

# “Hesitating and puzzling”: The experiences and decision process of acute ischaemic stroke patients with prehospital delay after the onset of symptoms

pao yu Wang<sup>1</sup> (✉ [sister585371@gmail.com](mailto:sister585371@gmail.com))

Mackay Junior College of Medical Management and Nursing: Mackay Medicine Nursing and Management College <https://orcid.org/0000-0002-3978-8857>

Lee-Ing Tsao<sup>2</sup>

National Taipei University of Nursing and Health Sciences

Mei-Hsiang Lin<sup>2</sup>

National Taipei University of Nursing and Health Sciences

Yu-Wei Chen<sup>3</sup>

Landseed International Hospital/ National Taiwan University Hospital

Ying-Tao Lo<sup>4</sup>

Landseed International Hospital

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## Research article

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# Abstract

## Background

Despite campaigns to increase public awareness of stroke symptoms by advocating FAST (Face-Arms-Speech-Time), some stroke patients still show delays in the recognition of and response to stroke symptoms and miss the golden first 4.5 hours to receive rt-PA treatment. The aim of this study was to explore how acute ischaemic stroke patients with prehospital delay seek help and undergo the decision process before arriving at the hospital.

## Methods

A qualitative approach using a grounded theory was applied. There were 24 ischaemic stroke patients recruited by purposive sampling.

## Results

“Hesitating and puzzling” was the core category to describe and guide the process of acute ischaemic stroke patients with prehospital delay. During this process, “Sudden loss of physical limbs sensation and dysfunction” was identified as the antecedent condition. This process would be marked by action and interaction among the following categories: “Self-judgement and self-rationalization”, “Self-treatment and seek medical attention nearby”, “Puzzling and doubting-it may only be a minor problem”, “Worse symptoms” needing immediate advanced medical help and “Rush to nearby ER-self-alerting that serious disease is coming”. Eventually, the patients would be informed that they were admitted to the ER too late to receive rt-PA and would become sad, melancholy and regretful about becoming a disable person.

## Conclusions

The study emphasizes the importance of educating the community residents about identifying stroke symptoms and seeking medical attention immediately. These results will assist the healthcare providers by offering references for designing patient-centric educational strategies for preventing stroke pre-hospital delay to improve the quality of stroke medical care.

## Background

Prehospital delay is defined as the prolonged time from symptom onset to arrival at a hospital; it can result in the failure to receiving rt-PA on time for patients with ischaemic cerebrovascular accidents [1, 2]. In the UK, the Department of Health has informed that stroke patients should be treated on time and have been assessed using ‘Stroke - Act FAST [3, 4]. Although progress has been made in stroke treatment, the study indicated that only a few patients have access to rt-PA, resulting in thrombolysis rates of 1.3–8.4%

[5, 6]. One study suggested that the public policy aim of the utilization rate of intravenous thrombolysis should be more than 12% to have a significant population effect on disability [7]. Many studies have reported on the effectiveness of rt-PA treatment and global guidelines recommending the use of rt-PA in selected patients [8, 9]. However, only a small proportion of patients (1.05–8.6%) receive thrombolysis treatment [10–13].

Some stroke patients have different symptoms and severity inconsistent with the FAST-promoted symptoms, affecting the patient's decision to seek medical treatment and leading to extended medical treatment [14, 15]. A further explanation for the limited perceived impact might be the description of the displayed symptoms using the FAST mnemonic [14]. Pre-hospital delay is an important cause of the inability of patients with ischaemic stroke to obtain thrombolytic therapy at the appropriate time [16]. It has also become an important challenge in the management of stroke care [17]. Delays in medical treatment can be caused by the lack of recognition of stroke symptoms, failure to treat immediately when symptoms occur, transfer from general clinics to hospitals, and failure to use emergency medical services [2, 18, 19]. More than two-thirds of patients failed to use EMS, consequently delaying their arrival at the hospital [19]. Although previous studies have demonstrated that the reasons for pre-hospital delays for stroke patients were the lack of initial recognition of stroke symptoms, unavailable immediate treatment and not obtaining emergency stroke medical services [2, 16, 18, 19].

To date, studies exploring the experiences and needs of acute ischaemic stroke patients with prehospital delay after the onset of symptoms has not emphasized how time and/or ethno-cultural background affect the ability of Taiwan stroke survivors to obtain the information, support and services that they need to re-integrate into the community in the Asia context. Therefore, the intent of this study was to explore how acute ischaemic stroke patients with prehospital delay seek help and undergo the decision process before arriving at the hospital.

