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The Association between Family Knowledge and Response with Pre-hospital Delay among Stroke Patients: A Study from Rural Area of Cirebon, Indonesia

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ABSTRACT

Background: Stroke is a non-communicable disease whose prevalence continues to increase in both young and old age groups. Stroke patients require immediate treatment at the hospital to prevent disability and death. Delayed treatment may result in a worse prognosis.

Aims: To analyze the relationship between family knowledge and response with pre-hospital delay in stroke patients in Cirebon Regency, Indonesia.

Methods: This cross-sectional study was conducted at Waled General Hospital, Cirebon Regency, Indonesia. The sampling technique used was consecutive sampling of patients hospitalized with stroke diagnosis from May 2024 to July 2024. Patients with recurrent stroke were excluded. Data were collected from medical records and questionnaires administered to the patient's families. The Indonesian version of Stroke Recognition Questionnaire (SQR) was used to explore family knowledge, while family responses were explored using the Stroke Action Test (STAT).

Results: There were 61 stroke patients recruited in this study. Majority of the sample were delivered to hospital late (78.7%). Most of the patients' families had poor knowledge (47.5%) and inadequate attitudes (85.2%). In the bivariate analysis, there was a strong correlation between family knowledge of stroke symptoms and pre-hospital delay ($p < 0.001$; $r = 0.746$). Inadequate family response was associated with pre-hospital delay [$p = 0.002$; PR 2.596 (95%CI 1.024-6.581)].

Conclusion: There is a positive correlation between family knowledge and response with pre-hospital delay in stroke patients in Cirebon Regency, Indonesia.

Keywords: Attitude, Family knowledge, Family response, Pre-hospital delay, Stroke.

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1. Introduction

Stroke is one of non-communicable diseases that causes high morbidity and mortality throughout the world. Globally, stroke is the second leading cause of death and the third leading cause of disability. Based on data from the World Health Organization (WHO), at least 15 billion people worldwide experience stroke each year. Of these, 5 billion of them die and another 5 billion can be saved but live with disability (World Health Organization, 2024). An estimated 70% of stroke cases occur in low- and middle-income countries, including Indonesia (World Health Organization, 2024).

Epidemiologic data in Indonesia shows that stroke is the leading cause of death. Based on RISKESDAS 2018, the prevalence of stroke in Indonesia increased from 7 per 1,000 population in 2013 to 10.9 per 1,000 population in 2018. In West Java province, the prevalence of stroke was 11.4% in the population aged ≥ 15 years. This number continues to increase due to the unhealthy lifestyle of Indonesian people. Stroke also causes a huge economic burden for the National Health Insurance (JKN), so it is called a catastrophic disease. Data shows that JKN financing for stroke treatment is the third largest after heart disease and cancer. The cost reached IDR 1.911 trillion in 2021 and increased to IDR 3.23 trillion in 2022 (Direktorat Jenderal Pelayanan Kesehatan-Kementerian Kesehatan Republik Indonesia, 2023; Kementerian Kesehatan Republik Indonesia, 2018).

One of the problems faced in the management of stroke patients is the delay in patients coming to the emergency room so that it is late to provide optimal treatment. Pre-hospital delay is the prolonged time from the onset of symptoms until the patient arrives at the hospital (Wang et al., 2021). If stroke patients are immediately given appropriate treatment, it can provide a better prognosis, namely preventing death and disability. Pre-hospital delay includes delay in recognizing stroke symptoms and delay in responding to deliver patient to health service. In this case, the family plays a very important role (Wanichanon et al., 2024).

Knowing the description of family knowledge about stroke symptoms, their responses, and its relationship with pre-hospital delay is very important. It can illustrate the burden in stroke management, especially from the patient's family factor. However, such data is still very limited, including in Cirebon Regency, Indonesia. Therefore, this study was conducted with the aim of finding out the description of stroke patient family knowledge regarding stroke symptoms and their responses. In addition, this study also aimed to determine the relationship between family knowledge and response with pre-hospital delay in stroke patients at Waled General Hospital, Cirebon Regency, Indonesia. Our study focuses on first-ever stroke patients, where rapid treatment greatly affects the outcome (Prasanna & Forshing, 2023; Randhawa et al., 2022; Wechsler et al., 2023).

