BARRIERS TO TIMELY STROKE CARE

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Abstract: Introduction: *Timely treatment is essential in acute ischemic stroke, but prehospital delays often prevent patients from receiving thrombolysis within the therapeutic window.* ***Purpose:*** *This study aimed to identify predictors of delay and explore barriers to prompt stroke care.* ***Methods:*** *A convergent mixed-methods approach was used at a teaching and stroke-ready hospital, involving nine ischemic stroke patients who arrived more than 4.5 hours after symptom onset. Structured questionnaires and semi-structured interviews were conducted, with quantitative data analyzed descriptively and qualitative data thematically. Findings from both methods were integrated using a joint display matrix.* ***Results:*** *All patients arrived after the treatment window, with a median time from onset to hospital of 14 hours. Most participants had low education levels and income, with 56% failing to recognize stroke symptoms and only 22% knowing the ambulance number. Thematic analysis identified four main barriers: symptom misinterpretation, limited stroke awareness, family-centered decision-making, and logistical or systemic obstacles.* ***Discussion:*** *Prehospital delay results from a cascade of personal, social, and systemic factors rather than a single cause. Even with universal health coverage, delays persisted, underscoring the urgent need for community education to improve stroke symptom recognition and for systemic reforms to strengthen emergency care pathways*

INTRODUCTION

Stroke remains a major global health issue, ranking as the second most common cause of death and a leading cause of disability worldwide (Edakkattil et al., 2024). According to the Global Burden of Disease study, stroke contributes significantly to global morbidity, ranking third in disability-adjusted life years (DALYs) lost (Murphy SJ and Werring DJ, 2020). Each year, about 15 million people worldwide are affected by stroke. Of these, 5 million die,

and another 5 million live with long-lasting disabilities (WHO, 2025). In Indonesia, the impact is especially severe, with the highest stroke mortality rate in Southeast Asia (193.3 per 100,000 people), along with the highest number of DALYs lost (3,382.2 per 100,000) due to stroke. The prevalence of stroke is 0.0017% in rural areas and 0.022% in urban areas (Venketasubramanian, Yudiarto, and Tugasworo, 2022).

A cerebrovascular accident not only impacts the individual but also imposes a considerable burden on caregivers, families, and society at large. Timely intervention is essential to minimizing morbidity and mortality. Effective treatment depends on rapid response, as underscored by the phrase "time is brain," which emphasizes the rapid loss of brain cells during a stroke. The optimal window for reperfusion therapies is within 4.5 hours of symptom onset, with the most favorable outcomes observed when treatment is initiated within the first 90 minutes (Murphy et al., 2020). Although the availability of stroke-ready hospitals has increased in several regions, many patients nonetheless do not access appropriate care promptly. Prehospital delays remain a persistent global challenge. In the United States, only a limited proportion of eligible patients receive recombinant tissue plasminogen activator (rt-PA), whereas in Thailand, treatment rates are as low as 3.8–5.5%, primarily due to delayed arrival beyond the therapeutic window (Wanichanon et al., 2024; Krishnan et al., 2025). These trends indicate significant barriers at the community level that impede timely access to stroke treatment.

In Indonesia, empirical data on prehospital delay remain limited, particularly in suburban areas. This mixed-methods study aims to explore the causes of prehospital delays among acute stroke patients treated at Sebelas Maret Teaching Hospital, a stroke-ready hospital in Sukoharjo, Central Java, to support the development of more effective and responsive stroke care strategies.

METHODS

Study Design and Setting

We conducted a convergent mixed-methods study to investigate predictors of prehospital delay in stroke treatment. Quantitative and qualitative data were gathered in June 2025. The study was conducted at the Neurology Ward of Universitas Sebelas Maret (UNS) Hospital, a tertiary teaching hospital in Central Java, Indonesia. Ethics approval was obtained from the institutional review board, and all participants provided informed consent before enrollment.

Participants

Participants were recruited through purposive sampling. Eligible participants were adults (≥18 years) admitted with a diagnosis of acute ischemic stroke confirmed by computed tomography (CT), presenting more than 4.5 hours from symptom onset to the hospital emergency department, and who were clinically stable with enough ability to take part in the interview. Patients with wake-up stroke or those unable to communicate effectively were excluded.

