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RESEARCH

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Factors Associated with Delays in Early Stroke Detection among Older Adults

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Abstract

Stroke is a medical emergency caused by disrupted blood circulation to the brain, leading to rapid neurological dysfunction and potentially fatal outcomes if not treated promptly. Optimal management must be initiated within the first three hours after symptom onset, known as the golden period. However, many stroke patients experience delays in receiving treatment, particularly in the prehospital phase, where more than 80% of cases fail to obtain timely medical intervention due to late recognition of stroke signs and symptoms. Several factors related to early stroke detection require further investigation to determine the most dominant contributors to delayed detection and management. This study aimed to analyze the factors associated with the occurrence of delays stroke detection among older adults in five Banjar in Melinggih Village. A descriptive correlational analytic design with a cross-sectional, conducted over three months from July to September 2025, with 292 respondents were selected proportionally based on inclusion and exclusion criteria. Data were collected from older adult using structured questionnaires from AST (Face, Arm, Speech, Time), the Los Angeles Prehospital Stroke Screen (LAPSS), and PACS (Medic Prehospital Assessment for Code Stroke). Data analysis was performed using Spearman's rho and multivariable logistic regression. The results demonstrated significant associations between early stroke detection and knowledge ($p < 0.001$; OR=5.702), attitude ($p < 0.001$; OR=4.820), awareness ($p < 0.001$; OR=4.820), assistant support ($p < 0.001$; OR=4.620), information access ($p < 0.001$; OR=0.474), education background ($p < 0.001$; OR=4.820). Multivariate analysis identified knowledge factor associated early stroke detection occurrence ($P < 0.001$; OR =5.502; 95% CI: 1.938–9.843). In conclusion, delays in early stroke detection among older adults is significantly associated with knowledge, attitudes, awareness, family accompaniment, access to information, and educational background. Enhancing knowledge among older adults, along with strengthening public health programs that provide stroke related education and reinforce the role of elderly health cadres in monitoring older adults' health, is essential to reduce delays in early stroke detection among this population.

Keywords: Access to Information, Early Stroke Detection, Knowledge, Older Adults, Support in Providing.

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1. INTRODUCTION

Stroke is one of the leading causes of morbidity and mortality among the elderly population worldwide. The risk of stroke increases significantly with advancing age, with more than two-thirds of cases occurring in individuals aged 60 years and older (Waisyaka, et al., 2025). According to the World Health Organization (WHO), older adults represent the most vulnerable group due to physiological aging processes, including decreased vascular elasticity, progressive atherosclerosis, and a high prevalence of comorbid conditions such as hypertension, diabetes mellitus, and cardiovascular disease (WHO, 2020). In Indonesia, data from the 2022 National Basic Health Research indicate that stroke prevalence is highest among older age groups, particularly those aged 55 years and above, with the risk continuing to increase in more advanced age categories (Badan Kebijakan Pembangunan Kesehatan, 2023).

Stroke is defined as a neurological disorder that occurs suddenly as a result of impaired cerebral blood circulation, leading to neurological deficits that may persist for more than 24 hours (Rahayu, 2023). It is broadly classified into ischemic stroke, caused by arterial occlusion or narrowing, and hemorrhagic stroke, resulting from the rupture of cerebral blood vessels. Among elderly patients, stroke represents a serious health problem as it not only increases mortality risk but also results in long-term disability, loss of independence, reduced quality of life, and increased burden on families and healthcare systems. The prehospital phase plays a critical role in determining clinical outcomes, as early recognition and management strongly influence patient condition prior to definitive treatment. Rapid and accurate prehospital care has been shown to significantly reduce disability and mortality among stroke patients (Satapathy, et al., 2025).