2. Methods

Study design and participants

This is a cross-sectional study conducted at Waled General Hospital, as one of the largest referral hospitals in Cirebon district. The sample was hospitalized patients with a stroke diagnosis from May 2024 to July 2024 and their families. The diagnosis of stroke was known through the diagnosis sheet in the medical record based on neurologist assessment. The sampling technique used was consecutive sampling. The calculation of the sample size used the proportion estimation formula and obtained 61 samples.

The inclusion criteria in this study were patients with acute ischemic and hemorrhagic stroke. The inclusion criteria of the patient's family were >18 years old, living in the same house with the patient and knowing the patient's condition. We excluded patients with transient ischemic attack (TIA), recurrent stroke and patients who were not accompanied by their families.

Data collection and definition of variables

Data for this study were collected through medical records and questionnaires completed by the patients' families. Stroke patient characteristics (gender, age and type of stroke) and arrival time to the hospital emergency department were collected from patients' medical records. Families accompanying the patients in the inpatient ward were asked about stroke onset, distance from home to hospital, transportation to hospital and family

characteristics (gender, age, education level). Families were also asked to complete a questionnaire exploring family knowledge and responses.

Family knowledge

Family knowledge is the level of knowledge of the patient's family regarding stroke symptoms. Data on family knowledge was collected using validated Indonesian version of the Stroke Recognition Questionnaire (SRQ) (Herliani, 2023). There were 17 questions with "yes" and "no" answer options. Family knowledge of stroke symptoms was categorized as poor if they could answer <56% of the questions correctly, sufficient if 56-75% and good if >75-100%.

Family response

Family response was defined as actions taken by the family in several conditions related to the occurrence of stroke. It was measured using the Stroke Action Test (STAT) which consists of 21 questions. Response options in this questionnaire include: [1] "immediately call an ambulance or go to the emergency room", [2] "immediately call or visit a doctor", [3] "wait 1 hour then decide to take the patient to the hospital" and [4] "wait 1 day to decide to take the patient to the hospital". Family response was categorized as inadequate if $\leq 77\%$ of the selected answers are [1] and [2]. Adequate response if $> 77\%$ of the selected answers were [3] and [4] (Sumarsono, 2019).

Pre-hospital delay

The operational definition of pre-hospital delay in this study is the duration of time between the onset of stroke and the patient's arrival at the hospital emergency department. We asked the patient's family when the patient felt the stroke symptoms and recorded arrival time from medical record. If the time duration is ≥ 24 hours then the patient is categorized as pre-hospital delay.

Data analysis

This data is presented in tables and graphs to describe the frequency and percentage values of the variables. Numerical data for age variable is described through median, interquartile range and min-max values. Bivariate analysis to determine the relationship between family knowledge and pre-hospital delay was carried out using the Spearman Rank test to obtain the p-value and correlation coefficient. The relationship between family response and pre-hospital delay was performed using Fisher's exact test. A p value of < 0.05 was considered as statistically significant. Analysis was performed using SPSS Version 26 software.

Ethical approval

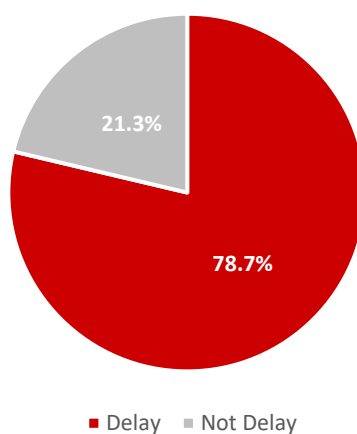
Respondents were given informed consent regarding the research procedures before data was collected. Those who agreed were then asked to sign the consent form. This study has obtained ethical approval from the Ethics Committee of Waled General Hospital No: 000.9.2/060/KEPK/V/2024.

