INDONESIAN JOURNAL OF NURSING SCIENCES
Indonesian Nursing and Scientific Journal

Volume: 14
Issue: 01
Years: 2024

Literature Review

Methods for Detecting Early Symptoms of Stroke: A Literature Review

Bambang Suryadi
Faculty of Health Sciences, Universitas Indonesia Maju, Indonesia
*Email Corespondent: bambangadyputro99@gmail.com

OPEN ACCESS
Editor: KS
Received: 22/02/2024
Accepted: 06/04/2024
Published: 07/04/2024
Available Article: 10.33221/jiiki.v14i01.3165

Conflict of interest statement: The researcher declares that this research is free from conflicts of interest.

Funding: Personal Funding.

Abstract

Background: In the world every 2 seconds 1 person suffers from a stroke, and 16% of the world's population experiences a stroke in their lifetime, every 4 seconds 1 person dies. The initial symptoms of a stroke must be recognized quickly until the stroke patient's golden period of 4.5 hours is over so that there is no wider damage to brain tissue due to a lack of oxygen for too long which causes brain cells (neurons) to die and connections or connections between neurons (synapses) to be lost. can cause paralysis, blurred vision, difficulty speaking, decreased consciousness and even death.
Objectives: To analyze the Early Symptom Detection Method of Stroke.
Methods: The authors conducted a PRISMA-style systematic review of Stroke Early Symptom Detection Methods in various countries. Using five articles that were used and then included for analysis and interpretation.
Results: There are two methods for early detection of early symptoms of stroke that can be used to detect early symptoms of stroke, namely F.A.S.T and BE-FAST. Both methods have the same accuracy and have an optimal limit for detecting stroke of ≥1.
Conclusion: There are two methods for early detection of early symptoms of stroke that can be used to detect early symptoms of stroke, namely F.A.S.T and BE-FAST, for this reason these methods need to be disseminated to the public. So it has the impact of being able to increase knowledge about stroke symptom detection which can increase timely stroke detection before the golden period ends.

Keywords: detection method, early symptoms of stroke

Introduction

Stroke is the second most deadly disease after heart disease. The incidence of stroke in the world is approximately 200 per 100,000 population in a year. A stroke can also be called a brain attack, which occurs when part of the brain is damaged due to a lack of blood supply to that part of the brain. Inadequate oxygen and nutrients carried by blood vessels cause brain cells (neurons) to die and connections or relationships between neurons (synapses) to be lost.[1] World Health Organization (WHO) data states that stroke carries a high risk of death. Strokes can result in loss of vision and speech, paralysis, and confusion. The risk of a further stroke increases significantly in people who have had a previous stroke.

The risk of death depends on the type of stroke. Transient ischemic attacks or TIA, where symptoms disappear in less than 24 hours – have the best outcomes, followed by strokes caused by carotid stenosis (narrowing of the arteries in the neck that supply blood to the brain). Blocked arteries are more dangerous, while rupture of cerebral blood vessels is the most dangerous.[2]

Every year, 15 million people worldwide suffer from stroke. Of this number, 5 million people died and 5 million others suffered permanent disabilities, placing a burden on families and society. Strokes are rare in people under 40; If it does occur, the leading cause is high blood pressure. However, stroke also occurs in about 8% of children with sickle cell disease. There are 17 million new cases of stroke recorded each year and in the world, there are 7 million deaths caused by stroke. Every 2 seconds 1 person suffers a stroke 16% of the world's population experiences a stroke in their lifetime, and every 4 seconds 1 person dies. In America, nearly 700,000 people experience a stroke, and nearly 150,000 die from stroke. In the United States, a stroke occurs almost every 45 seconds, and a death occurs every 4 seconds due to a stroke. Ministry of Health Survey stated that 21.1 percent of deaths in Indonesia were caused by stroke. In Indonesia, the number of stroke sufferers increases every year. According to Riskesdas 2018, the prevalence of stroke increased from 7% to 10.9%.[3]