According to the 2012 WHO report, stroke accounts for 31% of all global mortality, with approximately 6.7 million deaths attributed to stroke annually (Cheng, et al., 2025). Indonesia, the 2022 National Basic Health Research revealed an increased prevalence of stroke from 7% in 2013 to 10.9% in 2022, with more than two million citizens aged ≥ 15 years affected (Badan Kebijakan Pembangunan Kesehatan, 2023). In Bali Province, Gianyar Regency ranks second in stroke prevalence. Delays in stroke management particularly during the prehospital phase remain a major contributor to poor prognosis (Badan Penelitian dan Pengembangan Kesehatan, 2019). Evidence indicates that approximately 83.9% of patients experience delays due to inadequate family awareness of early stroke symptoms and insufficient community level information. The concepts of “Time is Brain” and the “Golden Period” emphasize that intervention within the first three hours after symptom onset is crucial to minimizing extensive brain injury (Bakri, et al., 2020).

Early stroke recognition can be supported by standardized screening tools such as the AST (Face, Arm, Speech, Time), the Los Angeles Prehospital Stroke Screen (LAPSS), and PACS (Medic Prehospital Assessment for Code Stroke), which enable rapid identification of key symptoms including facial drooping, arm weakness, and speech impairment (Waisyaka, et al., 2025). The presence of even one of these signs should be treated as a medical emergency requiring immediate stabilization, activation of emergency medical services, and prompt transport to the nearest healthcare facility (Lip, et al., 2022). However, delays in early stroke detection are strongly influenced by family-related factors, particularly knowledge, attitudes, awareness, educational level, social support, and access to health information (Elmukhsinur, & Kusumarini, 2021). Insufficient family knowledge often leads to failure in recognizing early clinical signs and underestimation of symptom severity, resulting in delayed decision-making during the critical golden period (Badan Kebijakan Pembangunan Kesehatan, 2023). Lower educational attainment and limited health literacy further hinder timely responses, while inadequate social support and restricted access to healthcare services prolong delays (Elvir-Lazo et al., 2020). Conversely, strong community networks and prior experience with stroke have been shown to improve early recognition and readiness for appropriate action (Yakubu, et al., 2025).

Based on the above conditions, it can be concluded that delays in early stroke detection among families are influenced by multiple individual and external factors. These include knowledge, attitude, awareness, assistant support, information access and education bedground. This study aimed to analyze the factors associated with the occurrence of delays stroke detection among older adults in five Banjar in Melinggih Village.

2. RESEARCH METHOD

In Melinggih Village, Payangan, Gianyar regions, Bali province and Indonesia country, this research was conducted durng July to September 2025. This study employed a quantitative research design with a descriptive analytic correlational approach using a cross-sectional method. Older adults who resided in Melinggih Village made up the study's population.

A purposive sampling technique was used to select 292 respondents who met the inclusion criteria: caregivers who actively assist and care for older adults (aged >59 to 74 years) in their daily activities, caregivers living in the same household or having regular interaction with the older adult being cared for, aged >17 years, able to read and write, have previously made decisions or played a role in seeking healthcare services for the older adult being cared for, willing to participate as respondents and have signed informed consent. The exclusion caregivers who work as healthcare professionals and caregivers who were not present at the time of data collection and caregivers who have been caring for the elderly patient for less than 6 months.

Knowledge, attitude, awareness, educational background, caregiver support, and access to information were the independent variables of this study, while early stroke detection was the dependent variable. Data were collected using a standardized questionnaire that had been validated for elderly populations. The questionnaire was developed based on modified versions of the FAST (Face, Arm, Speech, Time) assessment, the Los Angeles Prehospital Stroke Screen (LAPSS), and the Medic Prehospital Assessment for Code Stroke (PACS). These instruments were used to evaluate delays in early stroke detection, as well as respondents' knowledge, attitudes, awareness, caregiver support, access to information, and educational background. The questionnaire was designed to ensure that respondents had characteristics comparable to the target population of the study. The questionnaire consisted of 60 items. Variables related to early stroke detection, knowledge, awareness, caregiver support, and access to information were measured using the Guttman scale, while attitudes were assessed using a Likert scale. Demographic data included educational background. The questionnaire demonstrated acceptable reliability, with a Cronbach's alpha value of 0.650.

