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Knowledge and attitude towards stroke and prehospital delay among patients and their family members under high prehospital delay in Zhejiang, China: a cross-sectional study

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ABSTRACT

Objectives To investigate the knowledge of stroke and the attitudes towards stroke and prehospital delay among patients who had an acute ischaemic stroke (AIS) and their family members.

Design This cross-sectional study was conducted through a self-designed questionnaire.

Setting The study took place in a Grade-A tertiary hospital in Zhejiang Province, China, between July 2023 and November 2023.

Participants A total of 521 valid questionnaires were collected from 367 patients who had an AIS and 154 family members.

Interventions Participants provided demographic information and answered questions related to stroke knowledge, attitudes towards stroke and prehospital delay.

Primary and secondary outcome measures The primary outcome measures included scores on stroke knowledge, attitudes towards stroke and attitudes towards prehospital delay. Secondary outcomes focused on identifying correlations and independent factors influencing prehospital delay.

Results The average scores for patients were stroke knowledge 8.74±6.16 (range: 0–24), stroke attitude 23.52±2.73 (range: 7–35) and prehospital delay attitude 38.65±7.68 (range: 10–50). Family members scored 12.66±6.85, 23.60±2.57 and 40.02±7.45, respectively. Significant correlations were found between stroke knowledge and attitude (r=0.2262, p<0.001) and between stroke attitude and prehospital delay attitude (r=0.1305, p=0.0028). Multivariate analysis indicated that patients' prehospital delay attitude (OR=0.91) and choice of the first medical facility (OR=0.30) were associated with prehospital delay, while in family members, prehospital delay attitude (OR=0.91) and wake-up stroke (OR=2.91) were significant.

Conclusions Both patients who had an AIS and their family members demonstrated insufficient knowledge and moderate attitudes towards stroke and prehospital delay, which were associated with extended prehospital delay. Educational interventions are necessary to enhance stroke knowledge. Targeted stroke awareness programmes and rapid response training could help improve early recognition and timely medical intervention, reducing prehospital delay and improving patient outcomes.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Large sample size: The study analysed 521 valid questionnaires, yielding robust data from both patients who had an acute ischaemic stroke and their family members, thereby strengthening the reliability of the findings.
⇒ Comprehensive analysis: The investigation employed multivariate analysis and structural equation modelling, revealing significant relationships among stroke knowledge, attitudes and prehospital delay in patients and their family members.
⇒ Single-centre design: The study's single-centre approach and relatively small sample size limit the generalisability of the findings to broader populations or different healthcare settings.
⇒ Cross-sectional nature: The cross-sectional design limits the ability to establish causal relationships between stroke knowledge, attitudes and prehospital delay among participants.

BACKGROUND

Stroke continues to be a leading cause of long-term disability and mortality worldwide,[1] especially causing a high burden in China.[2 3] Despite established guidelines recommending timely intravenous thrombolysis or thrombectomy,[4] many patients miss these treatments due to prehospital delays. While previous studies have explored stroke knowledge and response behaviours,[5 6] limited research has examined the role of patients and their family members in symptom recognition and timely decision-making. This gap is crucial, as family members often play a key role in emergency response. This study aims to assess the knowledge and attitudes of patients who had an acute ischaemic stroke (AIS) and their family members, focusing on their influence on prehospital delay.

In China, only about 1–10% of patients who had an AIS receive intravenous thrombolysis

(IVT), a rate significantly lower than that in high-income countries, largely due to prehospital delays.[7] Prehospital delay is a global concern, with a systematic review indicating that the median time for patients who had a stroke to seek medical care ranges from 38 min to 4 hours.[8] Developing countries show longer decision-making times compared with developed nations. For example, in Sweden, the average time to seek medical help for stroke symptoms is 66 min, compared with 120 min in Thailand and up to 125 min in China.[9–11] Similar trends have been observed in African regions. A study in Somalia found that only 15% of patients who had a stroke arrived at the hospital within 4 hours, with key barriers including the lack of symptom recognition, transportation issues and living alone.[12]

Studies suggested that 24–54% of patients fail to seek medical help within the first hour of symptom onset due to inadequate stroke knowledge.[13 14] Beyond patients themselves, the ability of companions to recognise symptoms and take prompt action also plays a crucial role in ensuring timely hospital arrival within the thrombolysis window.[15] Studies have also shown that patients living with family members arrive at the hospital sooner than those living alone.[16 17] KAP (Knowledge, Attitudes, and Practices) surveys are tools that explore quantitative and qualitative data about the gaps and misunderstandings regarding a specific subject in a specific population.[18 19] Investigating stroke and prehospital delay from the perspective of patients and their families under the KAP framework can provide comprehensive insights. Therefore, this study aimed to explore patients who had an AIS and their family's knowledge and attitudes regarding stroke and prehospital delay.

