,

TABLE 2
Stroke awareness and behaviors according to education level of patients

	Illiterate		Primary school		Middle school		High school		Bachelor's degree and above		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
I realized that I had a stroke												
Yes	1	0.48	36	17.30	16	7.69	28	13.46	24	11.53	105	50.48
No	15	7.21	56	26.92	8	3.84	16	7.69	8	3.84	103	49.52
Stroke is a preventable disease												
Yes	0	0	16	7.69	4	1.92	9	4.32	13	6.25	42	20.19
No	16	7.69	76	36.53	20	9.61	35	16.82	19	9.13	166	79.80
Stroke is a treatable disease												
Yes	0	0	37	17.79	13	6.25	33	15.86	22	10.58	105	50.48
No	16	7.69	55	26.44	11	5.29	11	5.29	10	4.80	103	49.52
At the time of my stroke												
I rested	10	4.80	16	7.69	3	1.44	1	0.48	1	0.48	31	
I took a shower	2	0.96	14	6.73	5	2.44	3	1.44	2	0.96	26	
I used my medicine	0	0	6	2.88	6	2.88	6	2.88	4	1.92	22	
I called 112	2	0.96	9	4.32	2	0.96	13	6.25	16	7.69	42	
I went to the hospital on my own	2	0.96	57	27.40	18	8.65	29	13.94	14	6.73	120	
I was not aware; my relatives took me to the hospital	8	3.84	23	11.05	2	0.96	2	0.96	2	0.96	37	

			CI	
	p	OR	Lower bound	Upper bound
Education level	0,011	10,689	1,906	59,939
Recognizing a stroke	0,006	4,028	1,488	10,908
Knowing that stroke is a treatable disease	0,008	4,037	1,435	11,357

TABLE 3
Factors affecting hospital admissions of patients with stroke

CI: Confidence interval; OR: Odds ratio.

according to the patients' education levels, are summarized in Table 2.

The percentage of patients who correctly identified the appropriate time frame for stroke intervention was 30% (n=64); 31% (n=20) of graduates with a bachelor's degree and above stated the time frame correctly. Seventy-four patients, almost 80% (n=59) of whom were illiterate or primary school graduates, stated that they did not know, while 44 patients selected options indicating 12 h or more. The percentage of patients who indicated they had insufficient information about stroke was 86% (n=179). Among the 29 patients who felt they were adequately informed, 11 had a bachelor's degree or higher. Only seven patients, four with a bachelor's degree and three with a high school degree, who found their knowledge sufficient were able to answer questions about stroke correctly. Two patients with a bachelor's degree and one high school graduate stated that they still thought their knowledge was insufficient despite answering all questions correctly.

When asked about the sources of their stroke-related knowledge, 120 patients stated they had learned from relatives or neighbors, 83 from television programs, 51 from social media, and 80 from their physicians. Looking at the educational background of the patients who learned about stroke from their physicians, 41% (n=33) had primary school education, 6% (n=5) had middle school education, 32% (n=26) had high school education, and 20% (n=16) had a bachelor's degree or higher education. Regarding the distribution of patients who gained their knowledge from relatives or neighbors, 53% (n=64) had primary school education, 13% (n=16) had middle school education, 11% (n=14) had high school education, and 9% (n=11) had a bachelor's degree or higher education; 12% (n=15) of these patients were illiterate.

Patients who understood they had a stroke knew that stroke was preventable and treatable, and those who considered their knowledge about stroke sufficient were found to use ambulances at a statistically significantly higher rate than the other groups (p=0.001, p=0.001, p=0.001, and p=0.011, respectively). Furthermore, patients who believed stroke intervention should be performed within the first 6 h were significantly more likely to use ambulances than those who responded "I do not know," "12 h," or "24 h" (p=0.001).

Multivariate logistic regression analysis identified three statistically significant predictors among the independent variables influencing hospital presentation patterns in patients with stroke. Of these factors, education had the most significant impact. It was found that with education, the likelihood of patients reaching the hospital by ambulance increased by approximately tenfold. The other two factors were the recognition that a stroke was occurring and the knowledge that stroke is a treatable condition (Table 3).

The most commonly known risk factor for stroke was hypertension, with 168 out of 208 patients marking it as a response. The second most frequently cited risk factor was diabetes mellitus, with 114 patients identifying it as a concern; 84 patients selected coronary artery disease, 78 selected smoking, 66 selected hyperlipidemia, and 63 identified a previous stroke as a risk factor. Thirty-six patients marked all the listed risk factors; 61% (n=22) had high school degrees or above. Twenty patients stated that the listed factors did not constitute a risk; 85% (n=17) were primary school graduates or illiterate. Forty-six patients selected only a single risk factor.

Eighty-six percent (n=180) of patients recognized one-sided weakness as the most well-known symptom of stroke. The response of speech disturbance was selected by 72% (n=151) of the

patients, facial droop was identified by 64% (n=134), and unilateral numbness by 55% (n=115). Changes in consciousness were the least recognized symptom, identified by only 47% (n=99) of patients.

A total of 184 patients, including 22 out of 29 patients who found their knowledge level sufficient, expressed that their knowledge would improve with television programs, public service announcements, brochures, or patient education sessions related to stroke.

