

Factors Associated with Response to Stroke Symptoms among Family Members of Acute Ischemic Stroke Persons in Wenzhou, China

บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาการตอบสนองต่อการโรคหลอดเลือดสมอง และความสัมพันธ์ระหว่างการตอบสนองต่อการโรคหลอดเลือดสมองกับความรู้เกี่ยวกับโรคหลอดเลือดสมอง การรับรู้ความเสี่ยงต่อการเกิดโรคหลอดเลือดสมอง และความทุกข์ทางจิตใจของสมาชิกครอบครัวผู้ป่วยโรคหลอดเลือดสมองขาดเลือดเฉียบพลัน

วิธีการวิจัย: การวิจัยเชิงสหสัมพันธ์ (Correlational Research Design) กลุ่มตัวอย่างจำนวน 126 คน ได้มาจากการสุ่มอย่างง่าย เครื่องมือที่ใช้ในการวิจัยประกอบด้วย 1) แบบสอบถามข้อมูลส่วนบุคคลของผู้ป่วยโรคหลอดเลือดสมองขาดเลือดเฉียบพลันและสมาชิกครอบครัว 2) แบบวัดความตั้งใจในการตอบสนองต่อภาวะล่าช้าก่อนถึงโรงพยาบาลของผู้ป่วยโรคหลอดเลือดสมอง (The Stroke Pre-hospital Delay Behavior Intention Scale: SPDBI) 3) แบบสอบถามความรู้เกี่ยวกับโรคหลอดเลือดสมอง (Stroke Knowledge Questionnaire: SKQ) 4) แบบสอบถามการรับรู้ความเสี่ยงสำหรับผู้ที่มีความเสี่ยงสูงต่อโรคหลอดเลือดสมอง (มิติการรับรู้โอกาสเสี่ยงต่อการเกิดโรค) และ 5) แบบประเมินความทุกข์ทางจิตใจ (Psychological Distress Scale: K10) ค่าสัมประสิทธิ์แอลฟาของครอนบาค (Cronbach's α) ของเครื่องมือแต่ละฉบับเท่ากับ .852, .880, .816 และ .895 ตามลำดับ วิเคราะห์ข้อมูลด้วยสถิติเชิงพรรณนาและค่าสัมประสิทธิ์สหสัมพันธ์เพียร์สัน (Pearson's Product-Moment Correlation)

ผลการวิจัย: คะแนนเฉลี่ยการตอบสนองต่อการโรคหลอดเลือดสมองของสมาชิกครอบครัวผู้ป่วยโรคหลอดเลือดสมองขาดเลือดเฉียบพลัน เท่ากับ 82.389 คะแนน (SD = 14.829) อยู่ในช่วง 66-96 คะแนน ซึ่งแสดงถึงการตอบสนองต่อการโรคหลอดเลือดสมองถูกต้องในระดับปานกลาง ผลการวิเคราะห์สหสัมพันธ์ของเพียร์สันพบว่า ความรู้เกี่ยวกับโรคหลอดเลือดสมอง ($r = 0.569$, $p < 0.01$) และการรับรู้ความเสี่ยงต่อการเกิดโรคหลอดเลือดสมอง ($r = 0.389$, $p < 0.01$) มีความสัมพันธ์ทางบวกอย่างมีนัยสำคัญทางสถิติกับการตอบสนองต่อการโรคหลอดเลือดสมอง ขณะที่ความทุกข์ทางจิตใจ ($r = -0.193$, $p < 0.05$) มีความสัมพันธ์ทางลบอย่างมีนัยสำคัญทางสถิติกับการตอบสนองต่อการโรคหลอดเลือดสมองของสมาชิกครอบครัวผู้ป่วยโรคหลอดเลือดสมองขาดเลือดเฉียบพลัน

สรุป: ผลการวิจัยเป็นหลักฐานเชิงประจักษ์สำหรับพยาบาลและนักวิจัยทางการแพทย์ในการพัฒนาโปรแกรมส่งเสริมความรู้เกี่ยวกับโรคหลอดเลือดสมอง การรับรู้ความเสี่ยงต่อการเกิดโรคหลอดเลือดสมอง และการมีสุขภาพทางจิตใจที่ดีของสมาชิกครอบครัวผู้ป่วยโรคหลอดเลือดสมองขาดเลือดเฉียบพลัน เพื่อส่งเสริมให้สมาชิกครอบครัวสามารถตอบสนองต่อการโรคหลอดเลือดสมองได้อย่างมีประสิทธิภาพ อันจะนำไปสู่การดูแลผู้ป่วยโรคหลอดเลือดสมองขาดเลือดเฉียบพลันที่มีประสิทธิผลยิ่งขึ้น

คำสำคัญ: โรคหลอดเลือดสมองขาดเลือดเฉียบพลัน; การตอบสนองต่อการโรคหลอดเลือดสมอง; ความรู้เกี่ยวกับโรคหลอดเลือดสมอง; การรับรู้ความเสี่ยงต่อการเกิดโรคหลอดเลือดสมอง; ความทุกข์ทางจิตใจ

Abstract

Objective: To describe the status of response to stroke symptoms and to determine response to stroke symptoms and its relationships with stroke knowledge, perceived risk for stroke, and psychological distress among family members of acute ischemic stroke persons.