## Methods

This qualitative study employed a grounded theory that emphasizes the need to gather participants' perspectives to understand interaction processes and social changes [20]. Few studies have been conducted concerning seeking help and decision making for prehospital delay after the onset of symptoms in acute ischaemic stroke patients. A grounded theory research design was used to analyse the meaning, perceptions and process of seeking help and decision making before arriving at the hospital among acute ischaemic stroke patients who did not receive rt-PA therapy due to prehospital delay.

## Participants and setting

Purpose sampling techniques were used in this study. The following criteria were used to select research participants: (a) at least 20 years of age; (b) diagnosis of the first stroke by a neurologist; (c) prehospital delay of more than 4.5 hours before ischaemic stroke patients with acute symptoms arrived at the

emergency department with clear consciousness and normal language understandability; and (d) patients who could communicate in Taiwanese or Mandarin or Hakka and who agreed to be interviewed.

## Data collection

The recruitment period was from May 2018 to January 2019. The researchers visited the neurology clinics of regional hospitals to screen 26 patients who had met the inclusion and exclusion criteria of this study: two of them refused to attend because they had no time to interview and were rush to rehabilitation, and twenty-four participants agreed to participate in the interview. The researchers took the participants to an independent outpatient room for interviews to ensure the privacy of participants and facilitate the exploration of their experiences and perspectives. The interview process was anonymously recorded. The interviews averaged 20–40 minutes in length. The interview guidance content included the following questions:

1. Could you tell me what happened to you when you were brought to the hospital? What were the symptoms?
2. Why did you think you had these symptoms?
3. What do you do to deal with these symptoms? What did the people around you do to help you?
4. Under what circumstances did you decide to seek medical treatment? Could you tell me about the process of seeking medical treatment?
5. How did you feel when you were taken to the hospital?
6. What do you do when your symptoms don't improve?
7. What do you think is the lack of knowledge about pre-hospital treatment for stroke?
8. Do you have any other experience you would like to share?

## Data analysis

In grounded theory, there are several steps for data analysis, including open coding, axial coding, and selective coding using the constant comparative method, to analyse the interview content, and the theory is generated from the data analysis [21–23]. First, the content after the interview was written verbatim, from which descriptive sentences were formed that directly reflected the respondents' prehospital delay behaviour. Each meaningful sentence was coded and compared with each other and then was assigned to a suitable category according to attribute and orientation. Sub-categories were also assigned under each category. Next, axial coding was performed according to attribute and orientation linking category and sub-category to determine the relationship between each category. The categories and sub-categories were linked by continuous comparison to allow different categories to be related to each other. Finally, selective coding was performed to create a complete story line of the whole research phenomenon under the guidance of the core category and explain the relationship among the antecedent categories, interaction categories and outcome categories with theoretical framework [20, 23]. In total, 54 significant statements were produced by the 24 patients. The data were analysed immediately after each interview and collected until all the genera were saturated. In other words, no new category was generated in the current interview content.

# Rigour

Research rigour is defined as the trustworthiness of a qualitative study. Four criteria are required to enhance trustworthiness: credibility, transferability, dependability, and confirmability [24]. In terms of credibility, at the time of the study, the researcher had cared for stroke patients for more than 2 years and had already established a trusting relationship with some of the participants. Therefore, the participants were willing to share their subjective experiences and maintain self-reflection throughout the interview, reducing potential bias. The completed verbatim transcript of the interview was confirmed by the stroke patient to maintain the authenticity; twenty-four stroke patients expressed the same experience with verbatim content according to their description. Regarding transferability, the participants recruited in this study were from various backgrounds to enable the researcher to obtain sufficient information from the participants to apply these findings to acute ischaemic stroke patients. In terms of dependability, the researcher and senior nursing expert were involved in the data collection and analysis, and they constantly compared and recorded the transcripts to establish dependability. Finally, researcher neutrality was maintained through an evaluation of data collection and documents related to analytical strategies, detailed review, and critiques, confirming the coding, categorization and results to ensure the confirmability of the study.

## Ethical consideration

The Research Ethics Committee of the Landseed International Hospital Institutional Review Board (18-010-B1) approved this study. Before the interview, the researcher introduced himself to the participants, explained the topic and purpose of the interview, and reviewed the interview methods (including the recording of the process), possible problems, expected interview time and benefits of the research. Participation was voluntary, and interviews were not conducted until consent was obtained.

## Results

Twenty-four first-time ischaemic stroke patients participated in comprehensive interviews: 16 men and 8 women. The average age was 60.8 years. The mean duration from the onset of symptoms to arrival at the hospital was 34 hours. The modified Rankin scale ranged from 1 to 3 points (indicating mild to moderate dysfunction such as hemiparalysis and speech disturbance). The demographic data are shown in Table 1.