Spearman's rho test and logistic regression were applied in the data analysis. Sperman's rho is a statistical tool used to test hypotheses between variables. The resultant odds ratio (OR) illustrates the comparison between the chances of something occurring in the risk group and the chances of something happening in the no-risk group. A multivariate study using logistic regression highlights variables connected to early stroke detection. This study received ethical clearance from the Ethics Committee of ITEKES Bali under approval number 04.280/KEP-ITEKES-BALI/VIII/2025.

3. RESULTS AND DISCUSSION

Presents Characteristic Respondents in Study on Factors Associated with Delays in Early Stroke Detection in Melinggih Village, Payangan, Gianyar Region, Bali Province, as show in Table 1.

Table 1. The factors related to early stroke detection in elderly

Delay in Early Detection				<i>p</i> -value	OR	95% CI	
		>180 minutes f	≤180 minutes f			Lower	Upper
Knowlage	Good	0	33	<0.001	5.702	0.126	258.832
	Poor	220	39				
Attitude	Positive	0	209	<0.001	4.820	0.044	523.914
	Negative	83	0				
Awareness	Good	0	176	<0.001	4.820	0.044	523.914
	Poor	100	16				
Assistant support	Good	0	176	<0.001	4.620	0.056	523.200
	Poor	95	21				
Information access	Good	0	176	<0.001	0.474	0.034	6.673
	Poor	83	33				
Educational Background	Low education	40	0	<0.001	4.820	0.044	523.914
	Higher Education	0	252				

The analysis of Table 1 reveals that six factors knowledge, attitude, awareness, caregiver support, access to information, and education level are all significantly associated with delays in early stroke detection among older adults ($p < 0.001$). The order of dominance is evident from the odds ratio (OR) knowledge is the most dominant factor, followed consecutively by attitude, awareness, caregiver support, education level, and lastly, access to information. The following explanation discusses each variable from the strongest to the weakest influence.

Older adults with low levels of stroke knowledge have a substantially higher risk of delayed early stroke detection. Table 1 shows an OR = 5.702 ($p < 0.001$) for knowledge, indicating that older adults with poor knowledge are approximately 5.7 times more likely to experience delays (over 180 minutes) in recognizing stroke symptoms compared to those with good knowledge. This finding aligns with international evidence showing that knowledge is a key predictor of a rapid stroke response (Gardino, Firmansyah, & Naibaho, 2022). Multicentred study in China that higher scores of stroke symptom knowledge were strongly associated with earlier patient presentation to healthcare facilities (Satapathy, et al., 2025). Good knowledge enables older adults to recognize stroke warning signs facial drooping, limb weakness, slurred speech and understand that these are medical emergencies requiring immediate action. Conversely, lack of knowledge results in failure to identify early symptoms and underestimation of severity, delaying medical treatment (Waisyaka, et al., 2025).

Local studies also support this finding an educational program at RSUD M. Zein Painan successfully increased patient and family knowledge in detecting early stroke symptoms, affirming the importance of health education interventions (Waisyaka, et al., 2025). Therefore, increasing stroke knowledge among older adults is vital. Targeted education about FAST (Face, Arm, Speech, Time) signs has been proven effective in raising awareness; older adults or family members familiar with the FAST concept are more responsive in seeking medical help when a stroke occurs (Elvir-Lazo et al., 2020). Community studies in Indonesia also show that early stroke detection education through FAST methods can enhance knowledge and readiness to act in high-risk groups (Waisyaka, et al., 2025). Adequate knowledge not only improves the ability to recognize symptoms but also heightens risk perception and the sense of urgency to seek treatment (Elmukhsinur & Kusumarini, 2021).