3. Results

In this study, 61 stroke patients were recruited as samples during the study period. The characteristics of stroke patients during the study period are summarized in Table 1. Most of stroke patients were male (60.7%). Based on age, stroke was dominated by the 50-59 years age group, with an age range of 25-85 years. This study also found that stroke occurred in younger age groups, namely 20-29 years (4.9%) and 30-49 (14.8%). A total of 85.2% of the samples experienced ischemic stroke. Most stroke patients lived close to the hospital (80.3%), and there were 8.2% whose homes were quite far from the hospital (> 20 km). As many as 24.6% of stroke patients were brought to the hospital by ambulance. Figure 1 shows that as many as 78.7% of stroke patients arrived late at the hospital. Pre-hospital delay occurred in 76.9% of ischemic stroke and 88.9% of hemorrhagic stroke (Figure 2).

Table 1. Characteristics of stroke patients (n=61)

Characteristics	Frequency	Percentage
Gender		
Male	37	60.7
Female	24	39.3
Age (years)		
20-29	3	4.9
30-49	9	14.8
50-59	26	42.6
≥60	23	37.7
Median	58	
Q1-Q3	50-64	
Min-max	25-85	
Types of stroke		
Ischemic stroke	52	85.2
Hemorrhagic stroke	9	14.9
Distance from home to hospital		
<10 km	49	80.3
10-20 km	7	11.5
>20 km	5	8.2
Transportation to hospital		
Ambulance	15	24.6
Others	46	75.4

**Figure 1.** Proportion of pre-hospital delay in stroke patients

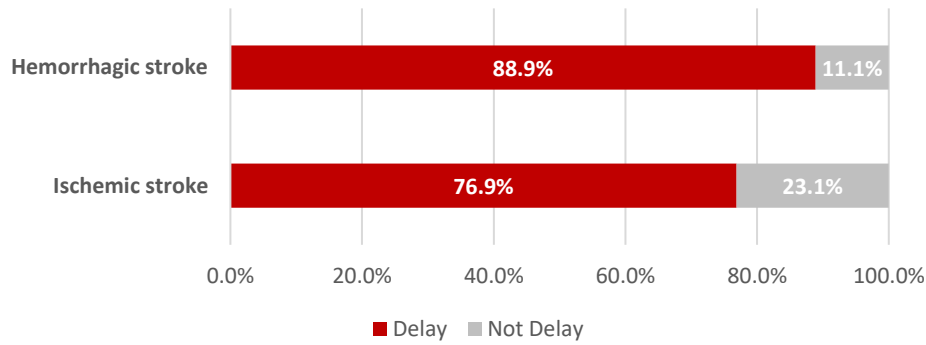


Figure 2. Pre-hospital delay based on type of stroke

The characteristics of stroke patients’ families are summarized in Table 2. In this study, 45.9% of the patients' families were male and 54.1% were female. The families were mostly aged 30-49 years (62.3%), with a median age of 40 years and an interquartile range 34-49.5 years. The majority of families were junior high school graduates (44.3%) and 21.3% were elementary school graduates. Nearly half of the respondents were taken to hospital and accompanied by their wives or husbands. This study found that most of patient's families had poor knowledge of stroke symptoms (47.5%). In addition, most of them also had inadequate responses in taking action when stroke symptoms occurred (85.2%).