Table 1  
Characteristics of the participants

Case no.	Gender/Age (years)/ Education level	Diagnosis	History	MRS/ <sup>Y</sup> time
1	Male/60/ Vocational high school	right medial cerebellum infarcts	HTN; DM; Hyperlipidemia	1/28 hours
2	Female/62/ Vocational high school	left pons infarcts	Arrhythmia	2/48 hours
3	Male/63/ Junior college	left pons infarcts	HTN; Hyperlipidemia	2/4 hours
4	Female/56/ primary school	right basal ganglia, right insular cortex and right F-T-P lobes infarcts.	Heart disease	2/9 hours
5	Male/73/ Vocational high school	right putamen and left centrum semiovale infarcts	HTN; Hyperlipidemia	2/5 hours
6	Male/64/ Vocational high school	right corona radiata and right frontoparietal infarcts	DM	2/54 hours
7	Male/52/ Graduate school	Cerebral infarction due to stenosis of right middle cerebral artery	HTN; Hyperlipidemia	2/7 hours
8	Male/67/ primary school	left internal capsule infarcts	HTN	2/72 hours
9	Female/58/ Vocational high school	right thalamic infarcts	DM; Hyperlipidemia	2/26 hours
10	Male/56/ Middle school	left thalamus infarcts	Hyperlipidemia	2/22 hours
11	Female/61/ primary school	right cerebral infarcts	HTN	2/28 hours

Note. MRS: Modified ranking Scale; <sup>Y</sup>Average time from symptom onset to hospital arrival.

HTN: Hypertension; MCA: Middle Cerebral Artery ; DM: Diabetes Mellitus

Case no.	Gender/Age (years)/ Education level	Diagnosis	History	MRS/ <sup>Y</sup> time
12	Male/62/ primary school	left cerebellar infarcts	HTN;  Hyperlipidemia	3/48 hours
13	Male/64/ Junior college	right thalamus infarcts	Hyperlipidemia	2/72 hours
14	Male/54/ Vocational high school	left striatocapsule infarcts	Hyperlipidemia	1/72 hours
15	Female/68/ primary school	right pons, infarcts	HTN; Hyperlipidemia	2/48 hours
16	Male/63/ primary school	left thalamus infarcts	Hyperlipidemia	1/24 hours
17	Male/66/ primary school	left pons infarcts	HTN; DM Hyperlipidemia	2/72 hours
18	Male/65/ Middle school	right posterior basal ganglia and corona radiate infarcts	DM	2/6 hours
19	Male/63/ Vocational high school	right periventricular white matter infarcts	HTN; DM Hyperlipidemia	2/5 hours
20	Female/58/ Vocational high school	left cerebral infarcts	HTN; DM; Hyperlipidemia	3/48 hours

Note. MRS: Modified ranking Scale; <sup>Y</sup>Average time from symptom onset to hospital arrival.

HTN: Hypertension; MCA: Middle Cerebral Artery ; DM: Diabetes Mellitus

Case no.	Gender/Age (years)/ Education level	Diagnosis	History	MRS/ Ytime
21	Male/53/ Vocational high school	Right MCA infarcts	Hyperlipidemia	3/20 hours
22	Female/58/ Vocational high school	Right MCA infarcts	HTN; Hyperlipidemia	2/18 hours
23	Female/57/ Middle school	left pons infarcts	HTN; DM	2/72 hours
24	Male/58/  Middle school	Right MCA Infraction	HTN;  Hyperlipidemia	2/9 hours
Note. MRS: Modified ranking Scale; <sup>Y</sup> Average time from symptom onset to hospital arrival.				
HTN: Hypertension; MCA: Middle Cerebral Artery ; DM: Diabetes Mellitus				

“Hesitating and puzzling” was the core category to describe and guide the process of acute ischaemic stroke patients with prehospital delay. “Sudden loss of physical limbs sensation and dysfunction” was the antecedent category to trigger the experience in the selection of treatment for the symptoms of patients with acute stroke. These patients felt the “sudden loss of physical limbs sensation and dysfunction” and expressed the “Hesitating and puzzling” medical treatment process situation. There were five interactive categories: “Self-judgement and self-rationalization”, “self-treatment and seeking medical attention nearby”, “puzzling and doubting- it may only be a minor problem”, “Worse symptoms” needing immediate advanced medical help, and “Rush to nearby ER- self-alerting that serious disease is coming”. When patients with acute stroke go through this process, they all believe the problem may be minor and take the approach they are familiar with. When the symptoms worsen and a stroke seems possible, they go to the emergency room immediately. The whole experience of medical treatment occurs in the context of “Hesitating and puzzling”. Eventually, they arrive at the ER too late to receive rt-PA. In addition to being deeply regretful, they are sad and depressed when they “become a person with disabilities”. The theoretical framework is displayed in Fig. 1. Quotations are identified by a participant number from 1 to 24 (e.g., P1).

