

Public awareness and knowledge of stroke risk factors and symptoms in Saudi Arabia: A cross-sectional study

Nouf Khaled A Alrawili¹ , Sadeem N. Alanazi², Shahad N. Alanazi¹,
Hind A. Rikabi³, Eman Mohamed Abdulkareem⁴, Lina Eltaib^{5*} 

1- Rafha General Hospital, Northern Border region, Rafha, Saudi Arabia

2- Department of Nursing science College of Nursing, Northern Border university, Arar, Saudi Arabia

3- Department of clinical practice College of Pharmacy, Northern Border university, Rafha, Saudi Arabia

4- Department of phytochemistry and natural product College of Pharmacy, Northern Border university, Rafha, Saudi Arabia

5- Department of Pharmaceutics College of Pharmacy, Northern Border university, Rafha, Saudi Arabia

Correspondence:

Dr. Lina Eltaib PhD, LSSGB;
Assistant Professor
Department of Pharmaceutics-
Faculty of Pharmacy
Northern Borders University
Rafha – 91911, P.O. BOX 840,
Saudi Arabia
Email: linasalaheldin@gmail.com

Received: 2025-02-06

Accepted: 2025-05-21

How to cite this article:

Alrawili NKA, Alanazi SN,
Alanazi SN, Rikabi HA,
Abdulkareem EM, Eltaib L.
**Public awareness and knowl-
edge of stroke risk factors and
symptoms in Saudi Arabia: A
cross-sectional study.** ARYA
Atheroscler. 2025; 21(4): 26-35.

DOI:

<https://doi.org/10.48305/arya.2025.43466.3027>

Abstract

Stroke is a critical global health issue characterized by sudden neurological dysfunction due to disrupted blood flow to the brain. This study aims to enhance understanding of stroke by examining its risk factors, symptoms, and prevention strategies. This was a cross-sectional study conducted in Saudi Arabia; the research involved a random sample of 442 participants over two months in 2024. The findings revealed that 63% of respondents were female, with the majority (64%) aged between 20–40 years, and 76% had university education. The overall knowledge level regarding stroke was moderate, at 62%. Of the 275 participants from the Northern Border Region, 60% demonstrated knowledge regarding risk factors, 58% regarding signs and symptoms, and 60% regarding treatment options. These results highlight a significant gap in knowledge among the Saudi public, particularly in understanding stroke's general aspects, risk factors, symptoms, and treatment options. The study emphasizes the importance of early recognition of stroke symptoms, summarized by the F.A.S.T. acronym, for timely medical intervention. It underscores the necessity for improved public education and awareness campaigns to enhance understanding and potentially reduce the impact of stroke in the community. A multifaceted approach integrating awareness, lifestyle modifications, and medical management is essential for effective stroke prevention and improved quality of life for individuals at risk.

Keywords: Stroke; Risk Factors; Public Awareness; Stroke Prevention

Introduction

Stroke is a significant health concern worldwide, characterized by sudden neurological dysfunction due to disrupted blood flow to the brain. Understanding the risk factors and warning signs of stroke is crucial for effective prevention and management. The risk factors for stroke are broadly categorized into modifiable and non-modifiable factors, with lifestyle changes and medical interventions playing a key role in prevention. Early recognition of stroke symptoms is vital for timely medical intervention, which can significantly improve recovery outcomes.

Stroke risk arises from a combination of modifiable, non-modifiable, and emerging factors. Modifiable risks include hypertension, diabetes, heart disease, hyperlipidemia, obesity, smoking, alcohol use, inactivity, poor diet, and sleep apnea—all of which can be addressed through lifestyle changes and medical intervention¹. Non-modifiable factors such as age, gender, genetics, and race are inherent, with women facing added risk during pregnancy, postpartum, and contraceptive use². Recent findings highlight emerging risks, including chronic kidney disease, air pollution, and psychological factors like stress and depression, which contribute to stroke through both biological and environmental mechanisms³⁻⁵.

Stroke symptoms vary from obvious to subtle and differ between genders. The most recognized signs follow the F.A.S.T. acronym—Face drooping, Arm weakness, Speech difficulty, and Time to act—emphasizing the urgency of immediate response. Less obvious symptoms may include sudden confusion, difficulty walking, and intense headache. Gender differences are also noted: women often report generalized weakness and headaches, while men more commonly experience pain, nausea, and fever. Early warning signs such as numbness, dizziness, and vision changes may precede a major stroke and should not be ignored⁶⁻⁷. Additionally, Transient Ischemic Attacks (TIAs), or “mini-strokes,” mimic stroke symptoms but resolve quickly, serving as critical red flags for future risk⁷. Advances in genetic testing and polygenic

risk scores (poly GRS) offer promising tools for early identification of high-risk individuals, potentially improving outcomes through timely intervention.