Methods: This correlational research design, used a simple random sampling to recruit 126 participants. Research instruments consisted of 1) Demographic questionnaire of AIS patients and their family members, 2) The Stroke Pre-hospital Delay Behavior Intention Scale (SPDBI), 3) Stroke Knowledge Questionnaire (SKQ), 4) The Risk Perception Questionnaire for People at High Risk of Stroke (Susceptibility dimension), and 5) the Psychological Distress Scale (K10). The Cronbach's α coefficients for the scales were .852, .88, .816 and .895, respectively. Descriptive statistics and Pearson's product-moment correlation were used for data analysis.

Result: The mean score of response to stroke symptoms among the family members of AIS patients was 82.389 (SD = 14.829), it was between 66-96 score, indicating a moderate correct response to stroke symptoms. Pearson's correlation analysis revealed that stroke knowledge ($r = 0.569$, $p < 0.01$), perceived risk for stroke ($r = 0.389$, $p < 0.01$) was significantly positively correlated with response to stroke symptoms, and psychological distress ($r = -0.193$, $p < 0.05$) was significantly negatively correlated with response to stroke symptoms among the family members of AIS patients.

Conclusion: The findings provide an evidence for nurses and nursing researchers to develop intervention programs to promote stroke knowledge, perceived risk for stroke, and healthier psychological state of the family members of AIS patients which can be encouraged family members to develop an effective response to stroke symptoms, ultimately leading to more effective care for the AIS patients.

Keywords: acute ischemic stroke; response to stroke symptoms; stroke knowledge; perceived risk for stroke; psychological distress

Introduction

Stroke is a leading global cause of death and disability, imposing substantial social and economic burdens worldwide.^{1,2,3,4,5} In China, stroke remains the foremost cause of mortality and long-term disability, with incidence and prevalence of risk factors rising above global averages and higher than many developed countries.^{6,7,8} Recent estimates indicate millions of annual stroke deaths and a large proportion of survivors experiencing permanent impairment, while direct treatment costs are considerable.^{9,10} Acute ischemic stroke (AIS) accounts for approximately 80–85% of all strokes and represents a critical public health challenge both globally and in China.^{2,3,4,5}

AIS is characterized by sudden reduction in cerebral blood flow that rapidly leads to neuronal injury; complete arterial occlusion for minutes can cause irreversible damage.^{11,12} Timely reperfusion—principally intravenous thrombolysis with recombinant tissue plasminogen activator (rt-PA) or Tenecteplase within the early therapeutic window—substantially reduces infarct size and improves functional outcomes.^{13,14,15,16,17} Clinical evidence consistently shows that earlier treatment yields better outcomes and fewer serious complications.^{18,19,20,21}

Despite compelling evidence for early reperfusion, many regions, including China, face persistent pre-hospital delays and low rates of thrombolytic treatment compared with developed countries.²² International comparisons and multicenter studies highlight substantial gaps: markedly higher proportions of patients in high-income settings arrive within thrombolysis windows and achieve recommended door-to-needle times than those in China.²³ Local data from Wenzhou underscore this problem: only a small fraction of AIS patients present within 4.5 hours of symptom onset and an even smaller proportion receive thrombolytic therapy.²⁴ Thus, pre-hospital delay constitutes a major barrier to improving stroke outcomes in China and in Wenzhou specifically.

Decision-making immediately after symptom onset is a key determinant of pre-hospital delay. Most strokes occur at home, and in a high proportion of events family members or other bystanders accompany the patient at onset.²⁵ Because patients often experience impaired consciousness or neurological deficits that hinder their ability to seek care, family members commonly act as first responders and decision-makers; their recognition, appraisal, and actions strongly influence time to hospital arrival.^{26,27,28} Studies link who makes decisions and the involvement of others at onset to arrival times, indicating that family responses are central to timely care.²⁵

Correct responses to stroke symptoms, rapid recognition of a possible stroke and immediate activation of emergency medical services (EMS), are essential to optimize the chance of receiving reperfusion therapies and favorable outcomes.^{29,30,31} The 2026 AHA/ASA guidance emphasizes urgent EMS activation, recording symptom onset time, and appropriate interim measures while avoiding non-evidence-based actions such as bed rest without medical evaluation or delayed outpatient follow-up.⁴ However, incorrect or delayed responses, minimizing symptom urgency, waiting to see whether symptoms resolve, or using home remedies, are common and are associated with longer pre-hospital times.^{8,32,33}