DISCUSSION

In the USA, it is estimated that approximately 795,000 individuals experience a first-time or recurrent stroke each year.[13] According to data collected between 2017 and 2020, the overall stroke prevalence was estimated to be 3%.[14] In Türkiye, for the year 2019, the stroke incidence was reported as 125,345 (0.0154%), stroke prevalence was 1,080,380 (1%), and the number of years of life lost due to stroke-related death/disability was 993,082 years. With the aging of the population in Türkiye, an increase in all types of strokes was reported.[15]

Between 2018 and 2023, the number of deaths attributed to stroke was recorded as 210,757, representing 6% of all deaths and accounting for 18% and 21% of cardiovascular disease-related deaths in males and females, respectively.[16] In light of these data, stroke is a significant public health issue that requires rapid diagnosis and initiation of treatment due to its mortality and the disability it causes.[3]

In a study conducted by Hu et al.[3] involving 5,147 patients with acute ischemic stroke, the awareness of risk factors was assessed, and similar to our study, general stroke risk factors were asked to the patients. As in our study, hypertension was the most commonly recognized risk factor. However, in their study, the awareness rate for hypertension was reported as 71%, while our study found a slightly higher rate of 80%. Additionally, in a regional awareness study conducted in the southeastern region of Türkiye, hypertension was the most recognized risk factor, with an awareness rate of 83%. In contrast to our study, Hu et al.'s study,[3] in which education level was not assessed, found much lower awareness percentages for other risk factors, with 50% of the patients reporting that they were unaware of their risk factors.[12] In our study, the rate of patients unaware of risk factors was found to be 9%.

In our study, although their ratios increased with the level of education, nearly half of the patients (49%) did not realize they were having a stroke, 86% indicated they had insufficient knowledge about stroke, and 69% did not correctly identify the treatable time window. These findings show that the most important awareness gap was the lack of adequate knowledge. The percentage of patients who reached the hospital by ambulance was only 20%. In a study based on six-month ambulance records, it was found that 44% of calls were for stroke, more than half of the calls were made within 1 h, and the problem was identified as stroke in only 43% of these calls. Speech issues, a family history of stroke, and having a relative present when the symptoms occurred were all associated with calls made within 1 h.[17] When considering these results together, it can be concluded that insufficient knowledge and awareness about stroke delayed hospital access and caused patients to miss the treatable time window.

In our study, about half of the participants (n=120) reported acquiring information about stroke from their social circles, such as family and neighbors. In the study by Çelik and Boyraz,[18] 35% of participants reported receiving information from family, friends, and neighbors, while in Evci et al.'s[19] study, 37% mentioned relatives as the source of information.

In a study investigating the reasons for prehospital delays in acute stroke cases, the most common reason for delay was found to be the delay in seeking medical help (73%).[20] In our study, the fact that nearly half of the patients did not realize they were having a stroke and the low rate of ambulance use further supported the delay in seeking help.

In our study, unilateral weakness was the most commonly recognized stroke symptom (86%). However, in a study where high school teachers' knowledge about stroke was assessed, numbness in the arms and legs was mentioned as the most common symptom, but only 22% of participants gave this response.[19] In another study consisting of patients with stroke, the most frequently mentioned symptom was weakness (60%), followed by speech difficulties (50%) and facial drooping (32%).[21] Although the rates in this study were found to be lower than those in our study, the order of the first three findings was the same.

In a pre- and posttest study on stroke awareness education, it was found that patients' knowledge

about the appropriate healthcare institution for initial stroke management, the possibility of returning to normal life after a stroke, and the frequency of anticoagulant use was significantly higher in the posttest group compared to the pretest group.[22] This study supported the effectiveness of public stroke awareness seminars. Considering that patients usually obtain information from their families and friends, as more than 50% of the patients in our study did, it is believed that each individual who gains awareness through such educational seminars will also indirectly contribute to the spread of awareness within their own communities.

In Türkiye, various events and informational activities are organized by the Turkish Neurological Society and the Turkish Brain Vascular Diseases Society to raise awareness on stroke, including World Stroke Day on October 29, Stroke Awareness Day on May 10, Brain Awareness Week during the third week of March, World Brain Day on July 22, and International Day of Persons with Disabilities on December 3. In Nepal, stroke awareness advertisements were disseminated via social media, reaching 2.5 million people at a very low cost. However, although this method was cost-effective, it was found to be time-consuming and insufficient to reach the elderly, who are at higher risk for stroke.[23] To raise awareness and disseminate information to the elderly population, billboards, brochures, television and radio spots, and even short informational segments on popular daytime television programs or series could be utilized. Important issues such as early treatment windows for stroke could be emphasized through these platforms.

This study had some limitations. The study was conducted with a small group. No information was given to the patients after their stroke to increase their awareness of the stroke; therefore, it is not known whether the information would have made a difference. Although approximately 20% of the patients were brought to the hospital by their relatives, only the patients' knowledge was investigated due to the difficulty of questioning their relatives.

In conclusion, when evaluating the data collected from patients, it was found that even patients with higher education levels did not possess sufficient knowledge about stroke, indicating the need for more patient and caregiver educational programs, as well

as a greater availability of brochures, public service announcements, and television programs addressing stroke awareness. Considering that the majority of the stroke population consists of elderly patients, it may be concluded that solely relying on social media is inadequate for reaching the target audience. Therefore, additional informational efforts, including billboards, brochures, television and radio spots, and short educational segments on popular media programs, could help highlight critical aspects such as the early treatment window for stroke.

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