## Hesitating and puzzling- The core category

“Hesitating and puzzling” means that the experiences of seeking help and decision making before arriving at the hospital among the stroke patients who missed receiving rt-PA therapy was due to prehospital delay. Acute ischaemic stroke patients in the process were in a state of hesitating and puzzling due to the inability to recognize stroke symptoms and then, through reasonable self-explanation, addressed issues in a familiar way, but the symptoms did not improve, leading to the results of prehospital delay, as described in the following case:

When I went shopping on foot, I kicked my left foot all the way to the floor because it felt like it was weak and numb. I thought it was just too tired. Because my hands and feet still moved, I didn't think it was a stroke. So my husband took me to get a massage and to the clinic for injection with muscle relaxation, and I went home to sleep after seeing the doctor. I thought it should be all right. I didn't expect to wake up the next morning and find that my left foot couldn't be lifted. I was scared...I called my son to my room right away... When my son saw me like this, he got me up immediately. I didn't change my clothes. I limped to his car. He drove me to the hospital very fast...When I got to the hospital, the doctor said it was a stroke...but we missed the golden cure. I was very depressed...because there was no chance of a thrombolytic injection (P15).

## Sudden loss of physical limb sensation and dysfunction

“Sudden loss of physical limbs sensation and dysfunction” means that the patient suddenly feels abnormal in head, face or limbs in daily life. Contains two categories: “Abnormal head and face” and “Abnormal limbs”.

### Abnormal head and face

The patient suddenly feels dizziness, headache, drooling or facial asymmetry. As described in the case:  
□My mouth was dripping all the time (P1). □When I walk, I suddenly feel dizzy (P2). □□□When I was talking to my wife, my face suddenly turned crooked (P4). □□□Get up in the morning more than seven o'clock began to have a headache (P6). □

### Abnormal limbs

The patient suddenly feels limb weakness, limb numbness. As described in the case: □At six o'clock in the morning, when I got up, I couldn't stand stably. I felt that my left foot had no strength to walk, so I leaned to one side. The glass bottle in my left hand fell to the ground (P1). □□Both hands and feet have no strength, and my hands and feet on one side are numb (P2). □

## Self-judgement and self-rationalization

“Self-judgement and self-rationalization” mean that the patient thinks that the symptoms are due to disease, environment, lifestyle changes, physical degradation caused by physical dysfunction. Contains two categories: “Disease” and “Environment, lifestyle changes, and physical degradation”

## Disease

The patient thinks that the symptoms are caused by cold, fasciitis, hand cramps, nerve compression or inner ear disorders. As described in the case: "Because of the problem of nerve compression, I may be a little slow in walking (P5). I thought I had a bad cold (P8). I dropped my chopsticks, I think it might be a cramp in my hand (P3). This foot had fasciitis before... I wonder if it caused it (P10). I thought it was an inner ear disorder (P13)."

## Environment, lifestyle changes, and physical degradation

The patient thinks that the symptoms are caused by hot weather, being too tired or ageing symptoms. As described in the case: "It's too hot to be comfortable (P7). Maybe it's too tired to drive (P11). Numbness of hands and feet is very common for the elderly (P12)."

## Puzzling and doubting- it may only be a minor problem

"Puzzling and doubting—it may only be a minor problem" means that patients believe that there is no risk factor and symptoms for stroke—take medicine to prevent stroke should be just a minor problems. Contains two categories: "No risk factor and symptoms for stroke" and "Take medicine to prevent stroke".

## No risk factor and symptoms for stroke

The patients believe that there is no risk factor and symptoms for stroke—they are young, are not fat, have no high triglyceride levels, can still move their limbs, and can speak normally, and they have not fallen and do not have a crooked mouth. As described in the case: "If I have a stroke, it seems that I am not very able to move my hands and feet, that's it...I can still move (P7). I don't have a problem with high triglyceride levels. It's just high blood sugar (P12). I want to say that I am so young... maybe it's work that causes numbness and weakness (P14). I didn't fall, no mouth crooked, no hands and feet soft prone (P15). It's just the numbness of the feet... I'm not fat either (P16)."

## Take medicine to prevent stroke

The patient thinks that taking medicine to prevent thrombosis will not lead to stroke. As described in the case: "Take medicine to prevent thrombosis... It's not a big problem with stroke (P7). I take medicine to prevent stroke every day...It's impossible to have a stroke (P23)."