METHODS

Patient and public involvement

Patients or the public were not involved in the design, conduct, reporting or dissemination of our research.

Study design and participants

This cross-sectional study was conducted from July 2023 to November 2023 at Zhejiang Taizhou Hospital, a Grade-A tertiary hospital in Zhejiang Province, China. The study included both patients who had an AIS and their family members, with ethical approval granted by the Medical Ethics Committee of Taizhou Enze Medical Center (approval number: K20230746). Informed consents were obtained from all participants. Participants were recruited consecutively from the neurology department of Zhejiang Taizhou Hospital.

Inclusion criteria for patients were as follows: (1) patients meeting the 2018 diagnostic criteria for AIS outlined by the American Heart Association/American Stroke Association[20]; (2) age ≥18 years; (3) patients who are conscious and capable of understanding and responding to the questionnaire and (4) voluntary participation in this study. Exclusion criteria were: (1) patients with liver failure, kidney failure or tumour; (2) patients with a history of AIS and (3) patients with language disorders after stroke. The included family members were those actively involved in the patient's care and medical decision-making during hospitalisation, ensuring that respondents had first-hand experience with the patient's condition and management. The inclusion criteria for family members were: (1) age ≥18 years; (2) family members who are conscious and able to independently complete the questionnaire and (3) voluntary participation in this study. No specific exclusion criteria for family members were applied in this study.

Sample size calculation

A sample size calculation was conducted using Cochran's formula[21]:

$$n = \left(\frac{z_{(1-\alpha/2)}}{\delta}\right)^2 \times p\,(1-p),$$

where $Z_{(1-\alpha/2)} = 1.96$ when $\alpha = 0.05$, the assumed degree of variability of $p = 0.5$ maximises the required sample size and δ represents the permissible margin of error (set at 5% in this study). The theoretical sample size was calculated to be 480, with an additional 20% included to account for potential subject dropout.

Questionnaire introduction

The questionnaire was developed based on previous literature.[20 22–24] The questionnaire was submitted to a panel of three experts (two experts were directors of the neurology department, while the other one was from the Evidence-Based Medicine Center) for further modification. To enhance clarity and respondent comprehension, experts reviewed and refined the questionnaire, modifying technical terminology and removing ambiguous wording. A preliminary survey was then performed, and 36 questionnaires were distributed. The presurvey yielded an overall Cronbach's α coefficient of 0.886, indicating good internal consistency.

The final questionnaire, in Chinese, encompassed four dimensions: demographic information, knowledge dimension, attitude dimension towards stroke and attitude dimension towards prehospital delay for stroke (online supplemental additional file 1). (1) Demographic information included data regarding age, sex, education level, monthly income, marriage status and self-rating of panic score of patients or family members (scored on a scale of 0–10, where 0 indicates no panic at all and 10 indicates extreme panic); it also included National Institutes of Health Stroke Scale (NIHSS) score, wake-up stroke and the presence of prehospital delay in patients. Prehospital delay was defined as a duration exceeding 3 hours from symptom onset to hospital admission.[4] Wake-up stroke was the condition in patients who were asymptomatic when asleep, with symptoms noticed on waking. (2) The knowledge dimension comprises 6 questions and 24 items. Participants receive 1 point for clear or correct responses and 0 points for unclear or incorrect answers, with a score range of 0–24 points. The stroke knowledge