Data Collection

Quantitative data were collected using a structured questionnaire administered in Indonesian to each participant. The questionnaire was developed by the research team, with reference to prior studies on stroke delay, and covered demographics, clinical characteristics,

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stroke knowledge, and acute response behaviors. All participants provided written consent to complete the questionnaire, and researchers were available to clarify any item in case of low literacy or health literacy, ensuring data quality.

Qualitative data were collected through semi-structured interviews after the completion of the questionnaire. These interviews were conducted in a confidential setting by trained researchers in Bahasa Indonesia, with each session lasting approximately 15 to 30 minutes. An interview guide featuring open-ended questions was used to investigate the patients' experiences from symptom onset to hospital arrival, including perceptions, decision-making processes, and any barriers encountered during this period. Additionally, field notes were recorded to document non-verbal cues and contextual details.

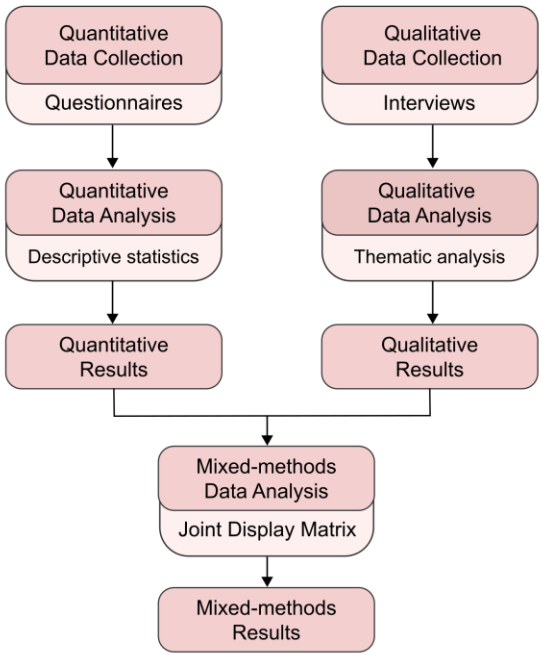

Figure 1. Mixed-methods Study Design

Data Analysis

Quantitative data were analyzed using descriptive statistics. We summarized patient sociodemographic and clinical characteristics using appropriate measures. Categorical variables were presented as frequencies and percentages, while continuous variables were reported as medians with ranges. Key time intervals, such as onset-to-hospital time (in hours) and travel time from home to hospital (in minutes), were calculated. Key outcome measures related to prehospital delay were also described. Qualitative data were analyzed using a thematic analysis to identify and report patterns in participants' responses.

The integration of quantitative and qualitative results occurred during the analysis's convergence phase. We constructed a joint display matrix, a table that aligns quantitative findings with related qualitative themes and illustrative quotes, to visualize the interaction between the two strands of data. This helped assess the degree of fit between datasets about barriers to timely stroke care.

RESULT

Nine patients with acute ischemic stroke met the inclusion criteria and were enrolled. Table 1 summarizes the demographic and clinical characteristics of the participants. The median age was 59 (50.5-68.5) years, and 56% (5/9) were male. Most patients were married (78%), had low educational attainment (55% with no or only primary schooling), and had low socioeconomic status, with 56% unemployed and many reporting household incomes < Rp 1,000,000 per month. Over half (56%) resided in urban areas, and the rest (44%) in rural areas, classified by distance from the city center. All were covered by national health insurance (BPJS). Clinically, stroke severity was mild to moderate, with a median NIHSS score of 4 (3,5-6) among nine patients with documented scores. Hypertension was present in all, and type 2 diabetes in five patients. The median travel time from home to hospital was 25 (12.5-60) minutes, while the median onset-to-treatment time was 14 (5.5-23.8) hours.

Qualitative Results

Through thematic analysis of the interview transcripts, we identified four major themes that encapsulate patients' experiences and perceptions regarding their delayed arrival. Despite the small sample, the narratives were rich and showed considerable consistency on several underlying issues. The four themes were: (1) Symptom Misinterpretation and Underestimation, (2) Limited Stroke Awareness and Knowledge Gaps, (3) Decision-making: Role of Family vs. Self, and (4) Logistical and Systemic Barriers. Each theme is described below, accompanied by illustrative quotes.