Within the framework of the Health Belief Model, knowledgeable individuals tend to have higher perceived severity and susceptibility, motivating them to take faster preventive action (Asri, Mundakir, & Hakim, 2024). This is consistent with the findings of Elmukhsinur and Kusumarini (2021), who emphasized that knowledge and risk perception affect how quickly someone seeks help. Practically, these findings underline the need for large scale, continuous health education programs to increase stroke knowledge among older adults, especially in communities previously lacking stroke outreach (Wang, & Zhang, 2025). Empowering health cadres and family members to educate older adults about stroke symptoms is also crucial to prevent detection delays.

Attitudes toward prompt medical treatment also emerge as an important determinant of detection delays. Older adults with negative or passive attitudes tend to be slower in recognizing and responding to stroke symptoms ($OR = 4.820$; $p < 0.001$). In contrast, a positive attitude toward seeking emergency medical help contributes to faster detection. These data indicate that knowledge alone is insufficient if not accompanied by attitudes or intentions that promote immediate action. This is supported by an international study by (Tuhusula & Silalahi, 2025) which stated that a positive attitude toward the urgency of stroke symptoms is associated with earlier arrival at hospitals. In other words, patients who perceive stroke as a condition that requires immediate attention are more prompt in seeking treatment (Feigin et al., 2024).

Therefore, interventions aimed Nur and Zulkifli (2020) at reducing prehospital delays must address both knowledge and attitude. Outreach efforts should not only transfer knowledge but also shape the mindset of older adults and their families so they do not hesitate to act when stroke symptoms appear. Practically, this could be done through stroke emergency response simulations or drills that instil a sense of urgency (Yusniawati, et al., 2024). Furthermore, it is essential to consider that in some communities, attitudes and responses are influenced by cultural beliefs. For example, some older adults in traditional settings tend to associate illness with non-medical or spiritual imbalances, prompting families to wait using traditional remedies or rituals before seeking medical assistance. Low health literacy often correlates with such beliefs, which can hinder immediate action (Agustini, et al., 2024). Similarly, local reports from Bali show a “waiting period” in stroke patients’ families due to beliefs that illness is something to be accepted or naturally healed. These cultural factors need to be addressed through culturally sensitive education. In essence, a proactive attitude must be developed alongside improved knowledge (Wahidiyat & Sastroasmoro, 2016). A good attitude encourages older adults to seek medical care immediately when symptoms appear rather than surrendering or delaying. Health workers can help foster the understanding that every minute counts in stroke events, motivating the public to act swiftly (Djano & Liputo., 2025).

Awareness refers to an individual's vigilance toward stroke risk and their ability to recognize that the symptoms experienced represent an emergency condition. Table results show that low awareness is closely associated with detection delays ($OR = 4.820$; $p < 0.001$). Older adults aware of the urgency of stroke tend to detect and respond to symptoms more quickly, whereas those less aware are more likely to ignore or delay acknowledging warning signs. Awareness includes understanding the consequences of delayed treatment for example, knowing that untreated stroke may result in permanent disability or death.

Yakubu, et al., (2025) found that families with high stroke awareness are quicker to decide to take patients to the hospital, thereby reducing prehospital delays. Increasing public awareness can improve early detection. Awareness programs involving older adults and their families have proven effective in increasing recognition and early response. However, recognizing symptoms alone is not enough without a sense of urgency (Suib & Mahmudah, 2022; Yusniawati, et al., 2023). It is vital to instil awareness that stroke is a time critical emergency every minute of delay means more brain cells die (Shah, et al., 2025).

Low awareness is often rooted in misconceptions. Many people believe that stroke only affects the elderly or hypertensive individuals, leading others to feel "it won't happen to me" and remain less alert (Yusniawati, et al., 2024; Yusniawati, et al., 2020). In fact, recent trends show stroke is increasingly affecting younger age groups due to unhealthy lifestyles, stress, and lack of physical activity. Indonesian studies by document rising stroke incidence in younger populations due to these factors (Terada, et al., 2025). Therefore, educational messages must correct this misconception everyone is at risk of stroke and emphasize that anyone experiencing symptoms must be treated immediately. Collective awareness within the family is also crucial: family members must be alert if an older adult suddenly exhibits stroke signs and promptly seek help. Overall, increasing public awareness of early symptoms and stroke risks will create a culture of rapid emergency response in the community (Tuhusula & Silalahi, 2025)