Table 1 Characteristics of patients and KAP scores

		Knowledge score		Attitude score for stroke		Attitude score for prehospital delay	
	N (%)	Mean±SD	p value	Mean±SD	p value	Mean±SD	p value
Total score		8.74±6.16		23.52±2.73		38.65±7.68	
Gender			0.185		0.030		0.068
Male	218 (59.4)	7.41±5.20		23.67±2.78		38.75±7.40	
Female	149 (40.6)	6.64±4.70		23.18±2.77		37.08±8.05	
Age (years)	65.76±11.32						
Age groups			<0.001		0.542		0.021
<50	28 (7.63)	6.78±3.78		23.46±2.31		41.10±7.27	
50–59	77 (20.98)	8.74±5.44		23.63±2.60		39.89±6.10	
60–69	112 (30.52)	7.59±4.77		23.51±2.95		37.71±7.59	
70–79	118 (32.15)	6.15±4.95		23.54±2.93		36.87±8.18	
≥80	32 (8.72)	5.21±4.79		22.75±2.48		36.75±8.98	
Education			<0.001		0.314		0.001
Primary school and below	329 (89.65)	6.70±4.68		23.44±2.79		37.63±7.76	
Junior high school and above	38 (10.35)	10.52±6.39		23.78±2.74		41.86±6.09	
Marital status			<0.001		<0.001		0.169
Married	322 (87.74)	7.48±5.11		23.68±2.81		38.26±7.65	
Other (single/divorced/widowed)	45 (12.26)	4.4±3.19		22.02±2.13		36.75±8.04	
Average monthly household income			<0.001		<0.001		0.027
<2000	95 (25.89)	4.82±3.52		22.91±2.74		37.13±7.81	
2000–5000	180 (49.05)	7.74±4.95		23.40±2.60		37.75±7.92	
5000–10 000	76 (20.71)	8.57±6.02		23.56±2.40		39.03±7.23	
>10 000	15 (4.09)	6.43±3.61		27.25±3.90		42.75±4.72	
Does the patient have a cohabitant?			0.046		0.009		0.089
Yes	331 (90.19)	7.24±5.07		23.58±2.81		38.27±7.77	
No	36 (9.81)	5.77±4.24		22.47±2.32		36.27±6.89	
Medical insurance			0.443		0.598		0.050
With	358 (97.55)	7.09±5.04		23.49±2.82		38.20±7.65	
Without	9 (2.45)	7.44±3.90		22.77±0.66		32.88±8.43	
Family history of stroke in addition to the patient			0.005		0.035		0.425
Yes	135 (36.78)	7.73±4.97		23.07±2.49		37.71±7.79	
No	232 (63.22)	6.73±5.01		23.71±2.92		38.28±7.66	
Wake-up stroke			0.385		0.170		0.803
Yes	92 (25.07)	6.88±5.30		22.93±2.31		38.32±7.61	
No	275 (74.93)	7.17±4.92		23.66±2.91		37.99±7.75	
Was the first medical facility you sought care from a comprehensive stroke centre?			0.288		<0.001		<0.001
Yes	258 (70.3)	7.44±5.37		23.84±2.96		39.13±7.61	
No	109 (29.7)	6.29±3.95		22.60±2.08		35.55±7.38	
Panic rating	5.92±3.16						
NIHSS rating			0.004		0.154		0.041
Normal	162 (44.14)	7.64±4.89		23.67±2.98		37.22±7.32	
Mild stroke	125 (34.06)	7.11±5.04		23.63±2.78		38.39±7.58	

Continued

Table 1 Continued

	N (%)	Knowledge score		Attitude score for stroke		Attitude score for prehospital delay	
		Mean±SD	p value	Mean±SD	p value	Mean±SD	p value
Moderate stroke	77 (20.98)	6.14±5.13		22.87±2.30		39±8.49	
Moderate to severe/ severe stroke	3 (0.82)	2.33±2.30		22.33±2.08		47.33±4.61	
Surgery during hospitalisation			<0.001		0.352		<0.001
Thrombolysis	27 (7.36)	8.51±5.34		23.37±2.45		40.55±8.78	
Thrombectomy	17 (4.63)	3±2.47		22.52±1.73		44.52±6.30	
None	323 (88.01)	7.20±4.99		23.53±2.85		37.52±7.50	
Prehospital delay			0.778		0.233		<0.001
Yes	304 (82.83)	6.95±4.76		23.44±2.86		37.16±7.21	
No	63 (17.17)	7.80±6.10		23.66±2.42		42.49±8.52	

NIHSS, National Institutes of Health Stroke Scale.

dimension encompassed a basic understanding of stroke, including its inducing factors (items 1–2), early identification (items 3–5) and symptoms of stroke (items 6–24). (3) The stroke attitude dimension consisted of seven questions, including three negative and four positive statements. A 5-point Likert scale ranging from very positive (5 points) to very negative (1 point) was used, and the score ranged from 7 to 35 points. (4) The prehospital delay attitude dimension included 10 items using a 5-point Likert scale, ranging from very positive (5 points) to very negative (1 point). The total score for this dimension ranged from 10 to 50 points. Achieving scores above 70% in each section denotes adequate knowledge and a positive attitude.[25]