Large Chinese surveys, people aged between 18 and 69, mainly investigating their understanding of stroke symptoms and seeking treatment. The results showed that the participants identified an average of 5.2 out of 14 stroke symptoms, individuals with cardiovascular events or family/friend history have higher recognition rates of stroke symptoms. The study also showed that 1/3 of people recommend bed rest, while 10% recommend drinking water when the stroke occurs.³⁴ This means that Chinese people did not respond to stroke symptoms correctly. Similarly, community-based Chinese data reveal that while recognition rates may be substantial, correct response rates lag behind.³⁵ Internationally, campaigns have improved stroke knowledge but have not consistently translated into faster help-seeking or reduced delays, suggesting that awareness alone may be insufficient to change acute behavioral responses.^{32,35}

The Common-Sense Model of Self-Regulation (CSM) provides a useful theoretical framework for understanding responses to acute health threats.³⁶ According to the CSM, individuals form cognitive and emotional representations of illness—knowledge about the condition and its consequences, perceptions of personal risk, and emotional reactions that guide coping behaviors.

Applying this model to family members' responses to AIS implies that stroke-related knowledge (symptom recognition and treatment awareness), risk perception (awareness of personal or familial susceptibility and severity), and psychological distress (acute emotional responses, anxiety, or panic) interact to determine whether and how quickly EMS is activated.^{37,38,39,40}

Empirical studies support the relevance of these constructs. Increasing population knowledge of stroke can do appropriate responses to stroke, and lead to reduced patient delay in seeking emergency medical care, thus enhancing treatment and outcome.^{41,42,43} However, knowledge of stroke in the general public is poor, an Ireland study showed that poor levels of public awareness of stroke risk factors, warning signs, and response in the general population, especially in older people (age >65).⁴² A Norwegian study shows that most people (91.3%) realize that stroke is a severe disease, but the degree of information about the treatment plan is low (23.7%).^{42,44}

Perception of high-risk factors for acute ischemic stroke is the illness perception in the Common-sense Model of Self-Regulation, it is also crucial for correctly responding. Perceived susceptibility and recognition of individual risk factors can shape urgency, but awareness of risk factors does not uniformly predict appropriate responses.^{42,45} identification of high-risk stroke populations makes effective early treatment difficult.⁴⁶ A study assesses the population's knowledge of the risk factors for stroke showed that 71% of participants could correctly list just two or more risk factors for stroke, typically generic lifestyle risk factors, insufficient understanding of stroke risk factors may affect the public's response speed to stroke symptoms and timely seeking medical attention.⁴²

The emotional response of the bystander was also crucial for faster response to stroke. Psychological stress has a profound effect on both physical and mental health, including how people make decisions.⁴⁷ Emotional and cognitive responses under acute stress may impair decision-making—heightened psychological distress among witnesses can delay appropriate action even when symptoms are recognized.^{47,48,49}

Local context matters. Sociocultural norms, health system accessibility, economic conditions, and community-level factors influence how families perceive and respond to emergencies. Wenzhou's unique geographic, economic, and cultural profile may shape family members' stroke knowledge, risk perceptions, and emotional coping, yet there is no comprehensive, systematic assessment of these factors and their association with acute response behaviors in this region. Addressing this evidence gap is essential to design targeted interventions that move beyond awareness campaigns to change in-the-moment behaviors of family decision-makers.

This study aims to evaluate family members' responses to stroke symptoms among hospitalized AIS patients in multiple comprehensive hospitals in Wenzhou, China, and to identify factors associated with those responses—specifically stroke knowledge, perception of stroke risk, and psychological distress. This study will provide information for healthcare providers in to develop advanced nursing interventions for the family members of acute ischemic stroke persons, to support their stroke knowledge, including the acute stroke symptoms, warning signs, perception of high-risk factors of stroke, and thrombolytic therapy. Guide them to correct response to stroke symptoms and appropriate mental state when the acute stroke occurs, shorten the pre-hospital time, increase thrombolytic therapy rate, and improve the patient's neurological outcome and quality of life.

Objectives of the study

1) To investigate the response to stroke symptoms among family members of acute ischemic stroke persons in Wenzhou, China.

2) To examine the relationship between stroke knowledge, perceived risk for stroke, and psychological distress with response to stroke symptoms among family members of acute ischemic stroke persons in Wenzhou, China.