Table 2. Characteristics of stroke patients’ families (n=61)

Characteristics	Frequency	Percentage
Gender		
Male	28	45.9
Female	33	54.1
Age (years)		
20-29	8	13.1
30-49	38	62.3
50-59	12	19.7
≥60	3	4.9
Median	40	
Q1-Q3	34-49.5	
Level of education		
Elementary school	13	21.3
Junior high school	27	44.3
Senior high school	16	26.2
University	5	8.2
Family relationship		
Wife or husband	29	47.5
Parent	7	11.5
Child	20	32.8
Others	5	8.2
Knowledge of stroke symptoms		
Poor	29	47.5
Moderate	20	32.8
Good	12	19.7
Family response		
Inadequate	52	85.2
Adequate	9	14.8

The families' knowledge of stroke symptoms and their responses were shown in Table 3. Most male (50%) and female (45.5%) families had poor knowledge of stroke symptoms. Poor knowledge was dominant in families aged ≥ 30 years, while in families aged 20-29 years more than half had moderate and good knowledge. The results showed that families with a low level of education had less knowledge. All families, whether wives, husbands, parents, children or others, mostly had poor knowledge. Present study showed that both male and female families mostly had inadequate responses. Inadequate responses were also seen predominantly in all age groups, education levels and family relationships.

Table 3. Families' knowledge of stroke symptoms and their response by characteristics; n(%)

Characteristics of family	Knowledge of stroke symptoms			Family response	
	Poor	Moderate	Good	Inadequate	Adequate
Gender					
Male	14 (50.0)	8 (28.6)	6 (21.4)	24 (85.7)	4 (14.3)
Female	15 (45.5)	12 (36.4)	6 (18.2)	28 (84.8)	5 (15.2)
Age (years)					
20-29	1 (12.5)	4 (50.0)	3 (37.5)	7 (87.5)	1 (12.5)
30-49	21 (55.3)	10 (26.3)	7 (18.4)	32 (84.2)	6 (15.8)
50-59	5 (41.7)	5 (41.7)	2 (16.7)	10 (83.3)	2 (16.7)
≥ 60	2 (66.7)	1 (33.3)	0	3 (100)	0
Level of education					
Elementary school	9 (69.2)	2 (15.4)	2 (15.4)	12 (92.3)	1 (7.7)
Junior high school	14 (51.9)	6 (22.2)	7 (25.9)	21 (77.8)	6 (22.2)
Senior high school	6 (37.5)	7 (43.8)	3 (18.8)	15 (93.8)	1 (6.3)
University	0	5 (100)	0	4 (80.0)	1 (20.0)
Family relation					
Wife or husband	14 (48.3)	8 (27.6)	7 (24.1)	25 (86.2)	4 (13.8)
Parent	3 (42.9)	2 (28.6)	2 (28.6)	6 (85.7)	1 (14.3)
Child	11 (55.0)	8 (40.0)	1 (5.0)	18 (90.0)	2 (10.0)
Others	1 (20.0)	2 (40.0)	2 (40.0)	3 (60.0)	2 (40.0)

The results showed that there was a strong relationship between family knowledge of stroke symptoms and pre-hospital delay in stroke patients ($p < 0.001$; $r = 0.746$). The better family's knowledge about stroke symptoms, the less frequent the pre-hospital delay (Table 4). The results of bivariate analysis also showed that there was a relationship between family response and pre-hospital delay (PR 2.596; 95%CI 1.024-6.581), as listed in Table 5.

Table 4. The correlation between family knowledge with pre-hospital delay in stroke patients

Knowledge of stroke symptoms	Pre-hospital delay		p-value	r
	Yes	No		
Poor	29 (100)	0	<0.001	0.746
Moderate	19 (95.0)	1 (5.0)		
Good	0	12 (100)		

Table 5. The correlation between family response with pre-hospital delay in stroke patients

Family response	Pre-hospital delay		p-value	PR; 95%CI (upper-lower)
	Yes	No		
Inadequate	45 (86.5)	7 (13.5)	0.002	2.596; 1.024-6.581
Adequate	3 (33.3)	6 (66.7)		