Questionnaire distribution and quality control

A convenience sampling method was used in this study. Five research assistants were invited to this study; each assistant participated in standardised training regarding the questionnaire content and interviewing techniques, including one online and one on-site training. Eligible participants were consecutively recruited from the Neurology Department. Trained research assistants identified patients who had an AIS through medical records and contacted them in the inpatient wards. Family members who accompanied the patients during hospitalisation were also invited to participate. Before obtaining written informed consent, all eligible participants received a detailed explanation of the study's purpose, procedures and voluntary nature. Assistants will first review patients' medical records and collect basic information such as age, gender and NIHSS score. A face-to-face interview was then conducted for each patient, and the questionnaire was filled out concurrently with the questioning process. If participants encountered any problem in answering, research assistants were responsible for interpreting and solving the problem. The documentation is managed by the assistants. Data entry and export were conducted using the Sojump website (https://www.wjx.cn/). To minimise potential recall bias, data collection was carried out within the first 3 days of the patient's admission once their vital signs were stable.

Statistical analysis

The statistical analysis in this study used STATA V.14.0 (Stata Corporation, College Station, TX, USA). The normal distribution of continuous data was checked using the Kolmogorov-Smirnov test. The continuous variables conforming to the normal distribution were described as means±SD and analysed using Student's t-test (two groups) or ANOVA (more than two groups). Those with a skewed distribution were presented as medians (ranges) and analysed using the Wilcoxon-Mann-Whitney U test (two groups) or the Kruskal-Wallis analysis of variance (more than two groups). Categorical variables were described with frequencies and percentages. Spearman correlation analysis was employed to investigate the associations among stroke knowledge, stroke attitude and prehospital delay attitude to prehospital delay in patients and family members. Univariate and multivariate logistic regression analyses were carried out to identify factors that are influenced by prehospital delay in patients. For the multivariate logistic regression model, variables with statistical significance ($p<0.05$) in univariate logistic regression were included. Additionally, a structural equation model (SEM) was employed to analyse the interrelationships among stroke knowledge, stroke attitude, prehospital delay attitude and prehospital delay in patients. Model fit was evaluated using root mean square error of approximation, incremental fit index, Tucker-Lewis index and comparative fit index. Statistical significance was determined with a two-sided p value of <0.05.

Table 2 Characteristics of family members and KAP scores

	N (%)	Knowledge score		Attitude score for stroke		Attitude score for prehospital delay	
		Mean±SD	p value	Mean±SD	p value	Mean±SD	p value
Total score		12.66±6.85		23.60±2.57		40.02±7.45	
Gender			0.524		0.495		0.030
Male	58 (37.66)	13.10±7.11		23.81±2.95		41.86±6.25	
Female	96 (62.34)	12.38±6.70		23.47±2.32		38.90±7.91	
Age (years)	53.32±13.63						
Age groups			0.015		0.024		0.462
<50	60 (38.96)	13.6±6.70		24.06±2.33		40.98±7.82	
50–59	42 (27.27)	14.16±6.14		23.59±2.52		39.19±8.07	
60–69	28 (18.18)	11.75±6.67		22.96±2.91		40.42±6.31	
70–79	23 (14.94)	8.913±7.39		23.30±2.75		38.69±6.71	
≥80	1 (0.65)	4		21		36	
Education			<0.001		0.101		0.061
Primary school and below	113 (73.38)	11.32±6.89		23.47±2.63		39.36±7.65	
Junior high school and above	41 (26.62)	16.31±5.26		23.95±2.37		41.82±6.62	
Marital status			0.744		0.571		0.117
Married	143 (92.86)	12.68±6.90		23.65±2.63		39.76±7.47	
Other (single/divorced/widowed)	11 (7.14)	12.27±6.40		23±1.61		43.36±6.51	
Average monthly household income			0.011		0.022		0.154
<2000	24 (15.58)	10.20±6.76		23.83±2.95		39.45±5.20	
2000–5000	74 (48.05)	11.79±6.95		23.08±2.28		40.48±8.36	
5000–10 000	38 (24.68)	15.42±5.50		23.86±2.50		38.31±7.38	
>10 000–20 000	18 (11.69)	13.61±7.52		24.88±2.92		42.44±5.50	
Does the patient have a cohabitant?			<0.001		0.870		0.556
Yes	132 (85.71)	11.88±6.73		23.63±2.72		40.09±7.64	
No	22 (14.29)	17.27±5.71		23.40±1.36		39.59±6.33	
Medical insurance			0.232		0.783		0.467
With	147 (95.45)	12.80±6.88		23.58±2.56		40.14±7.32	
Without	7 (4.55)	9.571±5.53		24±3		37.28±10.0	
Family history of stroke in addition to the patient			0.712		0.885		0.093
Yes	48 (31.17)	12.79±7.14		23.52±2.44		41.62±6.60	
No	106 (68.83)	12.59±6.74		23.64±2.64		39.29±7.72	
Wake-up stroke			0.400		0.113		0.484
Yes	34 (22.08)	11.94±6.29		23.02±1.99		40.91±7.17	
No	120 (77.92)	12.85±7.00		23.76±2.69		39.76±7.54	
Was the first medical facility you sought care from a comprehensive stroke centre?			0.290		0.115		0.273
Yes	106 (68.83)	13.09±6.58		23.73±2.43		40.47±7.34	
No	48 (31.17)	11.68±7.37		23.31±2.85		39.02±7.67	
Panic rating	6.62±3.51						
NIHSS rating			0.004		0.020		0.935