1. Symptom Misinterpretation and Underestimation

Patients commonly misinterpreted or underestimated their initial symptoms, attributing them to minor or familiar conditions. This tendency led to delays in seeking hospital care, as early warning signs were not recognized as serious. For instance, one participant explained, "*I thought my blood pressure was high, so my son bought me medicine from the pharmacy. When it did not help, he took me to the hospital.*" Another recalled, "*Because I felt dizzy, I thought it was just ordinary vertigo.*"

Some participants also minimized the seriousness of their condition by continuing their daily activities or relying on home-based care, which led them to delay seeking hospital treatment until their condition worsened. As one shared, "*I thought it was just a normal illness, but my family thought I had another stroke." At* the same time, another explained, "*I finished my work first because I thought rest would make it better, but the symptoms got worse and I was taken to the hospital,*" In some cases, families first sought treatment at home "*When the symptoms started, my family called a nurse and I was given drug and put on a drip, but when I did not improve, I was taken to the hospital*." Despite attempts to rationalize or downplay the symptoms, underlying fears persisted. One participant expressed, "*I was worried that I might be having another stroke.*"

2. Limited Stroke Awareness and Knowledge Gaps

Another important theme was the gap in stroke-specific knowledge, particularly regarding the need for urgent care. While some participants had heard of stroke and could recount the importance of fast treatment, their depth of understanding was limited. For example, one participant confessed: *"I did not know that there is a time limit for treating stroke. I thought if I went to get rest, I might get better,"* Another said he knew the stroke was severe but did not recognize the symptoms: *"I did not realize these symptoms were from a*

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stroke. I thought another illness caused it." Even those who knew the general concept of stroke often lacked practical knowledge, such as what exact steps to take at onset or how to call an ambulance. The interviews also revealed partial misconceptions, as one patient associated stroke only with very severe symptoms, so when he had milder symptoms, he did not consider stroke as a possibility. These qualitative insights align with the survey findings, which suggest that general awareness does not always translate into correct action.

3. Decision-Making: Role of Family vs. Self

Decisions about whether and when to seek hospital care were rarely made solely by patients. In most cases, families played a decisive role. Seven out of nine participants reported that family members determined when they should go to the hospital. For example, one patient explained: "*My son decided because he suspected stroke due to my previous stroke history*." Another participant said that her family was worried that she had a stroke, so the family brought her to the hospital. Another said, "*I was scared, so my family had to convince me to go.*" These accounts illustrate how family members frequently took responsibility for interpreting symptoms and initiating medical help.

Patients who attempted to rely on themselves often delayed their treatment. One patient, a driver, admitted that he continued working because he believed the complaints would subside with rest. However, after his condition worsened, he finally went to the hospital. This demonstrates how self-decision, without family pressure, may prolong treatment delays. Overall, this reveals that patients typically relied on their families. In this cultural context, health-seeking behavior was deeply embedded in family dynamics, and the absence of decisive family action often resulted in longer delays.

4. Logistical and Systemic Barriers

Beyond personal perceptions, participants described several practical barriers in the prehospital phase that delayed timely hospital arrival. Transportation problems were frequently mentioned. One participant cited "*difficulties with accommodation*" as the reason for not seeking care immediately. Another patient said, "*There was no transportation and no one to help lift me into the ambulance*." Another highlighted how environmental and temporal conditions compounded the delay: "*The symptoms began at around 1 a.m., but because it was raining heavily, I chose to wait until morning.*"

A different participant highlighted how work obligations and timing interfered with prompt action. "*As I was working as a driver delivering goods out of town, I prioritized completing the job, assuming the symptoms would resolve with rest. My son took over driving when the symptoms appeared, but I only sought hospital care after finishing the delivery, once the condition worsened*." This illustrates how employment or duty can lead someone to downplay health issues, effectively delaying treatment until a more appropriate time.