Methods

Study design and participants

A correlational research design was used to explore the response to stroke symptoms and its relationships with stroke knowledge, perceived risk for stroke, and psychological distress among family members of AIS patients. The study population was the family members who stay with the AIS patients' side when stroke occurs, and respond to take the AIS patients to the ED of the Second Affiliated Hospital of Wenzhou Medical University (WMU), China, then transferred to the Neurology Ward or Intensive Care Unit (ICU) for treatment within the first 24 hours. Participants were recruited using a simple random sampling technique. To be eligible, family members of AIS patients had to 1) be 18 years old or older, 2) lived with the AIS patients, 3) had a good orientation to date, time, place, and person, 4) be able to speak and understand Chinese or Mandarin, 5) not to be health care provider. For AIS patients, they had to 1) be 18 years old or older, 2) be diagnosed with the first-ever of AIS patients, 3) be first visit to the ED of the Second Affiliated Hospital of WMU, 4) be not in case with diagnosed as Transient ischemic attack (TIA), 5) be not have severe comorbidity such as acute coronary heart disease, malignant tumors, major organ transplantation, and end-stage kidney disease.

The sample size was calculated by using a power analysis with G*Power 3.1.9.7 program. The researcher tested the relationship between the response to stroke symptoms and each independent variable. Based on correlation analysis, estimated a medium effect size of 0.30 and aimed to achieve a power of 0.90, with $\alpha = .05$ used for computing the sample size, which resulted in at least 112 participants being needed, with a 10% compensation for incomplete questionnaire or potential outlier data, the final sample size was 126.

Research instruments

1. The Demographic Questionnaire of Family members was developed by the researcher, specifically for this study. The information was obtained from participants' self-report, include 1) General information: 2) The decision-making time from the onset of stroke symptoms to seek medical treatment. 3) The time from first see the stroke symptoms onset to arrive the Emergency Department. 4) Transportation methods.

2. The Demographic Questionnaire of acute ischemic stroke patients was developed by the researcher. The information from the first part was obtained from participants' self-report (family member), and the second part was obtained from the medical record (patient), include 1) General information 2) Health information

3. The Chinese version of The Stroke Pre-hospital Delay Behavior Intention Scale (SPDBI)

was developed by Zhao et al.⁵⁰ this instrument designed to obtain information about responses of participants to stroke symptoms or stroke warning signals, to reduce pre-hospital delays for AIS patients during symptom onset. This scale has 27 items, includes 5 dimensions: 1) stroke warning signals (9 items), 2) non-treatment justification (8 items), 3) symptom attributions (4 items), 4) habitual response style (3 items) and 5) emergency systems use (3 items), and each item is rated on a five-point Likert-type scale ranging from 1 to 5. In the dimension 1), the questions ask about "What do you think is the severity of the following situation when you see (or when you discover someone), the respond was scoring as 5 =extremely severity, 4 =very severity, 3 =moderately severity, 2 =mildly severity, and 1 =not at all severity. In dimensions (2) to (5), the questions ask about "do you agree with the following viewpoint when the above situation occurs," the respond was scoring as 5 = Not at all agree, 4 =mildly agree, 3 = moderately agree, 2 =very agree, and 1 =extremely agree. The total score ranges from 27 to 135 points. The higher the actual score, the higher the level of correct response, indicating a lower likelihood of pre-hospital delayed behavior and a greater likelihood of receiving treatment within the time window. Based on the total score of the SPDBI, the classification level of response to stroke symptoms is divided into five categories. Score ≤ 50 =Level 1 - Likely to have an extremely incorrect response, score 51-65 =Level 2 - Likely to have a mild level of correct respond, score 66-96 =Level 3 - Likely to be a moderate level of correct respond, score

97-111= Level 4 - Likely to be a high level of correct respond, and score ≥ 112 = Level 5 - Likely to be well of correct response. The SPDBI had a Cronbach's α of .808.

4. The Stroke Knowledge Questionnaire (SKQ) was used to measure the level of stroke knowledge among family members of acute ischemic stroke patients. It was developed by Wan.⁵¹ It consists of two parts and 17 items: stroke health knowledge (11 items) and risk factors of stroke (6 items). Respondents were asked to answer with "correct", "incorrect", or "Unknown / uncertain", and score of 1 = correct, 0 = incorrect or Unknown / uncertain. The total score ranges from 0 to 17 points, with higher scores indicating higher levels of stroke knowledge among participants. The SKQ had a Cronbach's α of .87

5. The Risk Perception Questionnaire for People at High Risk of Stroke (Susceptibility dimension) was used to measure the level of individuals from the family members' perception of risk factors. It was developed by Zhou and Ren.⁵² Perceived susceptibility dimension had 4 items, 1 to 3 items are rated on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. The fourth item is assigned values from "no risk", "low risk", "unknown", "medium risk", to "high risk" as 1 to 5 points. The higher the total score mean the higher the individual's perceived risk of a stroke. The Cronbach's α of the risk susceptibility dimension = .806

6. Chinese Version of Psychological Distress Scale (K10) was developed by Cheng.⁵³ it has 10 items, which measure the frequency of non-specific mental health-related symptoms such as anxiety and stress levels experienced in the past four weeks. The frequency of each item was divided into five levels: all time, most time, some time, occasionally, and almost none. When scoring, score 5 points, 4 points, 3 points, 2 points, and 1 point for each of the five levels mentioned above. Then calculate the total scores of the 10 items, Higher score mean higher psychological Distress. This scale had Cronbach's α = .80, indicating good reliability of this questionnaire.