Continued

Table 2 Continued

	N (%)	Knowledge score		Attitude score for stroke		Attitude score for prehospital delay	
		Mean±SD	p value	Mean±SD	p value	Mean±SD	p value
Normal	45 (29.22)	15±6.36		24.28±2.88		40.57±7.15	
Mild stroke	47 (30.52)	13.59±7.20		23.78±2.58		39.57±7.77	
Moderate stroke	57 (37.01)	10.21±6.20		23.03±2.24		39.91±7.34	
Severe stroke	5 (3.25)	10.6±7.02		22.2±1.30		40.4±10.2	
Prehospital delay			0.691		0.587		0.001
Yes	117 (75.97)	12.76±6.86		23.72±2.83		38.99±7.14	
No	37 (24.03)	12.29±6.85		23.21±1.45		43.27±7.56	

NIHSS, National Institutes of Health Stroke Scale.

RESULTS

Prehospital delay accident and its characteristics

A total of 750 individuals (548 patients who had an AIS and 202 family members) meeting the inclusion criteria were invited to participate. Of these, 689 individuals (501 patients and 188 family members) provided informed consent, yielding an initial response rate of 91.9%. A total of 168 cases were excluded due to incorrect filling, missing filling or choosing the same answer for all KA (Knowledge and Attitudes) items. Ultimately, data from 521 cases (367 patients and 154 family members) were included in the final analysis, resulting in a final valid response rate of 69.5%. Among the patients, there were 218 (59.4%) males, and the mean age was 65.76±11.32 years. Also, 162 had normal NIHSS ratings (44.14%). Impressively, 304 (82.83%) patients reported prehospital delay (table 1). Among the family members, 96 (62.34%) were female, with a mean age of 53.32±13.63 years. Only 45 (29.22%) reported that the patient's NIHSS rating indicated a mild stroke. Furthermore, 117 (75.97%) reported that patients had delayed seeking medical care (table 2), which was higher compared with developed countries.

Correlation analysis

The correlation analysis revealed that knowledge was correlated with attitude 1 (r=0.2262, p<0.001), and attitude 1 was correlated with attitude 2 (r=0.1305, p=0.0028) in patients who had an AIS. However, the correlation between knowledge and attitude 2 was not significant (r=0.0499, p=0.2552) (online supplemental table S1).

The SEM showed that stroke knowledge directly influenced stroke attitude (β=0.100, p<0.001) and prehospital delay attitude (β=0.110, p=0.048). The prehospital delay was directly influenced by prehospital delay attitude (β=−0.01, p<0.001) (figure 1, online supplemental table S2). The SRMR (Standardized Root Mean Square Residual) and CFI (Comparative Fit Index) fit indices presented in online supplemental table S2 collectively showed that the questionnaire fits the KAP model well (online supplemental table S3).

Risk factors influence stroke knowledge, attitude towards stroke and prehospital delay

Patients had mean scores of 8.74±6.16 for stroke knowledge (range: 0–24), 23.52±2.73 for stroke attitude