Hospital capacity also contributed to delays. One participant explained, "*We first intended to go to Banyu Bening Hospital, but it was full, so we went instead to UNS Hospital, which was relatively close.*" This detour resulted in additional time loss, highlighting how limited bed availability at local facilities can extend the optimal treatment window for patients. These accounts demonstrate that even when patients are willing to seek help, external barriers, such as limited transportation availability, unfavorable environmental conditions, and healthcare system limitations, can significantly prolong the process. While most participants emphasized obstacles, a few facilitators were also noted. For instance,

prior familiarity with the UNS hospital or family members working there influenced faster decision-making.

Table 1. Relationship of Demographic Characteristics with Independence of the Elderly

Characteristic	Patients (N=9)
Age (years), median(IQR)	59(50,5-68,5)
Sex	
Male, n (%)	5 (56%)
Female, n (%)	4 (44%)
Marital status	
Married, n (%)	7 (78%)
Widowed/Divorced, n (%)	2 (22%)
Education level	
No Schooling, n (%)	2 (22%)
Primary, n (%)	3 (33%)
High School, n (%)	3 (33%)
Diploma/College, n (%)	1 (11%)
Geographic classification	
Urban, n (%)	5 (56%)
Rural, n (%)	4 (44%)
Employment status	
Unemployed/Household, n (%)	5 (56%)
Informal Job, n (%)	4 (44%)
Monthly income	
No Income , n (%)	5 (56%)
<Rp 1.000.000, n (%)	4 (44%)
Stroke severity (NIHSS), median(IQR)	4(3,5-6)
Common comorbidities	
Hypertension, n (%)	9 (100%)
Diabetes, n (%)	5 (56%)
Time to Hospital, median(IQR)*	25(12,5-60)
Symptoms to Treatment, median(IQR) **	14(5,5-23,8)
Insurance coverage	
National Health Insurance, n (%)	9 (100%)

*In minutes
** In Hours

Table 2. Patient knowledge, initial response, and help-seeking indicators (N = 9)

Knowledge/Behavior Item	Number of patients (% of N=9)
Knew about stroke before	
Yes	6(67%)
No	3(33%)
Recognized symptoms as stroke at onset	
Yes	4(44%)
No	5(56%)

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Knew a treatment time window for stroke	
Yes	7(78%) said "as soon as possible" (various estimates)
No	2(22%)
Initial action after symptom onset	
Immediately informed family or someone nearby	3(33%)
Waited at home (hoping symptoms improve)	2(22%)
Sought medical help (clinic/health worker)	2(22%)
Other (went to a different hospital first)	1(11%)
No clear action	1(11%)
Decision-maker for going to hospital	
Family member decided/ pushed to go	7(78%)
Patient themself decided	2(22%)
Transport mode to hospital	
Car/Motorcycle	6(67%)
Ambulance	3(33%)
Knew the emergency ambulance number (119)	
Yes	2(22%)
No	7(78%)
Ambulance available in area at that time	
Yes	3(33%)
No	4(44%)
Not Sure	2(22%)

Table 3. Joint Display Matrix

Key Aspect	Quantitative Findings	Qualitative Findings	Integrated Interpretation
Symptom Misinterpretation & Underestimation	5/9 patients (56%) did not recognize their symptoms as stroke at onset, while 3/9 patients (33%) underestimated the seriousness by waiting at home or taking no clear action, assuming the symptoms would improve on their own.	Several patients misinterpreted or downplayed their symptoms. For example, one said, *"I thought it was just ordinary vertigo,"* while another recalled, *"I thought rest would make it better."*	Both strands of data indicate that patients often misunderstood early stroke symptoms as benign, leading them to delay seeking care due to a false sense of security.