Stroke is a significant cause of disability and death, characterized by neurological deficits caused by acute injury of the Central Nervous System (CNS) including cerebral infarction, intracerebral hemorrhage, and subarachnoid hemorrhage. There are 2 types of stroke, namely non-hemorrhagic (ischemia) and hemorrhagic. Ischemic strokes account for 83% of the frequent causes of stroke. The effects of ischemic disease are high-speed because the brain does not get glucose intake when ischemic occurs, while the brain is unable to be in a state of anaerobic metabolism, the remaining 17% of strokes are hemorrhagic. Early symptoms of stroke must be recognized quickly until the stroke patient's golden period of 4.5 hours is over so that there is no broader damage to brain tissue which can cause disability, decreased consciousness, and even death due to prolonged lack of oxygen. For this reason, a method for early detection of early symptoms of stroke is needed to recognize early that someone has had a stroke so that it does not exceed the golden period of 4.5 hours. namely 2 hours from the start of the attack to the hospital, then the next 2.5 hours is the examination time until the treatment is given at the hospital.[4]

Management for stroke patients is determined by initial treatment in the pre-hospital environment. The community can carry out appropriate initial treatment in the pre-hospital environment, both lay people and specialized or trained lay people. The public needs to know and be aware of the signs and symptoms of stroke because appropriate early treatment will improve the patient's condition and the selection of appropriate therapy.[5] The role of the community in stroke management has been stated in the 2018 Guidelines for the Early Management of Patients with Acute Ischemic Stroke and issued by the American Stroke Association (ASA). In these guidelines, people in the pre-hospital environment act as bystanders or first aiders. The public as first responders must know to recognize the symptoms caused by this disease.[6]

The main symptoms shown by someone who has had a stroke are known as the FAST (face drooping, arm weakness, speech difficulty, time to call Emergency Medical Services) and BE-FAST (balance, eyes, face, arms, speech, time) methods. It is hoped that this guide to recognizing stroke symptoms in patients can help the public understand changes in family members or people closest to them who have had a stroke. The public needs to know that signs of a face tilting to one side, arm weakness, slurred speech, or a slurred tongue, and occurring quickly are signs and symptoms of a stroke. The public needs to be familiar with the symptoms of stroke and understand how to initially treat it in a pre-hospital environment because the best stroke treatment is carried out during the golden hour, which is 3 hours after the first symptoms are recognized. The sooner help is given, the better the