4. Discussion

Characteristics of stroke patients

Our results showed that stroke was more common in males than females. A multicenter study conducted in Surabaya, Indonesia also obtained similar results, with 57.94% males and 42.06% females (Minalloh et al., 2022). Likewise, data from the Indonesian Health Survey in 2023 showed that the prevalence of stroke in males population aged ≥ 15 years was 8.8 ‰ (95%CI 8.3-9.3), higher than that of females (7.9‰; 95%CI 7.4-8.4) (Kementerian Kesehatan Republik Indonesia, 2023). However, a study at Hasan Sadikin Hospital in Bandung, Indonesia found that more females (53.4%) experienced stroke than males (46.6%), although not significantly different (Jamilatul Badriyah et al., 2018). The incidence of stroke in males may be closely related to the higher prevalence of smoking in males compared to females, even at a young age. Based on Indonesian health survey data in 2023, 43.8% (95%CI 43.5-44.2) of males aged ≥ 18 years in Indonesia smoked every day (compared to 0.7% of females) (Kementerian Kesehatan Republik Indonesia, 2023). Based on meta-analysis, it was found that smoking was associated with an increased incidence of all types of stroke, with a pooled OR of 1.61; 95%CI 1.34-1.93 (Pan et al., 2019). Cigarettes contain more than 7,000 harmful ingredients that cause inflammation, endothelial dysfunction, dyslipidemia and prothrombotic states. Additionally, there is also impaired vasodilation and reduced nitric oxide bioavailability. Atherosclerosis, an increased risk of thrombosis leads to impaired brain perfusion which then leads to ischemic stroke. Smoking increases the risk of hemorrhagic stroke through disruption of vascular wall structure and rupture of aneurysm (Luo et al., 2022).

Interestingly, present study examined that a higher proportion of stroke in young adults, namely 4.9% at ages 20-29 years and 14.8% at ages 30-49 years. Research conducted at Hasan Sadikin Hospital in Bandung, Indonesia found stroke at the age of 15-24 years was 0.6%, 25-34 years was 2.6% and 35-44 years was 9% (Jamilatul Badriyah et al., 2018). These results are also in line with national data from RISKESDAS 2018 which showed a shift in stroke patients to a younger age, even at the age of 18-24 years. (Kementerian Kesehatan Republik Indonesia, 2018; Saraswati, 2021).

Stroke in young adults is defined as stroke experienced by an individual aged < 50 years. The prevalence trend of stroke in young adults continues to increase worldwide and is closely related to morbidity. It is influenced by several risk factors, such as hypertension, dyslipidemia, heart disease, obesity, diabetes mellitus, smoking, sedentary lifestyle and unhealthy eating habits in young adults (Andriyani et al., 2020; Balgis et al., 2022; Bukhari et al., 2023; Effendi et al., 2022; Faruq et al., 2021; Harlianti et al., 2018; Pratiwi & Surgana, 2024; Rachmawan et al., 2024). The increasing trend of stroke incidence in young adults occurs in many countries and needs serious attention. It has major consequences, especially in terms of psychosocial aspects of stroke sequelae in survivors, as well as being a huge burden for individuals, families and the government (Bukhari et al., 2023).

The current study found that ischemic stroke was more common than hemorrhagic stroke. Previous research at Hasan Sadikin Hospital Bandung, Indonesia also showed similar results that ischemic stroke occurred in 66,4% of patients and hemorrhagic stroke in 33,6% (Jamilatul Badriyah et al., 2018). However, a study conducted at Kandou Hospital Manado, Indonesia obtained different results that hemorrhagic stroke (58%) was more common than ischemic stroke (42%) (Barahama & Tangkudung, 2019).

Pre-hospital delay

The results examined that 78.7% of stroke patients arrived at the hospital late (> 24 hours from the onset of symptoms). As many as 76.9% of pre-hospital delays occurred in ischemic stroke and 88.9% in hemorrhagic stroke. Studies showed better outcomes in stroke patients who received treatment sooner than those who had missed the therapeutic window. The outcomes in stroke patients are time-dependent so treatment should be given as soon as possible, especially within 60 minutes of symptom onset (golden hour) (Advani et al., 2017; Anderson, 2016). Moreover, references showed better outcomes in the first 30 minutes of symptom onset, which is called the platinum 30 minutes (Randhawa et al., 2022).