Support from caregivers significantly affects the timeliness of stroke detection in older adults (OR = 4.620; $p < 0.001$). Older adults accompanied or assisted by family members when symptoms appear are less likely to experience detection and treatment delays, while those living alone or lacking help are at higher risk of late detection (Jusuf, 2023). This finding highlights the importance of social and environmental factors in health emergency responses. Logically, a companion can help identify symptoms when the patient is confused or weak, call an ambulance, or immediately take the patient to a healthcare facility (Djano & Liputo, 2025).

Presence of a bystander or caregiver plays a vital role in expediting stroke treatment before the patient reaches the hospital. Especially for older adults who may face cognitive or physical limitations, family support becomes a key determinant of timely help (Cheng, et al., 2025). Therefore, family involvement in early stroke detection must be enhanced. Health cadres or officers can provide brief training for families of high-risk older adults on what to do when symptoms appear so they are ready to act. Interventions to strengthen caregiver roles such as training companions on stroke signs and how to contact emergency services will positively reduce delays (Bakri, et al., 2020). This finding also conveys that stroke prevention programs should involve families as the primary support system for older patients.

Formal educational background of older adults is significantly associated with delays in stroke detection (OR = 4.820; $p < 0.001$). Older adults with lower education are more likely to experience detection delays than those with higher education. Education functions as a structural factor influencing a person's health literacy (Yakubu, et al., 2025). More educated individuals are generally better able to understand health information, recognize disease symptoms, and make timely decisions. Conversely, limited education can be a barrier to understanding the urgency of stroke situations (Yusniawati, et al., 2025; Gardino, et al., 2022).

Bakri, et al., (2020) through a systematic review, highlighted that low education is a key factor contributing to stroke treatment delays in many developing countries. This is mainly because lower education often correlates with lower health understanding and limited access to information. Therefore, older adults with limited education require more intensive and simplified educational strategies to recognize stroke symptoms. For example, using visual media or simulations may be more effective for reaching this group than complex written materials (Utama & Nainggolan, 2022; Hamria, Mien, & Saranani., 2020). It is important to note that having a high level of formal education does not automatically ensure a quick response unless accompanied by specific stroke education. This means that every education level requires an appropriate health literacy intervention. For those with higher education, emphasizing the importance of the stroke time window may suffice; for those with lower education, communication approaches must be simpler and more repetitive (Wang & Zhang, 2025). Practically, this finding supports the need for health literacy improvement programs across all education levels. Programs like elderly health posts or door to door outreach can be optimized to ensure that all older adults, regardless of schooling background, understand stroke symptoms and know what actions to take when those symptoms appear (Abedin, et al., 2026).

Access to health information is also significantly associated, though with a weaker effect than the other factors (OR = 0.474; $p < 0.001$). Interestingly, an OR < 1 indicates that good access to information is protective older adults with better access are less likely to experience detection delays. On the other hand, limited access increases the risk of delay. Nonetheless, the impact of access to information is smaller compared to knowledge, attitude, or social support. The relatively low OR indicates that simply providing information is not enough to ensure quick action.

Elmukhsinur and Kusumarini, (2021) emphasized that health information must be accompanied by efforts to improve the recipient's understanding and motivation to influence behaviour. In this study's context, many older adults may have received stroke information but if the information is not understood or trusted, it may not be acted upon during a stroke incident. Thus, access to information is a necessary but insufficient condition (Mc Leron et al., 2025). Information must be accessible and comprehensible. Health communication programs must ensure that materials are appropriate for the literacy level of the target audience. In this way, broad access to information can contribute meaningfully to reducing delays. Additionally, mass media and social media can be optimized to increase stroke information access for older adults and their families (Terada, et al., 2025; Prick, 2025).