Ethical consideration

The study was approved by the Ethical Approval Committee, Burapha University, Thailand (G-HS096/2568) and the Second Affiliated Hospital of Wenzhou Medical University in China (2025-K-479-01). Before collecting data, the subjects were introduced to the purpose and process of the research, and participation in this study was voluntary. During the study, participants had the right not to answer questions, they also had the right to change their minds and refuse to participate in the project at any time, and such refusal did not affect the medical services they received. After obtaining informed consent from the participants, the informed consent forms were issued to the participants and signed. The survey was conducted anonymously, and the personal information of the participants was kept confidential.

Data collection procedures

The nurses in the Neurology Ward and ICU screened the AIS patients who met the inclusion criteria first and then spoke with the eligible family members who met the inclusion criteria, after inquired about the family members initial interest to participate in the research study, then introduced tentative participants to the researcher. After identifying the eligible criteria and completing the process of obtaining consents, questionnaires were administered in a face-to-face setting using a self-report approach in a private room.

Data analysis

Descriptive statistics including frequency, percentage, mean (M) and standard division (SD) were used to describe demographic characteristics and the study variables. Pearson's product-moment correlation coefficient was used to explore the association between the response to stroke symptoms and selected factors, including stroke knowledge, perceived risk for stroke, and psychological distress. Statistical significance was at a type I error of 5%. All statistical analyses were done using the software program SPSS 26.0.

Results

Of the 126 family members, their age ranged from 24 to 77 years, with a mean age of 53.413 years, 55.56% of them were female, nearly two-third of them were married (67.46%), 65.87% of the them were employed, 35.71% with junior college education, followed by bachelor's degree (33.33%). Most of them lived in urban areas (78.57%), among all of them in decision-making, the husband be the highest (27.78%), followed by the daughter (23.81%).

The duration of the decision-making time ranged from 15 to 159 minutes with a mean 61.722 minutes, more than half (53.97%) took 15 - 60 minutes to making decision. The duration of the time from first see the stroke symptoms onset to arrive the ED ranged from 29 to 274 minutes with a mean of 112.556 minutes, median was 103.5 minutes. 35.71% of them took 61-120 minutes, while 25.40% took 15-60 minutes. 42.06% of them reported the transportation methods was by taxi, followed by private cars (23.02%), with only 14.29% calling for Emergency vehicle (Table 1).

For all AIS patient, their age ranged from 39 to 89 years old with a mean of 65.19 years, elderly aged ≥ 60 years accounting for 59.53%. More than one-third of the participants with senior high school-level education, being the highest (35.71 %), followed by those who had primary school-level education (25.40%), more than half were unemployed (57.94%), Most of the them were married (80.95%), 73.01% reported living with spouse and children, and 57.14% had three family members living together. 88.89% of them had comorbidities, with hypertension (30.71%), followed by diabetes (25.47%). The distribution of each symptom ranged from 12.22% to 14.29%, the GCS score ranged from 11 to 15 with a mean of 13.849, most of the them (71.03%) were ranged from 13-14 points. The NIHSS score ranged from 1 to 41 with a mean score of 14.429, 41.27% of them had moderately severity of stroke (NIHSS score 5-15) at the first time when arrived ED (Table 2).

Most of the family member had a moderate correct response to stroke symptoms (60.32%), while only 3.97% of them reported a score of 112 or higher. 20.63% of them had high level of correct response, and in addition, 11.11% of them showed mild correct response to stroke symptoms (Table 3).

The score of response to stroke symptoms ranged from 43 to 124 with a mean of 82.389 (SD = 14.829), it was between 66-96 score, which means the level of response was moderate correct. Stroke knowledge score with mean of 7.587 (SD = 4.103), the score indicator of the SKQ scale was 44.63%. perceived risk for stroke of the family member with mean score of 11.905 (SD = 3.081), the score indicator of the scale was 59.53%. The score of psychological distress ranged with a mean of 24.802 (SD = 11.958), the score indicator of the K10 scale was 49.6%, which indicated likely to have mild risk of mental illness (Table 4).

Response to stroke symptoms was significantly positively correlated with stroke knowledge ($r = .569$, $p < .01$) and perception risk for stroke ($r = .389$, $p < .01$). Meanwhile, response to stroke symptoms was significantly negatively correlated with psychological distress ($r = -.193$, $p < .05$). (Table 5).

Discussion and conclusion

Response to stroke symptoms among the family members of AIS persons

In this study, the mean score of response to stroke symptoms among the family members of AIS patients was 82.389 out of 135 (SD = 14.829), indicating a moderate level of correct response. Meanwhile, this study showed that 60.32% of participants had a moderate correct response to stroke symptoms. According to the Common-Sense Model of Self-Regulation (CSM), response to stroke symptoms represents the action plan or coping procedure activated by the individual's representation of the health threat.³⁶ Incorrect response can manifest in behavior, such as delayed decision-making, then leading to pre-hospital delay.