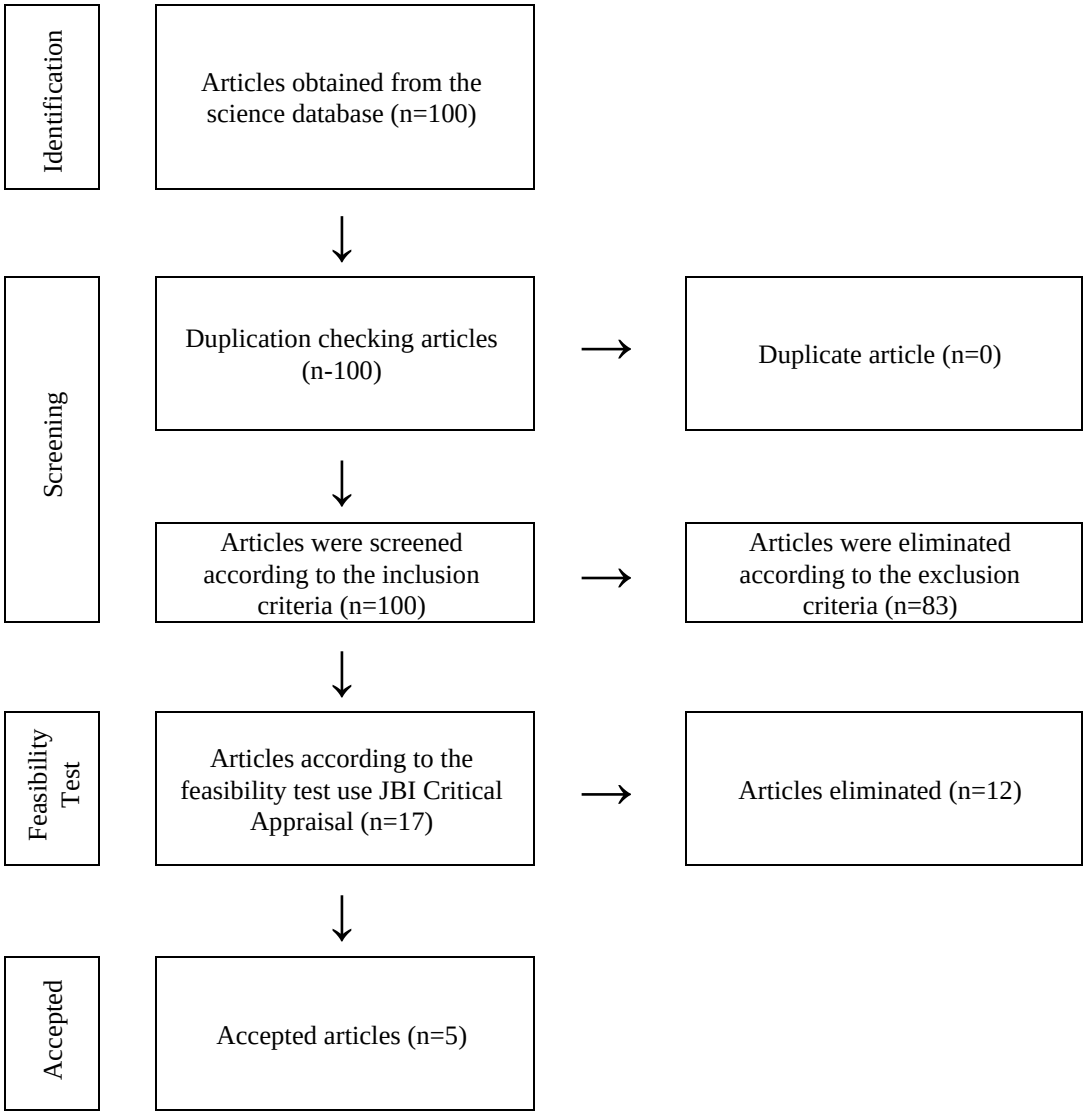
treatment will be. Vice versa, if the initial treatment takes longer, the more widespread the brain damage will be.[5,7,8]

In the world, there are several methods for early detection of early symptoms, including in England, namely the British Ministry of Health using recognition of early stroke symptoms, namely FAST (Face, Arm, Speech, and Time). The British Ministry of Health also evaluated the success of implementing FAST within the first year, and the results were: A 55% increase in emergency ambulance calls for stroke patients in the first four months, an increase in the number of stroke patients coming to hospital by 9,900 patients and receiving medical treatment. specialists for 2,500 patients, reduced mortality and morbidity rates for 640 patients, and improved quality of life for 2,200 patients. The country of Australia, before using notifications via mass media in the form of *FAST*, noted that there were 68% delays when patients were taken to hospital for treatment.[4] This study aims to devise strategies for the early detection of stroke symptoms, focusing on improving public awareness and facilitating timely pre-hospital intervention. By implementing efficient detection methods akin to the FAST (Face, Arm, Speech, Time) and BE-FAST (Balance, Eyes, Face, Arms, Speech, Time) protocols, the research seeks to empower communities to identify stroke symptoms promptly and administer appropriate initial treatment. Drawing insights from international initiatives such as the British FAST program, the study endeavors to enhance stroke recognition and response mechanisms, ultimately optimizing patient outcomes and reducing stroke-related morbidity and mortality rates.