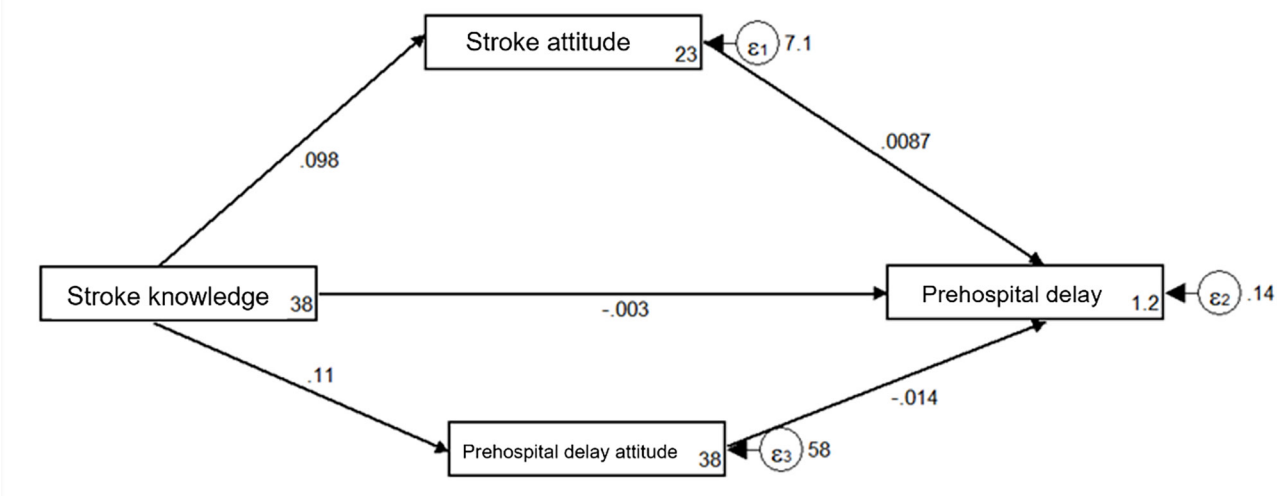

Figure 1 Structured equation model.

Table 3 Risk factors for prehospital delay among patients

	Univariate analysis		Multivariate analysis	
	OR (95% CI)	p value	OR (95% CI)	p value
Knowledge score	0.96 (0.91 to 1.01)	0.221		
Attitude 1	0.97 (0.88 to 1.06)	0.558		
Attitude 2	0.89 (0.85 to 0.93)	<0.001	0.91 (0.87 to 0.95)	<0.001
Gender				
Male	Ref.			
Female	1.33 (0.75 to 2.35)	0.314		
Age (years)	1.00 (0.98 to 1.03)	0.598		
Age groups				
<50	Ref.			
50–59	1.47 (0.49 to 4.40)	0.484		
60–69	1.33 (0.47 to 3.73)	0.582		
70–79	1.06 (0.38 to 2.92)	0.898		
≥80	4.09 (0.75 to 22.2)	0.103		
Education				
Primary school and below	Ref.			
Junior high school and above	0.75 (0.32 to 1.72)	0.503		
Marital status				
Married	Ref.			
Other (single /divorced / widowed)	1.39 (0.56 to 3.45)	0.468		
Average monthly household income				
<2000	Ref.			
2000–5000	1.09 (0.56 to 2.15)	0.782		
5000–10 000	0.82 (0.37 to 1.79)	0.626		
>10 000	0.60 (0.17 to 2.12)	0.436		
Does the patient have a cohabitant?				
Yes	0.41 (0.12 to 1.38)	0.151		
No	Ref.			
Medical insurance				
Has medical insurance	Ref.			
No insurance	1.67 (0.20 to 13.6)	0.629		
Family history of stroke in addition to the patient				
Yes	1.01 (0.57 to 1.78)	0.96		
No	Ref.			
Wake-up stroke				
Yes	Ref.			
No	1.24 (0.67 to 2.27)	0.481		
Was the first medical facility you sought care from a comprehensive stroke centre?				
Yes	0.24 (0.10 to 0.56)	0.001	0.30 (0.12 to 0.71)	0.006
No	Ref.		Ref.	
Panic rating	0.90 (0.83 to 0.99)	0.035	0.89 (0.81 to 0.98)	0.027
NIHSS rating				
Normal	Ref.		Ref.	
Mild stroke	0.55 (0.29 to 1.07)	0.081	0.53 (0.27 to 1.07)	0.08
Moderate stroke	0.43 (0.21 to 0.88)	0.022	0.50 (0.23 to 1.09)	0.084
Moderate to severe/ severe stroke	0.06 (0.00 to 0.76)	0.03	0.14 (0.01 to 1.75)	0.129

Attitude 1, attitude towards stroke; attitude 2, attitude towards prehospital delay.
NIHSS, National Institutes of Health Stroke Scale.