Limited Stroke Awareness & Knowledge Gaps	3/9 patients (33%) had no prior knowledge of stroke and many were unsure of the recommended treatment time window. Several simply answered "*as soon as possible*," and at least 2 admitted they did not know the time frame.	Participants reported significant knowledge gaps. One admitted, "*My knowledge about stroke was still lacking,*" and another did not recognize the signs, explaining, "*I didn't realize those symptoms were from a stroke, I thought it was caused by another illness.*"	Quantitative and qualitative findings converge on a lack of stroke-specific knowledge. Even those aware of stroke often did not understand the urgency or how to respond appropriately, highlighting an educational gap.
Decision-Making: Family vs. Self	In 7/9 cases (78%), a family member made the decision to seek medical help, rather than the patient	One patient described about who made the decision to bring her to the hospital "*My son made the decision because he suspected stroke due to my previous stroke history.*" Another noted, "*I was scared, so my family had to convince me to go.*"	Survey results and interviews both emphasize the crucial role of family in care-seeking decisions. Patients often relied on family to recognize the emergency and initiate transport, especially when the patient was hesitant or impaired.
Logistical & System-Level Barriers	Only 3/9 patients (33%) arrived by ambulance, while the remaining patients used private vehicles (4 by car, 1 by motorcycle). 6/9 (67%) did not know the emergency ambulance number, and a similar proportion reported no ambulance available locally or could not use a phone	One patient noted, "*There was no transportation and no one to help lift me into the ambulance*," Another delayed going to the hospital, "*The symptoms began at around 1 a.m., but because it was raining heavily, I chose to wait until morning.*"	Both data sources highlight external barriers. Limited access to ambulance services, lack of transport or assistance at critical moments, and inconvenient timing like nighttime frequently impeded rapid hospital arrival, even

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	to call for help. Travel times varied widely, ranging from approximately 10 minutes to 2 hours.	though financial cost was not an issue (all patients were insured).

Discussion

In this mixed-methods study, we identified several critical barriers contributing to prehospital delays in acute stroke care. These delays arise from the interplay of symptom misinterpretation, limited stroke knowledge, family-centered decision-making, and logistical constraints such as limited ambulance use, nighttime onset, and hospital overcrowding. The findings reveal that early symptoms are frequently underestimated or misattributed, and family members defer decisive action; structural barriers further prolong the critical timeline for intervention. Collectively, these results suggest that prehospital delay is not a single point failure but a cascade of personal, social, and system-level barriers. Even when financial costs were not an obstacle due to universal insurance coverage, delays persisted, underscoring that effective solutions must target recognition, decision-making, and emergency system readiness simultaneously.

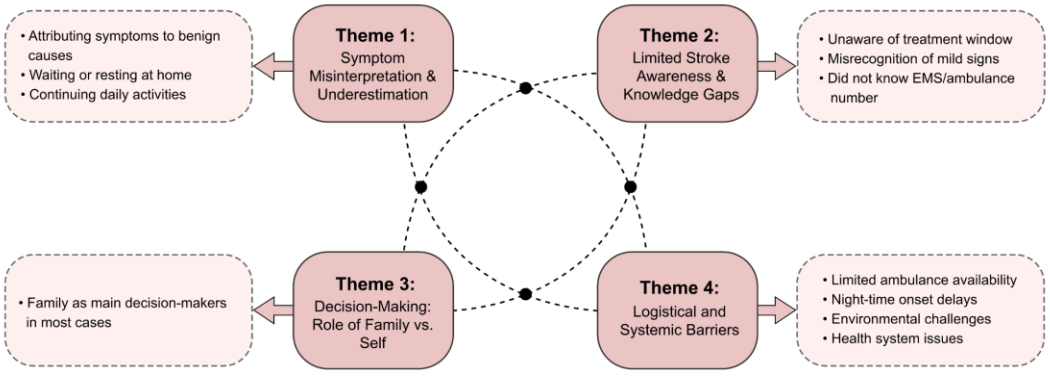

Figure 2. Themes and Subthemes of Prehospital Delays in Acute Stroke Care

Symptom misinterpretation was evident in both the quantitative and qualitative components of our study and emerged as a central factor in prehospital delay. Quantitatively, more than half of the participants (56%) failed to recognize their initial neurological symptoms as indicative of stroke. Misinterpretation of early symptoms as fatigue, gastritis, or vertigo/headache was common. Echoing findings across LMICs, where cultural beliefs and health literacy gaps often drive symptom trivialization (Wiyarta et al., 2024). Qualitative interviews provided further depth, revealing that patients frequently attributed early signs to non-serious conditions, tried home remedies, and felt uncertain or afraid. These findings closely parallel the results of Alegiani et al. (2019), who observed that despite a proportion of patients suspecting stroke, the most common first reaction (70%) was to wait for symptom resolution, often influenced by feelings of uncertainty, denial, or shame. Knowledge gaps regarding stroke emerged as a consistent barrier to timely treatment in our study. Quantitatively, 67% of patients reported having heard of stroke, and fewer than half (44%)