The results of multivariate analysis using logistic regression highlight the factors linked to early stroke detection . In the multivariate analysis, factors associated with early stroke detection had a spearman rho test p-value of <0.25 were included. Meanwhile, if sustainable, factors with a p-value of >0.25 may also be taken.

Table 2. Analysis of the most influential factors in early stroke detection using logistic regression.

Variables	p-value	Exp-B	95% CI	
			Lower	Upper
Knowlage	<0.001	5.702	0.126	258.832
Attitude	<0.001	4.820	0.044	523.914
Awareness	<0.001	4.820	0.044	523.914
Educational Background	<0.001	4.820	0.044	523.914

Table 2 highlights four core factors knowledge, attitude, awareness, and education as independent determinants of delays in early stroke detection among older adults. These factors are primarily cognitive and behavioural in nature. Meanwhile, other structural or social factors play an indirect role by supporting these core domains (Ikhsan & Andri, 2020). Knowledge, attitude, and awareness can be seen as the main pillars that must be strengthened to reduce delays. The findings of this study align with the KAP (Knowledge, Attitude, Practice) framework, in which knowledge and attitudes influence health-related practices or behaviours (Mc Leronet al., 2025). In the context of stroke, knowledge provides the foundation for symptom recognition, a positive attitude drives the willingness to act, and awareness ensures constant vigilance all three combined foster a prompt response. Education level then reinforces the older adult's capacity to absorb such knowledge and adopt these attitudes (Asri, et al., 2024; Lip, et al., 2022).

The practical implication raised by the researchers is the need for comprehensive and context-based educational strategies to empower the above key factors (Hamria, et al., 2020; Sartik, et al., 2017). This includes improving stroke knowledge through community campaigns, fostering proactive attitudes via simulation training and regular education, raising awareness of the stroke golden hour, and strengthening health literacy across all societal levels (Shah et al., 2025). This approach is supported by various studies: community education programs have

been shown to increase prompt responses to stroke symptoms and reduce prehospital delays. (Cheng, et al., 2025; Gardino, et al., 2022; Yakubu, et al., 2025)

These combined interventions are believed to be mutually reinforcing. For instance, stroke knowledge education becomes more effective when participants are also trained with response simulations to shape attitudes and accompanied by repeated counselling to maintain awareness (Yusniawati, et al., 2025). Lastly, these multivariate findings remind us that early stroke detection in older adults is a multidimensional issue. Reducing delays means addressing various aspects: knowledge, attitude, awareness, education, as well as support and information access (Pratiwi, 2020; Perhimpunan Dokter Spesialis Kardiovaskular Indonesia, 2015). Ideally, prevention efforts should include ongoing community health education, family and health care involvement as monitoring partners for the elderly, and accessible emergency information systems (Satapathy, et al., 2025). Through this holistic approach, it is expected that older adults can recognize stroke symptoms as early as possible and receive treatment within the golden period. Ultimately, this will reduce disability and mortality rates due to stroke among the elderly population (Cheng, et al., 2025; Lip, et al., 2022)

Several limitations of this study should be acknowledged. The questionnaires were completed by elderly caregivers during elderly-related activities at community health centres and village meeting halls, which may have reduced their concentration while answering. Additionally, some parts of the questionnaire required the caregivers to rely on memory, which may have influenced the accuracy of the study's findings.

4. CONCLUSION

Factor associated with early stroke detection in older Adult include knowledge, attitude, awareness, assistant support, information access and education bedground. Knowledge is the most crucial determinant of early stroke detection. Older adult who are not have good knowledge have a risk of delay detection stroke by 5.70 times compared to older adult who are have good knowledge. Families or caregivers with higher levels of understanding and preparedness are more likely to make prompt decisions in emergency situations. Primary healthcare facilities and relevant government agencies play a crucial role in preventing delays in stroke detection through the promotion of community-based health education. The findings of this study may serve as a reference for future research development. Subsequent studies are expected to identify additional factors influencing delays in early stroke detection and to explore effective intervention strategies to reduce delays in stroke management among older adults.

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