Methods

This study follows the methodology outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. Adhering to the PIO (Population, Intervention, Outcome) framework, the research defines its parameters as: Population (P) - individuals at risk of stroke, Intervention (I) - various techniques for early symptom identification, and Outcome (O) - the effectiveness of early detection in mitigating stroke severity and enhancing patient outcomes. The search strategy entails utilizing keywords like "stroke symptoms," "early detection," "screening methods," and "neurological assessments." ScienceDirect databases are utilized for comprehensive literature retrieval. Inclusion criteria prioritize studies with observational designs that assess the efficacy of early detection methods for identifying stroke symptoms. Preference is given to articles discussing interventions targeted at healthcare professionals and those available in English. Exclusion criteria include studies not addressing stroke symptom detection, literature reviews, books, chapters, proceedings, and unrelated cohort studies. Employing a systematic approach, this methodology aims to collect pertinent literature to advance comprehension and enhance early detection strategies for stroke.

Scheme 1. Steps Review PRISMA



Results

Table 1. Summary of Literature Review Search Results

No	Language	Writer	Year	Objective	Method	Results	Conclusion
1	English	David Pickham, et al	2019	I compared the performance of the BEFAST and FAST scales for detecting stroke.	This research uses a prospective study of emergency departments for stroke patients in Santa Clara County, California.	Three hundred fifty-nine patients were included in the analysis. Compared with non-stroke patients (n = 200), stroke patients (n = 159) more often scored positively on each of the five elements of the BEFAST scale ($p < 0.05$ for each). In multivariable analysis, only facial creases and arm weakness were independent predictors of stroke ($p < 0.05$). The accuracy of the BEFAST and FAST scales for stroke identification was comparable (area under the curve [AUC] = 0.70 vs. AUC = 0.69, $p = 0.36$). The optimal threshold for detecting stroke is ≥1 for both scales. At this threshold, the positive predictive value (PPV) was 0.49 for the BEFAST and 0.53 for the FAST scale, and the negative predictive value (NPV) was 0.93 for the BEFAST and 0.86 for the FAST.	BE-FAST and FAST scales for stroke identification have the same accuracy.
2	English	Xinjie Chen, et al	2022	To screen all acute ischemic strokes in the hospital.	Uses Medline and Ovid databases for relevant literature in English.	A total of 9 studies, including 6,151 participants were analyzed. FAST pooled sensitivity was 0.77 [95% CI (0.64-0.86)], specificity was 0.60 [95% CI (0.38-0.78)], area under the ROC curve was 0, 76, and the diagnostic ratio was 1.57, while the sensitivity of BEFAST was 0.68 [95% CI (0.23-0.93)], specificity was 0.85 [95% CI (0.72-0.92)], the area under the ROC curve was 0.86, and the diagnostic odds ratio was 2.44. No publication bias was detected in the Deeks funnel plot. For FAST, meta-	The results suggest that FAST and BEFAST may be helpful in the diagnosis of acute ischemic stroke. The diagnostic value of BEFAST in acute ischemic stroke is higher than FAST; thus, it may have an essential role in the