## Self-treatment and seeking medical attention nearby

"Self-treatment and seeking medical attention nearby" means that patients will patients will taking rest or seeking complementary and alternative medicine (CAM) or going to a nearby pharmacy or clinic for help. Contains three categories: "Taking a rest", "Seeking CAM", and "Going to a nearby pharmacy or clinic for help".

## Taking a rest

Patients will taking rest to improve physical dysfunction. As described in the case: "I go to bed.. I should be OK when I get up (P7)."; "Take a rest in a chair (P1)."

## Seeking CAM

Patients will undergo acupoint massage, cloth sticking, bloodletting with scissors or needles, pressing of the philtrum to treat physical dysfunction. As described in the case: "Massage thighs or legs...use scissors to stab the index finger and middle finger, pressing philtrum (P10)."; "The foot numbness pastes the medicine cloth (P17)."; "I kicked my left foot all the way to the floor... it was weak and numb... my husband took me to get a massage (P15)."

## Going to a nearby pharmacy or clinic for help

Patients will going to a nearby pharmacy or clinic for help, taking Western medicine or traditional Chinese medicine, or accepting muscle relaxant or analgesic injections to treat physical dysfunction. As described in the case: "My husband took me to the clinic for injection with muscle relaxation (P15)."; "Go to the nearby pharmacy to take Chinese medicine(P17)."; "Go to the clinic and the doctor prescribes medicine for me (P12)."; "Go to the clinic for a sore injection (P18)."

## Worse symptoms

"Worse symptoms" means that the patient realized that abnormal head and face symptoms or abnormal limbs symptoms or abnormal language symptoms becomes more serious. Contains three categories: "Abnormal head and face symptoms becomes more serious", "Abnormal limbs symptoms becomes more serious", and "Abnormal language symptoms becomes more serious".

## Abnormal head and face symptoms becomes more serious

When the patient's dizziness did not improve and showed vomiting, headache, and obvious facial asymmetry, they realized that physical dysfunction becomes more serious. As described in the case: "The depth of hair lines on the face is different, so the face is asymmetric (P3)."; "I still feel dizzy and start to vomit (P2)."; "The head became dizzy and painful (P21)."

## Abnormal limbs symptoms becomes more serious

When the patient more and more weakness in the hands and feet, and showed numbness in the hands and feet, they realized that physical dysfunction becomes more serious. As described in the case: "When I go to the toilet, I suddenly fall to the ground when my feet are weak... One foot can't walk. It's walking by dragging (P17)."; "Hands and feet become more numb, holding things in the hands cannot hold, fall on the ground... When walking, the left foot becomes more powerless (P22)."

## Abnormal language symptoms becomes more serious

When the patient's obvious speech disturbance, they realized that symptoms becomes more serious. As described in the case: "The speech is very unclear (P3)."; "My family can't understand me when I speak (P4)."

# Rush to a nearby ER- self-alerting that serious disease is coming

“Rush to nearby ER-self-alerting that serious disease is coming” means that when patients find that they may have a stroke or become seriously ill, they will drive or call a taxi to the hospital through their family/friends or ride their own motorcycle/ drive to the hospital or call 119 to call an ambulance to the hospital. Contains three categories: “Drive or call a taxi to the hospital through their family/friends”, Ride their own motorcycle/drive to the hospital”, and “Call an ambulance to the hospital”.

## Drive or call a taxi to the hospital through their family/friends

When patients find that they may have a stroke or become seriously ill, they will drive or call a taxi to the hospital through their family/friends. As described in the case: “Tell my wife to drive over to the hospital immediately...It must be a big problem (P7).” “Stroke... My son's wife quickly called a taxi to take me to the hospital (P17).”

## Ride their own motorcycle/drive to the hospital

When patients find that they may have a stroke, they will ride their own motorcycle/drive to the hospital. As described in the case: “The doctor said that there might be a stroke, so I drove to the emergency room (P14).” “I had a stroke... So I rode my motorcycle to the hospital (p24).”

## Call an ambulance to the hospital

When patients find that they may have a stroke, they will call 119 to call an ambulance to the hospital. As described in the case: “It's a stroke. My wife is looking for help from the neighbour, who carries me from the second floor to the first floor, my wife call 119 and call an ambulance to the emergency room (P12).”

## Becoming a person with disabilities

Becoming a person with disabilities means that the patient feels sad, melancholy and regretful when facing the physical disability and fails to arrive at the hospital in time to miss the golden emergency treatment time. Contains three categories: “Sad”, “Melancholy”, and “Regretful”.

### Sad

The patient cry when facing the physical disability. As described in the case: “I have a stroke now, like this... (with tears), my hands and feet are weak and I need my husband's help now (P9).” “I can't walk.(with tears flowing). When I was in the hospital, I cried every day (P10).”