In this study, the mean duration of the decision-making time was 61.722 minutes (median 57.5 minutes), meeting the definition which has been defined in previous studies as a duration of more 1 hour between the onset of discomfort symptoms to the initial decision to seek medical help, they indicated that exceeding the critical of >1 hour often associated with pre-hospital behavior in acute stroke contexts.^{54,55,56} Although this median time was faster than that reported in studies from Norway (92 minutes)⁴⁴, Thailand (120 mins)⁵⁷, and Malaysia (120 mins)⁵⁴, the finding from this study that 99.21% of family members required

more than 15 minutes to decide remains concerning, that in a study from Spain on 382 acute stroke patients has used “15 minutes” as a cut-off point for decision-making delay to evaluate patients’ immediate response⁵⁸. This is longer than findings from Spain, where 75.1% of witnesses took >15 minutes to make decisions.³³

Meanwhile, most studies indicate that decision-making time delay was one of the main reasons for pre-hospital delay, and the speed of time was significantly correlated with decision-maker identity.²⁵ A study from Norway specifically pointed out that decision delays accounted for 55.1% of the total pre-hospital delay time.⁴⁴ A study from Thailand found that decision delay represented 49% of pre-hospital delays, with a median decision time of 120 minutes.⁵⁷ A study from China showed a medical decision delay rate as high as 74.76% among AIS patients.⁵⁵

In this study, the mean duration time of arrive from first see the stroke symptoms onset to the Emergency Department was 112.556 minutes, median was 103.5mins. 21.43% of participants took more than 3 hours to arrive the emergency room, faster than a multicenter observational study in the United States on 606,369 acute stroke patients showed a median symptom onset to arrival time of 176 minutes (IQR, 64 – 565).²² A Serbian study showed 44.54% of patients arrive at the hospital within 3 hours of onset⁵⁹, besides, faster than a China study that in Hunan showed that the incidence of pre-hospital delay among 671 patients was 79.6%(> 3 hours).⁶⁰ This may be related to the fact that 78.57% of participants live in urban areas, urban living typically means shorter distances to hospitals and perceived accessibility.⁶¹ Research has shown that patients in urban areas are more likely to arrive at stroke centers within 3 hours compared to rural patients (27.5% vs. 19.2%).⁶²

However, even so, the data revealed that only 14.29% of participants calling for Emergency vehicle, while the majority relied on taxis (42.06%) or private cars (23.02%), even 20.63% patients choose to walk to the hospital, the extremely low utilization rate of the EMS mirrors issues of the participants lack of awareness of correctly using EMS in Wenzhou, China, this pattern aligns with the “emergency system use” dimension of correct stroke response.⁵⁰ Within the CSM framework, the choice of transportation mode is a direct behavioral output of the coping procedure, an incorrect response is often characterized by the underutilization of EMS (Tarantini et al., 2023). Previous research confirms that non-EMS transport significantly reduces the likelihood of timely reperfusion therapy (Srinivasa et al., 2025; Wu et al., 2025). A study targeting urban populations in the United States found that although 89% of participants said they know should call EMS during stroke occurs, but only 12% did so (Hsia et al., 2011). A prospective study by Tarantini et al.⁶³ on 669 patients with acute stroke found that only 48.7% of patients called EMS

Urban living usually means being nearby to hospitals and having more convenient transportation.^{61,62} This may lead to a misconception among family members that walking is a reasonable choice, believing that “the hospital is nearby”, “walking is faster than waiting for EMS”, or “walking is more convenient”, without perceiving that stroke symptoms as urgent, do not realize the professionalism and importance of emergency response systems in dealing with acute stroke, leading to inappropriate transportation choices such as walking. Consistent with the findings of this study, Chinese research from Sichuan Province on acute stroke patients revealed that underutilization of EMS is a common phenomenon, with only 26.16% participants call the EMS. Independent factors associated with lower EMS usage rates included perceiving symptoms would disappear spontaneously (OR = .34) or not wanted to disturb others (OR = .06), or perceiving of symptoms not as urgent (OR = .15).⁶⁴

Factors influencing response to stroke symptoms among the family members of AIS persons