(range: 7–35) and 38.65±7.68 for prehospital delay attitude (range: 10–50). Family members scored 12.66±6.85, 23.60±2.57 and 40.02±7.45, respectively. Stroke knowledge scores varied among patients and family members based on age, education level, marital status, average monthly income, family history of stroke, NIHSS rating and history of surgery (all p<0.05). Meanwhile, patients and family members with different gender, marital statuses, average monthly incomes, cohabitants, stroke history in the family and first medical facility have different stroke attitude scores (all p<0.05). Moreover, prehospital delay attitude scores were different in patients and family members with different ages, education, average monthly income, first medical facility and NIHSS rating (p<0.005) (tables 1 and 2).

The results of multivariate analyses revealed that among patients, attitude 2 (OR=0.91, 95% CI: 0.87 to 0.95, p<0.001), first medical facility (OR=0.30, 95% CI: 0.12 to 0.71, p=0.006) and panic level (OR=0.89, 95% CI: 0.81 to 0.98, p=0.027) were independently associated with prehospital delay (table 3). Among family members, attitude 2 (OR=0.91, 95% CI: 0.85 to 0.97, p=0.004) and not part of 'wake-up stroke' (OR=2.91, 95% CI: 1.24 to 6.85, p=0.014) were independently associated with prehospital delay (table 4).

Table 4 Risk factors for prehospital delay among family members

	Univariate analysis		Multivariate analysis	
	OR (95% CI)	p value	OR (95% CI)	p value
Knowledge score	1.01 (0.95 to 1.06)	0.714		
Attitude 1	1.08 (0.92 to 1.27)	0.295		
Attitude 2	0.91 (0.85 to 0.96)	0.003	0.91 (0.85 to 0.97)	0.004
Gender				
Male	Ref.			
Female	2.11 (0.99 to 4.47)	0.051		
Age (years)	0.99 (0.96 to 1.01)	0.54		
Age groups				
<50	Ref.			
50–59	1.22 (0.47 to 3.13)	0.676		
60–69	1.22 (0.41 to 3.58)	0.715		
70–79	0.94 (0.31 to 2.83)	0.919		
≥80	1.22 (0.47 to 3.13)	0.676		
Education				
Primary school and below	Ref.			
Junior high school and above	0.97 (0.42 to 2.24)	0.949		
Marital status				
Married	Ref.			
Other (single / divorced /widowed)	1.45 (0.30 to 7.07)	0.64		
Employment status:				
Employed	Ref.			
Unemployed	1.13 (0.53 to 2.39)	0.74		
Average monthly household income				
<2000	Ref.			
2000–5000	0.26 (0.05 to 1.22)	0.089		
5000–10 000	0.22 (0.04 to 1.11)	0.068		
>10 000	0.23 (0.03 to 1.39)	0.112		
Does the patient have a cohabitant?				
Yes	0.91 (0.31 to 2.68)	0.878		
No	Ref.			
Medical insurance				
Has medical insurance	Ref.			
No insurance				
Family history of stroke in addition to the patient				
Yes	1.29 (0.57 to 2.95)	0.533		
No	Ref.			
Wake-up stroke				
Yes	Ref.		Ref.	
No	2.95 (1.29 to 6.70)	0.01	2.91 (1.24 to 6.85)	0.014
Was the first medical facility you sought care from a comprehensive stroke centre?				
Yes	0.53 (0.22 to 1.26)	0.154		
No	Ref.			
Panic rating	0.89 (0.79 to 1.00)	0.063		
NIHSS rating				
Normal	Ref.			
Mild stroke	0.70 (0.25 to 1.96)	0.506		
Moderate stroke	0.55 (0.21 to 1.44)	0.227		
Moderate to severe/ severe stroke	0.32 (0.04 to 2.26)	0.257		

Attitude 1, attitude towards stroke; attitude 2, attitude towards prehospital delay.
NIHSS, National Institutes of Health Stroke Scale.

DISCUSSION

This study aimed to assess the knowledge and attitudes of patients who had an AIS and their family members regarding stroke and prehospital delay, focusing on factors influencing timely medical intervention. Using a cross-sectional design, we analysed the relationship between stroke knowledge, stroke attitudes, prehospital delay attitudes and their impact on prehospital delay. Understanding these associations is crucial for developing targeted educational interventions to improve early stroke recognition and reduce delays in seeking medical care. The results of this cross-sectional study revealed a significant gap in knowledge and attitudes towards stroke and its associated prehospital delay among patients who had an AIS and their family members.