						regression analysis showed that the prospective design, satisfactory index test description, and broad disease spectrum contributed to sensitivity heterogeneity, while no source contributed to sensitivity heterogeneity. When the pretest probability is set at 20%, the posterior probability in the Fagan Nomogram is 32%; however, when the pretest probability is set at 20% in BEFAST, the posterior probability in the Fagan Nomogram is 52%.	rapid recognition of acute ischemic stroke.
3	English	Faten El Ammar, et al	2020	We are analyzing the performance of BE-FAST in inpatients evaluated via an inpatient stroke alert system.	We retrospectively analyzed all stroke alert activations at an academic medical center between 2012 and 2016.	Of the 1965 stroke alerts, 489 were inpatients. Mean age was 63 ± 16.1 years; 57% of patients were female (n = 1121). Acute ischemic stroke was diagnosed in 29% of all activations (n = 567), transient ischemic attack in 12% (n = 232), intracranial hemorrhage in 8% (n = 160), and noncerebrovascular in 51% (n = 1006). When comparing inpatients with stroke alerts in the community, the sensitivity of BE-FAST for diagnosing acute ischemic stroke was 85% versus 94% (P = 0.005), with a specificity of 43% versus 23% (P < 0.001), respectively. However, when evaluating hospitalized patients with an intact level of consciousness separately, the sensitivity of BE-FAST for diagnosing acute ischemic stroke was 92% compared with 94% in the community setting (P = 0.579). Among hospitalized patients with acute ischemic stroke who were (1) candidates for reperfusion therapy and (2) diagnosed with acute large vessel occlusion,	BE-FAST has become a highly accurate tool for screening all acute ischemic strokes in the hospital, including inpatients who are candidates for acute reperfusion therapy.

						the sensitivity of BE-FAST was 83% and 94%, respectively.	
4	English	Ethan Mackay, et al	2021	Identify the implementation of FAST and the barriers and facilitators of implementing FAST assessments.	Retrospective and exploratory research.	Results showed that FAST assessment was successfully applied in 15/20 (75%) calls. Eight barriers under three themes (practical barriers, emotionality, and knowledge and understanding) and three facilitators under one theme (clear communication) were identified. Most notably, language incompatibilities, lack of empathy, and caller frustration were the main barriers, while caller cooperation and clear instructions were the main facilitators.	FAST can be applied with a value of 15/20 or (75%) and has eight barriers.
5	English	Sichen Yao, et al	2023	Analyzing the effect of community stroke 120 with FAST for stroke in the elderly	This research is a community-based prospective study.	There were 466 respondents to the pre-education survey (231 from the FAST community, 235 from the Stroke 120 community) and 456 to the post-education survey (230 from the FAST community, 226 from the Stroke 120 community). The average age of respondents in the Stroke 120 community was 76 years (40% male) and in the FAST community was 71 years (52% male). Of the common stroke symptoms, we only found a significant increase in awareness of Face drop (61.7% versus 34.6%, $P<0.001$) and Dizziness (45.7% versus 27.7%, $P<0.001$) in the post-education survey for respondents living in FAST Communities. However, for respondents living in the Stroke 120 community, significant improvements were seen in all stroke symptoms (all $P<0.05$). Meanwhile, for the ability to remember the meaning of the stroke awareness tool, the number of respondents	In the Elderly Community, Stroke 120 is more suitable than FAST in increasing awareness of stroke symptoms.

	who could remember all the meanings of Stroke 120 increased from 0 in the pre-education survey to 44 (21.5%) in the post-education survey (P<0.001) for respondents living in the community Stroke 120. However, among respondents living in FAST communities, only 4 (5%) could recall the entire meaning of FAST in the post-education survey (5% versus 0%, P = 0.47). Meanwhile, the proportion of respondents who could remember part or all of the meaning was also higher in the Stroke 120 community in the post-education survey.	

Discussion

Based on the results of the analysis of 5 (five) Articles, it is stated that there are two methods for early detection of early symptoms of stroke that can be used to detect early symptoms of stroke, namely FAST, and BE-FAST. Both methods have the same accuracy and have an optimal upper b for detecting stroke of ≥1. These results mean that being able to add assessments of coordination and diplopia to assessments of the face, arms, and speech does not improve stroke detection in the prehospital setting.[9] This could be because these two methods better describe stroke symptoms in general. This is in line with according to the Ministry of Health of the Republic of Indonesia, the symptoms and signs of stroke are asymmetrical lips (turned to one side), choking, sudden difficulty swallowing drinking water, sudden weakening of body parts, slurred speech/sudden suddenly unable to speak / not understanding words / speaking incoherently, numbness or numbness, or tingling in half of the body, blurred vision in one eye that occurs suddenly, severe headache that appears suddenly and has never been felt before, functional disorders balance, feels like you are spinning, movements are difficult to coordinate.[10] One of the essential keys to reducing deaths and minimizing brain damage caused by ischemic stroke is providing fast and appropriate treatment (golden period). The most recommended time for stroke patients is 4.5 hours, called the golden period. If stroke treatment is given for more than the golden period, the neurological damage experienced by the patient will be permanent. In another study, the golden period for stroke sufferers to obtain optimal rescue was less than 6 hours after the stroke was first discovered.[3]