The proportion of pre-hospital delays in this study was higher compared to several previous studies in Indonesia. A study in Manado, Indonesia showed a lower proportion of pre-hospital delay than our study, which was 48.5% (Barahama & Tangkudung, 2019). Previous study in Banjarmasin, Indonesia found that the proportion of pre-hospital delays was 34.7%. However, this study used a cut off of 3 hours to categorize delays (Julianto et al., 2023). The high proportion of pre-hospital delays in this study may be closely related to the characteristics of the rural population in this study, which is dominated by residents with low levels of education. Based on the type of stroke, pre-hospital delay was more common in hemorrhagic stroke compared to ischemic stroke, namely 88.9% and 76.9%. It is in line with a study in Manado, Indonesia that pre-hospital delay occurred 99.6% in hemorrhagic stroke and 0.4% in ischemic stroke, with a cut-off time of 4 hours (Tangkudung et al., 2019).

The relationship between family knowledge about stroke symptoms, family responses and pre-hospital delay in stroke patients

Our findings showed that most patients' families had poor knowledge of stroke symptoms, especially in those with low level of education. Family knowledge of stroke symptoms was strongly related to pre-hospital delay in stroke patients. These results are similar with previous studies in Gorontalo and Lombok, Indonesia (Ishak et al., 2020; Jusuf et al., 2023). Good family knowledge about the symptoms of stroke leads to the perception that the patient's condition is an emergency. Therefore, the patient's family will respond quickly by bringing the patient to health services. Conversely, poor family knowledge leads to the perception that the symptoms experienced by the patient are normal, so the patient is brought to the hospital after the condition worsens (Putri & Santoso, 2020).

Results also found that the majority of families had inadequate responses. It was known that an adequate family response can reduce the risk of pre-hospital delay. Pre-hospital delay mainly occurs when the decision to refer a patient requires the agreement of several family members. In this study, children as decision maker caused more pre-hospital delay compared to husbands or wives as decision makers. These results are in line with those obtained by previous study (Rahmawan et al., 2020).

The low level of knowledge and family response that led pre-hospital delays in this study was closely related to education level. Previous study found that low education level increased the risk of pre-hospital delay with an AOR of 2.29; 95%CI 1.12-5.1 (Kazadi Kabanda et al., 2024). Public health campaigns on stroke prevention can increase public awareness of stroke, including knowledge, recognition of stroke symptoms and immediate access to health services (Jiayi et al., 2021). Through the results of this study, the government also needs to develop emergency medical services to reduce pre-hospital delays for stroke patients, for example by improving accessibility to ambulances and emergency calls for stroke patients. However, this study did not examine this further and may provide direction for future research (Gude et al., 2023).

The limitation of this study is the possibility that the families who filled out the questionnaire were not the ones who decided whether or not to refer the patient to hospital. The decision to refer the patient to hospital could have been the result of extended family discussion. In this case, selection bias may occur.

5. Conclusion

Based on the results of this study, the proportion of pre-hospital delay in stroke patients at Waled General Hospital, Cirebon Regency, Indonesia was 78.7%. Most of the patients' families had poor knowledge of stroke symptoms and inadequate responses. It also concluded that family knowledge and response were associated with pre-hospital delay in stroke patients in Cirebon Regency, Indonesia. Health education and promotion programs on early symptoms of stroke need to be encouraged to increase public knowledge about stroke symptoms. The public also needs to be educated about the importance of referring patients with stroke symptoms immediately to the emergency room so that patients get optimal treatment. In addition, further research is needed to analyze other factors besides the role of the family that influence pre-hospital delay in stroke patients.

Conflict of Interest

There is no conflict of interest to declare.

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