correctly recognized their own symptoms as stroke. Qualitative findings added further: participants often expressed only partial understanding, such as knowing stroke was dangerous but lacking awareness of the treatment time window. Similarly, an extensive population-based survey in China found that although awareness of stroke existed, only a few individuals recognized the warning signs or knew they needed urgent care, indicating a lack of practical understanding (Lin et al., 2025). These findings resonate with the recent systematic review and meta-analysis by Ganeti et al. (2025), which identified a lack of stroke symptom awareness as a key determinant of prehospital delay in Africa, with patients who were unaware being more than four times as likely to arrive late to the hospital (AOR = 4.43, 95% CI: 1.04–7.83). Awareness of stroke remained limited in our study. This contrasts with higher awareness levels reported (Jackson et al., 2020) in Western contexts, though even there, uncertainty about unusual stroke symptoms, such as headaches, still contributes to delays in seeking treatment.

The decision to seek hospital care for stroke was mainly made by family members rather than patients themselves. In this study, 78% of patients relied on relatives to decide for them or were encouraged to go, while only 22% made the decision independently. Qualitative accounts confirmed this, with participants describing how spouses, children, or other relatives insisted on immediate hospital transfer. Family involvement was central to decision-making, reflecting collectivist cultural norms observed in other Asian settings, such as research conducted in China (Han et al., 2025), where relatives often override or delay patient action to obtain immediate medical care. Patients usually relied on them to confirm symptoms or decide what to do. Bystanders sometimes pushed patients to seek help, but they could also cause delays by misjudging the situation or avoiding responsibility (Mellor et al., 2015).

Logistical and systemic barriers often delay stroke care. In our study, only 22% of patients knew the ambulance number, and many reported that there was no ambulance service in their area. Patients also mentioned transportation problems, adverse weather conditions, personal commitments, and even full hospitals as reasons for delay. Similarly, Brice et al. (2022) reported low ambulance use in Jakarta, with fewer than 10% of patients arriving at hospitals by ambulance. 37.9% of patients were unaware that ambulance services existed. Response times were also slow (median 24 minutes) due to traffic and the low priority given to ambulances, while high costs further discouraged their use (Brice et al., 2022). Patients often rely on private vehicles, while in rural areas, long travel times, poor connectivity, and a shortage of health workers are standard (Sebastian et al., 2023; Zachrison et al., 2023). Low public awareness, inadequate access, and high costs, mirroring rural challenges worldwide (Mathur et al., 2019). Unique to our setting, hospital overcrowding underscored infrastructure gaps that compound delays. Such findings suggest that improving stroke outcomes requires both community education and system-level reforms.

The findings of this study underscore the importance of enhancing public awareness about stroke. Patients often underestimate the significance of early symptoms, which contributes to delays in seeking medical care. Enhancing health education and awareness initiatives could improve recognition of stroke warning signs and reduce the time to treatment. This is not only crucial for patients but also for their families, as the decision to seek medical assistance is often influenced by family awareness and responsiveness. Most

patients in this study arrived at the hospital using their own vehicles, mainly because they or their families were unaware of available emergency medical service (EMS) contacts in their area. Interestingly, patients who arrived by ambulance also tended to present late, reporting hesitancy to call EMS and challenges such as the unavailability of ambulance drivers. Policy initiatives should encourage ambulance utilization, such as subsidizing EMS fees for stroke cases, and facilitate direct transfers to stroke-ready hospitals, thereby reducing delays associated with multi-step referrals.

Limitations Of This Study

The limitation of this study is reliance on self-reported information, which introduces potential recall bias, and only limited clinical details were captured.

CONCLUSIONS

This study shows that several factors, including poor recognition of symptoms, reliance on family decisions, low ambulance use, and system challenges such as transport difficulties, cause delays in stroke treatment. These delays occur even when costs are covered, indicating that awareness and system readiness are more important than cost coverage. To improve stroke outcomes, it is crucial to enhance community education about stroke symptoms, foster prompt family action, and strengthen the reliability of emergency services and hospital systems.

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