The results showed that stroke knowledge was significantly positively correlated with response to stroke symptoms, participants (family members) with more stroke knowledge had more appropriate response to stroke symptoms. The relationship between stroke knowledge and response to stroke symptoms can be explained by the CSM³⁶ that stroke knowledge is the health threat information in CSM, increasing population knowledge of stroke can do appropriate responses to stroke.⁴² This finding is indicating a correlation between better stroke knowledge and correct responses to stroke, lack of knowledge about stroke can lead to incorrect family coping.⁵⁵ A multicenter study confirmed that a correct understanding of acute stroke knowledge by family members is an independent predictor of early hospital arrival (OR = .224, 95% CI .109 – .462). If family members have a correct understanding

of this stroke knowledge, the risk of delayed admission for patients is reduced by approximately 77.6%.⁶⁵ The other study has found that family members, who have low level of stroke knowledge, insufficient risk perception and struggle in the medical decision-making process, which are the reasons for incorrect coping. Specifically, this is manifested in incorrect judgments of symptoms, such as thinking that their patients felt fatigue not stroke symptom and select to use home remedies leading to pre-hospital delay.⁶⁶

Similarly, perception risk for stroke was another factor that significantly associated with response to stroke symptoms among family members of AIS patients. In this study, the perception risk for stroke had a mean score of 11.905 out of 20 (SD = 3.081), the score indicator was 59.53%, which means a relatively high-level of stroke risk perception indicates that the family member behaved more appropriate responses to stroke symptoms. Perception risk for stroke is the illness perception in the CSM, it is crucial for correctly responding. The finding in the current study is similar to those of previous studies. Underestimations of perceived risk can hinder the decision-making process to act in response to the risk.⁶⁷ A study conducted in Ireland suggests that insufficient understanding of stroke risk factors may affect the public's response speed to stroke symptoms and timely seeking medical assistance.⁴² A study in China found that lower risk perception is an independent influencing factor for delayed pre-hospital medical treatment (OR value range .384 - 3.458, $p < .05$).⁶⁸ A study in the United States have both confirmed the significant correlation between perceived disease risk levels and decision correctness and actual behavior. Accurate and high-level perception risk for disease helps promote timely decision-making, while low-level risk perception is associated with inaction and is one of the factors leading to decision-making delays and dilemmas.^{69,70}

Psychological distress was significantly negatively correlated with response to stroke symptoms among the family members of AIS patients. In this study, the participants had mild risk of mental illness with the mean score 24.802 (SD = 11.958). Psychological distress is the emotion response in the CSM, participants (family members) with lower levels of psychological stress had more appropriate response to stroke symptoms, the data shows that coping emotions have an impact on the response to stroke symptoms.^{48,49} The results of this study are consistent with previous research findings, which show that high levels of psychological stress (anxiety, depression) are not only the factor leading to decision conflicts (i.e. decision difficulties, decreased decision quality, delayed decision-making)⁷¹, but also independent risk factor affecting the efficiency and quality of stroke emergency care.^{72,73} Especially decision-makers with high levels of anxiety, even with high social support, still exhibit characteristics of "low trust" and "decision delay". One study data showed that the anxiety score was significantly positively correlated with decision-making duration ($r = .189$, $p < .001$).^{74,75} Morgenstern et al.'s study published in *Neurology* in 2024 showed that long-term stress states such as stress, anxiety, and depression inevitably affect their decision-making abilities.⁷⁶

These findings confirm that enhancing stroke knowledge, improving accurate stroke risk perception, and reducing psychological distress can promote more appropriate symptom response among family members, thereby potentially reducing pre-hospital delay and improving stroke outcomes. The findings also help nurses screen high-risk person with incorrect stroke response, provide an evidence for nurses and nursing researchers to develop intervention programs to promote stroke knowledge, perceived risk for stroke, and healthier psychological state of the family members of AIS patients which can be encouraged family members to develop an effective response to stroke symptoms, ultimately leading to more effective care for the AIS patients.

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Table 1 Frequency, percentage, mean, and standard deviation of demographic characteristics of the family members of AIS patients (n = 126)

Characteristics		Number (n)	Percentage (%)
Gender	Male	56	44.44
	Female	70	55.56
Age	18-44 years (Young adult)	36	28.57
	45-59 years (Middle-aged)	47	37.30
	≥ 60 years (Elderly)	43	34.13
	(M = 53.413, SD = 14.5, Min = 24, Max = 77)		
Education level	Primary School	3	2.38
	Junior and senior high school	21	16.67
	Junior College	45	35.71
	Bachelor's degree	42	33.33
	Master and Doctor of Philosophy	15	11.91
Marital status	Single	36	28.57
	Married	85	67.46
	Divorced	3	2.38