Some factors influence success in detecting early symptoms of stroke, one of which is knowledge. This is in line with Muskananfola, 2021, who stated that there is a relationship between early detection, recognition of early symptoms of stroke, and knowledge about how to treat stroke in the community.[11] This research reveals that knowledge of pre-hospital stroke management begins with the ability to recognize symptoms, so the role of health agencies and educational institutions is needed to maximize health education for the community so that they are ready to deal with emergency conditions in the pre-hospital environment. Another study stated that with the Act FAST educational intervention, total knowledge about signs, symptoms, and management of stroke increased significantly from moderate to high (n = 112; 95% confidence interval [CI] 1.419-2.188; P < 0.0001). Total knowledge about stroke risk factors also increased significantly after educational intervention (n = 88; 95% CI 0.6496–1.746; P<0.0001).[12] Research in various countries shows that parents' knowledge about the three-stroke symptoms has increased by 69% to 87% (p<0.001). Their knowledge of emergency numbers increased from 75% (t1) to 88% (t2) (p<.001). A 17% increase in basic knowledge occurred in correctly identified stroke symptoms between waves 1 (11 countries) and 2 (18 countries).[13]

The development of acute ischemic stroke in hospitalized patients represents a significant proportion of all cerebral ischemia. Several prehospital stroke scales were developed to screen for acute ischemic stroke in the community. Despite advances in inpatient stroke alert systems, there is a lack of validated screening tools for the inpatient population. In China, the combined sensitivity analysis result of FAST was 0.77 [95% CI (0.64-0.86)], the specificity value was 0.60 [95% CI (0.38-0.78)], the area under the ROC curve was 0.76, and the diagnostic ratio was 1.57, while the sensitivity of BEFAST was 0.68 [95% CI (0.23-0.93)], the specificity was 0.85 [95% CI (0, 72-0.92)], the area under the ROC curve was 0.86, and the diagnostic odds ratio was 2.44. This shows that FAST and BEFAST can be used in the diagnosis of acute ischemic stroke. The diagnostic value of BEFAST in acute ischemic stroke is higher than FAST; thus, it may have an essential role in the rapid recognition of acute ischemic stroke.[14] Another study showed that the sensitivity of the BE-FAST test for diagnosing acute ischemic stroke was 92% compared

to 94% in the community (P=0.579). Among hospitalized patients with acute ischemic stroke who were (1) candidates for reperfusion therapy and (2) diagnosed with acute large vessel occlusion, the sensitivity of BE-FAST was 83% and 94%, respectively.[15]

Because stroke is a time-sensitive condition and must be treated quickly, methods of increasing knowledge are needed, namely by holding training on emergency medical services (EMS), which plays a vital role in early recognition of stroke. However, the implementation of FAST has several obstacles according to research by Ethan Mackay, 2021 showing that the FAST assessment was successfully implemented in 15/20 (75%) calls. Eight barriers under three themes (practical barriers, emotionality, and knowledge and understanding) and three facilitators under one theme (clear communication) were identified. Most notably, language incompatibilities, lack of empathy, and caller frustration were the main barriers, while caller cooperation and clear instructions were the main facilitators. In conclusion, with these barriers known, methods to overcome them can be developed i.e. additional training and credentialing for call recipients may be a reasonable first step. These lessons can likely be applied to other acuity and phone recognition algorithms.[16] Among community-dwelling elderly people in Shanghai, Stroke 120 appears to be more suitable than FAST in the promotion of stroke knowledge. Meanwhile, for the ability to remember the meaning of the stroke awareness tool, the number of respondents who could remember all the meanings of Stroke 120 increased from 0 in the pre-education survey to 44 (21.5%) in the post-education survey (P<0.001) for respondents living in the Stroke community 120. However, among respondents living in FAST communities, only 4 (5%) could recall the entire meaning of FAST in the post-education survey (5% versus 0%, P = 0.47). Meanwhile, the proportion of respondents who could remember some or all of the meaning was also higher in the Stroke 120 community in the post-education survey.[17]