### Melancholy

When the patient is physically disabled, he will shut himself in the room and do not want to contact anyone. As described in the case: "I didn't dare to go out when I just came home from hospital. I stayed in my room...didn't want to talk to anyone (P10)." "I don't want anyone to see me like this, so I shut myself up at home (P22)."

## Regretful

The patient regretful fails to arrive at the hospital in time to miss the golden emergency treatment time. As described in the case: "I didn't think it was a stroke, so I didn't come to see the doctor soon... It's a pity that I've delayed my golden therapy, because it's going to take a lot of time to recover now, and I will cry when I think of becoming like this (P10)." "I really regret coming to the hospital so slowly... My daily life now depends on the help of my family... If I come early, maybe I can get a thrombus injection (P17)."

## Discussion

This study illuminates the experiences of seeking help and decision making before arriving at the hospital among acute ischaemic stroke patients who missed receiving rt-PA therapy due to prehospital delay. The stroke patients with prehospital delay were full of hesitation and were puzzled before arriving at the hospital. The findings were similar to those of a previous study in which the main cause of delay in reaching the hospital was identified as indecision [25]. In the current study, the patient's self-awareness of involuntary movements of the limbs reminded us that we should strengthen the self-discovery and cognition of early symptoms of stroke and the timely reaching to available and appropriate hospitals. It is better for local clinic staff to strengthen their understanding of on-the-job education to reduce unnecessary prehospital delays.

These patients with delay in medical treatment showed signs of sudden loss of physical limb sensation and dysfunction similar to other studies [26, 27], indicating that the initial symptoms of stroke patients who are delayed in seeking medical care include weakness on one side, headache, slurred speech, blurred vision and wry mouth. When a stroke suddenly occurs and the patient can continue to perform normal daily activities, the initial neurological symptoms are ignored (e.g., one side of the limb is weak, slurred speech, blurred vision, diplopia or headache), and the patient will not choose to seek medical treatment immediately [26]. Therefore, the promotion of the Face-Arms-Speech-Time formula needed in assessing stroke symptoms is not only needed but also the increase in the public awareness of other neurological symptoms associated with stroke and emphasis on that each patient may have different neurological symptoms and severity of symptoms.

When neurological symptoms occur, the patients would make judgement or self-rationalize the symptoms and they believed that there was no risk factor for stroke or that the limbs can still move, so the body likely only had a small problem. Mackintosh et al [15] pointed out that stroke patients will try to match the symptoms with the diseases they know, often leading patients to misunderstand their stroke symptoms, such as they think that shoulders not being able to move are caused by nerve compression or that it is necessary to have a severe headache and then the failure of movement of a part of the body to develop a

stroke. O'Connell & Hartigan [26] pointed out that patients tend to think the symptoms of stroke are caused by migraine or dizziness when the patient has a headache. People's perception of symptoms can be influenced by a previous experience of illnesses and the cultural norms and values of their communities [28]. Therefore, it is recommended that when advocating how to respond to stroke symptoms, the stroke symptoms will occur suddenly and that the neurological symptoms of stroke patients are different from the physical and neurological symptoms caused by ageing or other diseases.

The results of this study found that the patients would take a break or go to a nearby pharmacy to take medication or a muscle relaxant or an analgesic injection to treat the physical symptoms, similar to what was found in other studies [26, 27]. Thus, patients with delayed medical treatment will wait for a while after the symptoms appear, during which time, they will allow themselves to lie down, rest, sleep or continue their normal life, as they expect the symptoms to disappear or considered their actions may contribute to symptom relief [26, 27]. Ahasan et al. [25] pointed out that stroke patients choosing to first visit the general clinic or pharmacy to seek medical treatment will cause delays in treatment. When most people are unwell, they will go to a familiar and trustworthy family doctor because they believe they can obtain credible medical information and advice [15]. However, it is quite uncertain whether these nearby medical clinics have sufficient professional knowledge for strokes. This study also found that some stroke patients followed the advice of friends or advertisements to use scissors or acupuncture to bleed the hands and feet, press the philtrum or use massage to deal with stroke symptoms. Although Yi et al. [29] pointed out that the implementation of finger Jing-well acupoint bleeding may help stroke patients restore consciousness, increase heart rate and reduce respiratory rate, the results concerned hospitalized patients 3 days after the stroke. Lin [30] pointed out that stroke patients who have undergone bloodletting therapy had basically received complete modern medical treatment, and the operation of bloodletting needs to be performed by professional medical personnel. Thus, it is not encouraged to operate using untrained people. Taiwan's Health Promotion Administration, MOHW [31], has indicated that if bloodletting is performed as stroke first aid, the blood pressure will fall to dangerously low levels, accelerating brain cell death.