Characteristics		Number (n)	Percentage (%)
Occupation	Widowed	2	1.59
	Employed	83	65.87
	Public officer of the state	18	14.28
	Commercial staff	40	31.75
	Labor (eg. Builder, Factory worker, Sanitation worker, Farmer)	25	19.84
Living place	Retirement	43	34.13
	Rural areas	27	21.43
	Urban	99	78.57
Relationship with the patients	Husband	35	27.78
	Wife	29	23.02
	Father	1	0.79
Decision-making time for seeking medical help	Mother	7	5.56
	Son	19	15.08
	Daughter	30	23.81
	Sisters	4	3.17
	Brother	1	0.79
Duration time to arrive the Emergency Department	< 15 mins	1	0.79
	15 - 60 mins	68	53.97
	61-120 mins	33	26.19
	> 120 mins	24	19.05
	(M = 61.722, SD = 34.217, Min = 15, Max = 159, Med = 57.5)		
Transportation to hospital by	15-60 mins	32	25.40
	61-120 mins	45	35.71
	121-180 mins	22	17.46
	181-240 mins	14	11.11
	> 240 mins	13	10.32
	(M = 112.556, SD = 62.399, Min = 29, Max = 274, Med = 103.5)		
	Emergency vehicle	18	14.29
	Private car	29	23.02
	Walking	26	20.63
	Taxi	53	42.06

Table 2 Frequency, percentage, mean, and standard deviation of demographic characteristics and health information of AIS patients (n = 126)

Characteristics		Number (n)	Percentage (%)
Gender	Male	53	42.06
	Female	73	57.94
Age	18-44 years (Young adult)	12	9.52
	45-59 years (Middle-aged)	39	30.95
	≥ 60 years (Elderly)	75	59.53
	(M = 65.19, SD = 13.387, Min = 39, Max = 89)		
Education level	Never go to school	12	9.52
	Primary School	32	25.40
	Junior school	23	18.25
	Senior High School	45	35.71
	Junior College	10	7.94
	Bachelor's degree	4	3.18
Occupation	Employed	53	42.06
	Public officer of the state	10	7.94
	Commercial staff	7	5.56
	Labor (eg. Builder, Factory worker, Sanitation worker, Farmer)	36	28.56
	Unemployed	73	57.94

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Characteristics		Number (n)	Percentage (%)
	No occupation	37	29.37
	Retirement	36	28.57
Marital status	Single	3	2.38
	Married	102	80.95
	Divorced	7	5.56
	Widowed	14	11.11
Residential status	Living with children	21	16.67
	Living with spouse	13	10.32
	Living with spouse and children	92	73.01
How many persons living in the same house	2 persons	18	14.29
	3 persons	72	57.14
	4 persons	21	16.67
	More than 4 persons	15	11.90
Comorbidity	None	14	11.11
	Yes** (n=267)	112	88.89
	Hypertension	82	30.71
	Diabetes	68	25.47
	Hyperlipidemia	58	21.72
	Heart disease	59	22.10
First symptom onset	Symptom Summary** (n=469)	126	100.00
	Sudden limb weakness or angular deviation	62	13.22
	Sudden facial numbness	64	13.65
	Sudden limb numbness	62	13.22
	Dizziness, nausea and vomiting	58	12.37
	Sudden visual impairment	64	13.65
	Sudden language barrier	60	12.79
	Severe headache	67	14.29
	Sudden unconsciousness	32	6.81
Glasgow Coma Scale (GCS) at Emergency Room	15 (Conscious)	24	19.05
	13-14 (Mild)	90	71.43
	9-12 (Moderate)	12	9.52
	(M = 13.849, SD = .716, Min = 11, Max = 15)		
NIHSS score at Emergency Room	1-4 (Mild stroke/minor stroke)	40	31.75
	5-15 (Moderate stroke)	52	41.27
	16-20 (Moderate to severe stroke)	30	23.81
	21-42 (Severe stroke)	4	3.17
	(M = 14.429, SD = 8.794, Min = 1, Max = 41)		

**One participant can have more than one comorbidity
**One participant can have more than one symptom onset

Table 3 Frequency, percentage, mean, standard deviation and the level of response to stroke symptoms among the family members of AIS patients (n = 126)

The response to stroke symptoms	Number (n)	Percentage (%)	Mean	SD	Response level
≤50	5	3.97	45.2	4.1	Extremely incorrect
51-65	14	11.11	59.8	3.7	Mild correct
66-96	76	60.32	82.4	8.9	Moderate correct
97-111	26	20.63	102.5	3.9	High level correct
≥112	5	3.97	117.3	4.8	Well of correct

Table 4 Range, mean, standard deviation of response to stroke symptoms, stroke knowledge, perception risk for stroke and psychological distress among the family members of AIS patients (n=126)

Independent variables	Range		Mean	SD
	Possible score	Actual score		
Response to stroke symptoms	27-135	43-124	82.389	14.829

Stroke knowledge	0-17	0-17	7.587	4.103
Perception risk for stroke	4-20	5-20	11.905	3.081
Psychological distress	10-50	11-46	24.802	11.958

Table 5 Correlation coefficients between response to stroke symptoms and stroke knowledge, perceived risk for stroke, and psychological distress (n = 126)

Variables	Correlation coefficients
Stroke knowledge	0.569**
Perception risk for stroke	0.389**
Psychological distress	- 0.193*

* $p < 0.05$ ** $p < 0.01$