The research findings highlight the efficacy of early stroke detection methods like FAST and BE-FAST in promptly identifying stroke symptoms, albeit indicating that the addition of coordination and diplopia assessments does not augment detection accuracy. This underscores the comprehensive symptom coverage of these methods, aligning with Ministry of Health guidelines. Recognizing stroke symptoms within the crucial 4.5-hour golden period post-onset is pivotal to minimizing neurological damage. Moreover, knowledge emerges as a key determinant of successful early symptom recognition, with educational interventions significantly enhancing awareness and understanding among the general populace. The development of validated screening tools, particularly BE-FAST, shows promise in expediting acute ischemic stroke diagnosis, although the implementation of FAST faces practical and emotional barriers. Strategies like additional training and clear communication protocols are proposed to overcome these obstacles. Community-based stroke awareness programs, such as Stroke 120, effectively enhance knowledge retention among elderly populations, underscoring the importance of tailored educational initiatives. Overall, these findings emphasize the critical role of robust education, validated screening tools, and clear communication in optimizing early stroke detection and management.

Conclusion

There are two methods for early detection of early symptoms of stroke that can be used to detect early symptoms of stroke, namely FAST, and BE-FAST, because this method follows the research results, it is easy to apply and is understood by the public. For this reason, these methods need to be disseminated to the public. So it has the impact of increasing knowledge about stroke symptom detection which can increase timely stroke detection before the golden period ends.

Conflict of Interest Declaration
The researcher declares that this research is free from conflicts of interest.

Acknowledge
Thank you very much to god.

Funding
Personal Funding.