However, when these patients found that the symptoms became more severe, most of them would go to the hospital in the car of a family member or a friend or a taxi, or they would ride a motorcycle or drive to the emergency room of the hospital. Similar to other studies, patients will seek immediate medical treatment when they have severe stroke symptoms [16, 18]. It was pointed out by the research survey of Wongwiangjunt et al. [32] that 83.4% of patients with acute stroke took a family car or taxi to the hospital, and only 16.6% of patients used an ambulance. Previous studies have indicated that access to emergency medical services can shorten the time to delay in pre-hospital care for patients with stroke [2, 18, 19].

The results of this study showed that when the patients arrived at the emergency department, they felt regret for missing the golden time of emergency treatment as they did not go to the hospital immediately, and then they felt sad, grieved and depressed to facing their physical disability. Harrison et al. [27] pointed out that stroke patients must realize that they have to arrive at the hospital within a limited time to obtain

rt-PA medication, increasing their frustration with delays in the medical process. Thus, there is a significant correlation between stroke severity and post-stroke depression [33]. About one-third of stroke patients have symptoms of depression over time [34].

The delay in the treatment of acute ischaemic stroke patients before they arrive at the hospital is mainly due to patients lacking the correct perception of recognition and treatment of stroke. Therefore, it is recommended to strengthen the concept of correct stroke treatment for the public and advocate for the awareness of stroke-related neurological symptoms other than the FAST stroke formula, such as dizziness, headache, limb numbness, blurred vision and diplopia. Additionally, it should be emphasized that stroke symptoms will occur suddenly, each patient may have different neurological symptoms and symptom severity, the myth of bloodletting should be corrected, and the necessity of correct stroke treatment and the need to contact the emergency ambulance system to help the public should be strengthened to reduce the delay for stroke treatment prior to arrival at the hospital.

## Limitations

The study area was limited to acute ischaemic stroke patients who were delayed in seeking medical treatment in a regional hospital in northern Taiwan. Therefore, it is impossible to infer all stroke patients who have delayed medical treatment in Taiwan. The stroke patients who had aphasia and were too late to seek medical treatment were excluded from the study subjects, so their experience was not presented. Despite the above limitations, our research still provides relevant factors leading to the delay in the treatment of patients with first-episode stroke. It is hoped that the findings of the study can serve as a reference for the government to develop strategies to improve the delay of stroke patients in obtaining medical treatment. Future research should further design intervention measures to improve the ability of the public to correctly manage strokes.

## Conclusion

Acute ischaemic stroke patients with prehospital delay were full of hesitation and were puzzled before arriving the hospital. "Hesitation and puzzling" was the core category, and the causes of delay were the inability to recognize stroke symptoms, incorrect self-treatment, choosing to go to the clinic first and failure to use emergency medical services. Our research emphasizes the importance of educating the community residents about identifying stroke symptoms and correct stroke treatments, allowing the public to understand that stroke symptoms will have different neurological symptoms due to different parts of the brain affected by stroke. It was necessary to provide a common understanding of the related basilar artery and stroke neurological symptoms posterior to cerebral vascular circulation. Breaking the myth of bloodletting is a key to helping people correctly identify stroke symptoms and quickly seek medical treatment. Therefore, to improve the delay of medical treatment for patients with stroke, in addition to actively advocating FAST to the public, it is imperative to provide education to identify the symptoms related to strokes and correctly manage strokes.

# Abbreviations

FAST

Face-Arms-Speech-Time

rt-PA

recombinant tissue plasminogen activator

ER

Emergency room

EMS

Emergency Medical Service

MOHW

Ministry of Health and Welfare

CAM

Complementary and alternative medicine

# Declarations

## **Ethics approval and consent to participate:**

This study was approved by the Landseed International Hospital Institutional Review Board of the research hospital (Approval No. 18-010-B1). The study was initiated once the participants provided their consent and signed the consent form.

**Consent to publication:** Not applicable.

## **Availability of data and materials:**

The datasets used and analysed during the current study are available from the corresponding authors on reasonable request.

## **Competing interests**

The authors declare no conflict of interest.

## **Funding: no funding**

## **Authors' contributions:**

Pao-Yu Wang: Conceptualization, Methodology, Investigation, Data Curation, Writing - Original Draft

Lee-Ing Tsao: Methodology, Writing - Review & Editing, Supervision

Mei-Hsiang Lin: Methodology, Writing - Review & Editing

Yu-Wei Chen: Resources, Project administration

Ying-Tao Lo: Resources, Investigation

All authors contributed to writing, revising, and approved the final manuscript.