The findings of this study highlight several key aspects regarding the knowledge and attitudes related to stroke and the timeliness of seeking medical care among patients and their family members. First, age emerged as a critical factor, as individuals younger than 50 years

demonstrated higher scores in knowledge and attitudes across both groups. This finding is consistent with the results of previous studies[26–28] which indicate a generational shift in health literacy. Additionally, education level played a significant role in both groups, with higher education being associated with greater knowledge and more positive attitudes towards prehospital delay. This aligns with broader research linking higher education levels to improved health awareness and behaviours.[28–30]

Marital status significantly influenced attitudes among patients but not among family members. Married patients showed higher attitude scores, possibly due to the support systems provided by spouses in health-related decision-making.[31 32] In contrast, the influence of marital status on family members' attitudes was not statistically significant, indicating that family members may perceive their role more as auxiliary support rather than primary decision-makers. Income level and the presence of cohabitants positively influenced knowledge and attitudes, especially among patients. This emphasises the crucial role of socioeconomic factors and living arrangements in health awareness and illness response.[33] Family experience of stroke influenced attitudes towards stroke and prehospital delay among patients. This result may be due to the fact that families with prior stroke experience are generally more familiar with the symptoms and the urgency of seeking medical care. This familiarity often leads to quicker response times and less hesitation in recognising stroke signs, which can be crucial for effective treatment. Additionally, families with stroke history may have better knowledge of healthcare systems and are more likely to understand the importance of rapid hospital admission for a favourable outcome.[34 35]

In multivariate analyses, attitudes towards prehospital delay, the choice of the first medical facility and panic levels at symptom onset were independently associated with prehospital delay among patients, which was consistent with similar previous studies.[36 37] A study conducted in Somalia further supports these findings, demonstrating that key factors contributing to delayed hospital arrival include limited symptom awareness, night-time stroke onset and transportation barriers.[12] Also, research has highlighted that a lack of awareness regarding stroke symptoms and their severity contributes to delayed decision-making when seeking care.[38] Moreover, the initial panic and confusion experienced by patients and their families can lead to indecision, further exacerbating the delay.[39] This indicates that psychological factors and initial healthcare choices play a crucial role in response time during a stroke.[40 41] Among family members, the attitude towards delays and the absence of a 'wake-up stroke' scenario were significant predictors of prehospital delay. This highlights the role of family members' perceptions and knowledge in influencing patient care decisions. Enhancing awareness can be significantly supported through localised efforts and strategic communication initiatives. First, local hospitals and health centres play a key role in public outreach meetings through media and medical education, which can also explain the significant role of stroke medical experience in terms of attitudes in previous results. Besides, community-based educational programmes are crucial for enhancing patient awareness, especially when tailored to fit the local environment and policies. Additionally, public health messaging could focus more on dispelling fear about stroke symptoms and the critical need for immediate medical attention.[42 43]

The correlation analysis showed that knowledge significantly influenced attitudes towards stroke but did not directly affect prehospital delay attitudes. A similar discrepancy between theoretical stroke knowledge and actual response behaviour has been reported in international studies. Research by Teuschl and Brainin indicates that, despite greater awareness of stroke symptoms, many individuals still experience delays in seeking medical care due to difficulty recognising symptom severity and a lack of prompt action from bystanders.[8] Several factors may contribute to this discrepancy. First, there is often a gap between knowledge and action, a phenomenon well-documented in health behaviour research. Individuals may understand the symptoms and seriousness of stroke yet fail to recognise these symptoms when they occur or underestimate the urgency of immediate medical intervention. This discrepancy can be attributed to a lack of situational awareness or the inability to apply abstract knowledge to real-life scenarios. Second, psychological factors such as panic or denial in the face of alarming symptoms can impede prompt action, even among those well-informed about stroke. This also explains why, in our study, panic rating was an independent factor affecting prehospital delay, underscoring the importance of psychological factors in the decision-making process for seeking timely medical attention. This gap highlights the need for public health interventions that focus not only on stroke education but also on practical training in emergency response, thereby bridging the gap between knowledge and actionable behaviours in critical situations.[44 45]

The study had several limitations. This study is a single-centre study with a small sample size, limiting the general generalisability of the results. The study was cross-sectional, preventing the analysis of causality. The questionnaire was designed according to local practice, culture and policies, limiting the exportability of the questionnaire to other geographical areas and the generalisability of the results. Besides, all KAP studies are at risk of social desirability bias, in which the participants can answer what they know and what they should think or do instead of what they are doing.[33 34]

Conclusion

Both patients who had an AIS and their family members displayed insufficient knowledge and less-than-ideal attitudes towards stroke and prehospital delay for stroke, with family members generally exhibiting higher scores in these aspects compared with patients. Educational interventions should be designed to improve knowledge of the typical symptoms and early identification of stroke.

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