References

1. Silva D, Narayanaswamy V, Artemio Jr A, Loh P, Yair L. Understanding Stroke a Guide for Stroke Survivors and Their Families. NeuroAiD. 2014; Available from: https://neuroaid.com
2. World Health Organization. Stroke, Cerebrovascular Accident. World Health Organization - Regional Office for the Eastern Mediterranean. Available from: http://www.emro.who.int/health-topics/stroke-cerebrovascular-accident/index.html
3. Badan Penelitian dan Pengembangan Kesehatan -. Laporan Nasional Riskesdas 2018. Jakarta: Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan; 2020. 628 p. Available from: https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/
4. Yuriske Agnovianto -, Linda Dewanti -, Sri Ratna Dwiningsih -. Infertility Causing Factors & the Success Rate of in Vitro Fertilization (IVF) in One of Fertility Center of Surabaya City, Indonesia. Indian Journal of Public Health Research & Development. 2020 [cited 2024 Apr 6];11(2):1978–82. Available from: https://www.i-scholar.in/index.php/ijphrd/article/view/195121
5. Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, et al. 2018 Guidelines for the Early Management of Patients with Acute Ischemic Stroke: A Guideline for Healthcare Professionals from the American Heart Association/American Stroke Association. stroke. 2018;49(3):e46–99. Available from: https://www.ahajournals.org/doi/full/10.1161/STR.0000000000000158
6. Warner JJ, Harrington RA, Sacco RL, Elkind MS. Guidelines for the Early Management of Patients with Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke. Stroke. 2019;50(12):3331–2. Available from: https://doi.org/10.1161/STR.0000000000000158
7. ACLS Training Center. ACLS Suspected Stroke Algorithm: Managing Acute Ischemic Stroke. 2023 [cited 2024 Apr 6]. Available from: https://www.acls.net/acls-suspected-stroke-algorithm
8. Aroor S, Singh R, Goldstein LB. BE-FAST (balance, Eyes, Face, Arm, Speech, Time) Reducing the Proportion of Strokes Missed Using the Fast Mnemonic. Stroke. 2017;48(2):479–81. Available from: https://doi.org/10.1161/STROKEAHA.116.015169
9. Pickham D, Valdez A, Demeestere J, Lemmens R, Diaz L, Hopper S, et al. Prognostic Value of BEFAST vs. FAST to Identify Stroke in a Prehospital Setting. Prehospital Emergency Care. 2019 Mar 4;23(2):195–200. Available from: https://doi.org/10.1080/10903127.2018.1490837
10. Direktorat Promosi Kesehatan dan Pemberdayaan Masyarakat (Kemenkes). Begini Cara Mengenali Gejala Stroke. 2019. Available from: https://ayosehat.kemkes.go.id/begini-cara-mengenali-gejala-stroke
11. Muskananfola IL, Tahu SK, Febriyanti EN, Lekitoo WJB. THE Hubungan Antara Deteksi Dini Pengenalan Gejala Awal Stroke Dengan Pengetahuan Tentang Cara Penanganan Stroke Pada Masyarakat Dalam Tindakan Pertolongan Pra Rumah Sakit di wilayah kerja Puskesmas Bakunase Kota Kupang. Jurnal Keperawatan Malang. 2021 Dec 13;6(2):67–75. Available from: https://doi.org/10.36916/jkm.v6i2.132
12. Vo LP, Souksavong JH, Tran A, Chang J, Lor KB. Impact of the Act FAST Stroke Campaign Delivered by Student Pharmacists on the Primary Prevention of Stroke. Journal of the American Pharmacists Association. 2017;57(3):326–32. Available from: https://doi.org/10.1016/j.japh.2017.02.026
13. van der Merwe J, Tsakpounidou K, Baskini M, Webb C, Keramydas C, Martins SCO, et al. Continuity and Change in Baseline Stroke Knowledge across the world: Second Wave of FAST Heroes campaign implementation. Journal of Stroke and Cerebrovascular Diseases [Internet].

2023;32(12):107426. Available from: https://doi.org/10.1016/j.jstrokecerebrovasdis.2023.107426
14. Chen X, Zhao X, Xu F, Guo M, Yang Y, Zhong L, et al. A Systematic Review and Meta-Analysis Comparing FASTand BEFAST in Acute Stroke Patients. Frontiers in neurology. 2022;12:765069. Available from: https://doi.org/10.3389/fneur.2021.765069
15. El Ammar F, Ardelt A, Del Brutto VJ, Loggini A, Bulwa Z, Martinez RC, et al. BE-FAST: A Sensitive Screening Tool to Identify in-Hospital Acute Ischemic Stroke. Journal of stroke and cerebrovascular diseases. 2020;29(7):104821. Available from: https://doi.org/10.1016/j.jstrokecerebrovasdis.2020.104821
16. Mackay E, Theron E, Stassen W. The Barriers and Facilitators to the Telephonic Application of the FAST Assessment for Stroke in a Private Emergency Dispatch Centre in South Africa. African Journal of Emergency Medicine. 2021;11(1):15–9. Available from: https://doi.org/10.1016/j.afjem.2020.11.002
17. Liu X, Yao S, Ling L, Li Z. Stroke 120 or FAST (Face, Arm, Speech, Time): Which is Better in Stroke Awareness Promotion for Older Residents Living in Shanghai? Journal of Stroke and Cerebrovascular Diseases. 2022;31(7):106490. Available from: https://doi.org/10.1016/j.jstrokecerebrovasdis.2022.106490