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### **Author details:**

<sup>1</sup> Department of Nursing, MacKay Junior College of Medicine, Nursing and Management, Taiwan, R.O.C.

<sup>2,3</sup> Department of Nursing, National Taipei University of Nursing and Health Sciences, Taiwan, R.O.C.

<sup>4</sup> Department of Landseed Neuroscience Center, Landseed International Hospital, Taiwan, R.O.C./  
Department of Neurology, National Taiwan University Hospital, Taiwan, R.O.C.

<sup>5</sup> Department of Division of Marketing Planning, Landseed International Hospital, Taiwan, R.O.C.

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## Figures

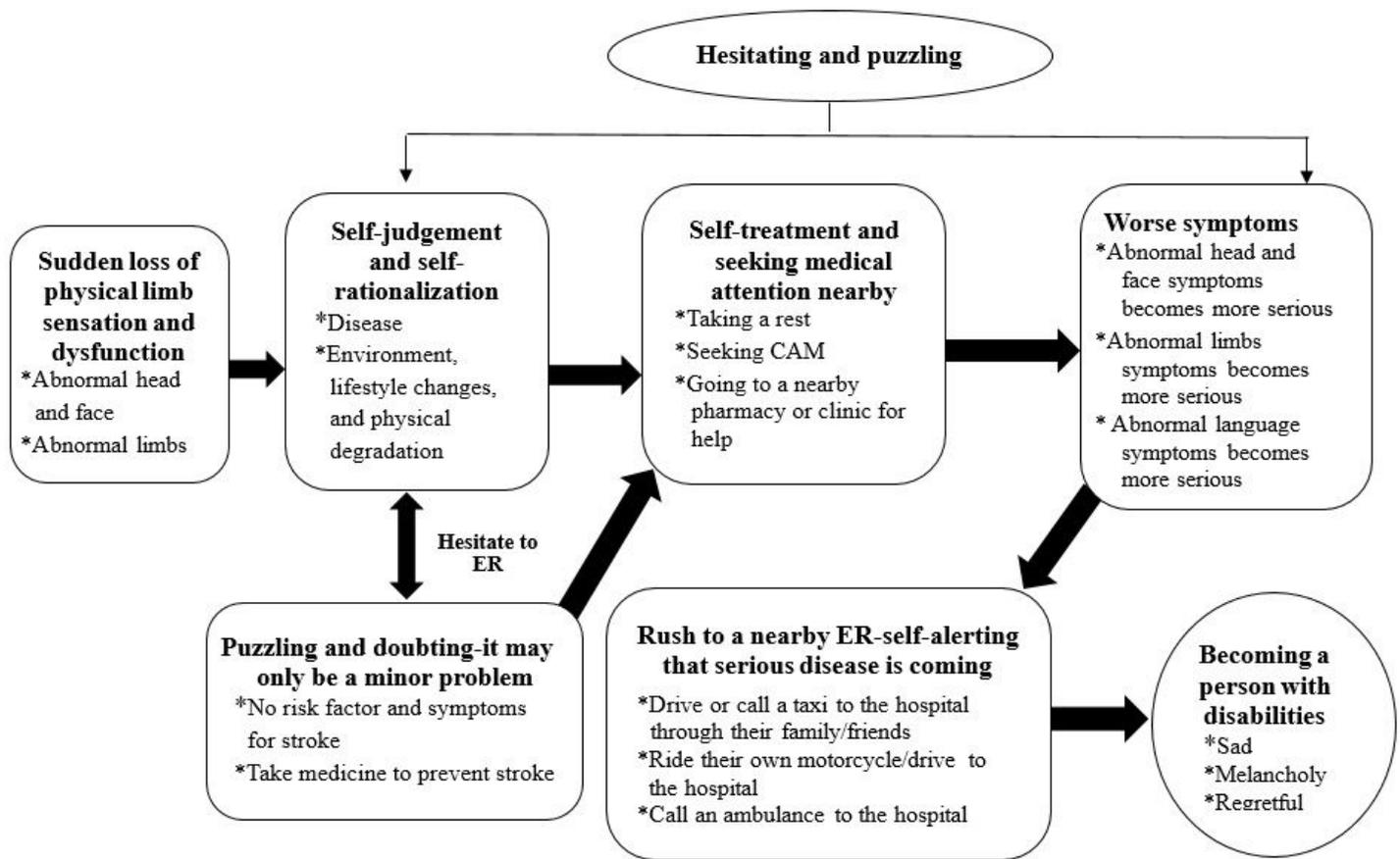


Figure 1

The theoretical framework