Stress Management and Other Lifestyle Factors

Lifestyle modifications play a significant role in stroke prevention. Engaging in regular physical activity, adopting a healthy diet³, quitting smoking, and reducing alcohol intake are effective strategies⁴⁻⁵. Additionally, medical interventions are crucial; managing conditions such as hypertension, diabetes, and atrial fibrillation through medication and regular monitoring can significantly reduce stroke risk. For certain patients, statin therapy and anticoagulants like warfarin may be recommended¹. Public awareness and education are also vital; increasing knowledge about stroke risk factors and symptoms can facilitate early detection and prevention. Community education programs that emphasize healthy lifestyle choices and regular health screenings are essential⁶⁻⁷. For individuals identified as high-risk through genetic testing, implementing lifestyle modifications and medical interventions can further mitigate stroke risk. These strategies may include dietary changes, exercise, and management of other modifiable risk factors.

Genetic predispositions also play a role in stroke risk. Certain monogenic disorders are directly linked to stroke, such as Fabry disease and cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL), which are caused by specific gene mutations known to increase stroke risk⁸. Moreover, polygenic influences involve multiple genes contributing to susceptibility, including those affecting inflammation, blood clotting, lipid metabolism, and other physiological processes⁹⁻¹⁰. Specific genetic pathways, such as the cAMP pathway, have been implicated in familial cases of early-onset ischemic stroke, underscoring the complex genetic underpinnings of stroke risk¹¹⁻¹².

Stress management and addressing other lifestyle factors are crucial for stroke prevention.

Managing stress and avoiding chronic stress exposure are important, along with addressing issues like obesity and sedentary behavior. Weight management and regular physical activity are key components of a comprehensive stroke prevention strategy¹³.

Literature review

Importance of Awareness in Identifying Risk Factors

Awareness of risk factors such as hypertension, diabetes, smoking, and high cholesterol is vital for the prevention of strokes. Research highlights the necessity for personalized risk assessments and tailored interventions to effectively manage these factors¹⁴. Public awareness campaigns play a significant role in educating individuals about the importance of lifestyle changes, including maintaining a healthy diet, engaging in regular physical activity, and quitting smoking—all of which are crucial for reducing stroke risk¹⁵. For those who have already suffered a stroke, understanding secondary prevention measures is equally important. This awareness encompasses adherence to medication regimens and making lifestyle modifications to prevent recurrent strokes¹⁶. Community-based prevention programs and public awareness initiatives have proven effective in enhancing stroke awareness, often involving local health centers and media campaigns to engage diverse populations¹⁷. Notably, the For Life study conducted in Italy illustrated that systematic stroke risk assessments and heightened awareness among hypertensive patients resulted in better blood pressure control and a decrease in estimated stroke risk¹⁸.

Importance of Immediate Action

Immediate emergency response is critical at the first sign of a stroke, as seeking medical care promptly can prevent further brain damage and enhance recovery outcomes¹⁹⁻²¹. Raising public awareness about stroke symptoms and the necessity for rapid intervention is a national priority, as it can lead to improved

health outcomes and lower mortality rates^{20,22}. In terms of treatment, intravenous thrombolysis with alteplase (rt-PA) is the only FDA-approved medication for acute ischemic stroke, effective when administered within 4.5 hours of symptom onset. It works by dissolving clots and restoring blood flow, significantly reducing disability in eligible patients²³. Tenecteplase is emerging as a promising alternative to alteplase, boasting a better safety profile and potential effectiveness in specific cases, and is currently being investigated for broader application in stroke management²⁴⁻²⁵.

Endovascular therapy, particularly mechanical thrombectomy, involves the physical removal of clots using a stent retriever and is highly effective for large vessel occlusions. This procedure is recommended within six hours of symptom onset but can be extended up to 24 hours in select patients through advanced imaging techniques²²⁻²³. Advanced neuroimaging, such as CT perfusion and MRI, is vital for identifying patients who may benefit from extended treatment windows, thereby improving outcomes for those with unknown onset times²⁴.

Emerging therapies and technologies, including neuroprotective agents and stem cell therapies, remain largely experimental but show promise for future stroke management²³. Additionally, the rise of telemedicine, particularly in rural areas, provides specialist guidance for complex treatment decisions, while artificial intelligence is being explored for early diagnosis and the development of management protocols²³.

Rehabilitation strategies are essential for post-stroke recovery, with innovative approaches like robotic therapy and telerehabilitation being investigated to enhance rehabilitation outcomes²⁵. Furthermore, secondary prevention measures, such as novel oral anticoagulants (NOACs) for atrial fibrillation and endovascular closure of patent foramen ovale, represent significant advancements in preventing recurrent strokes²⁴.

MATERIALS AND METHODS

Study Design

This was a cross-sectional study conducted during a period of two months (April and May 2024) in different regions of Saudi Arabia.

Study population

A sample size of 442 individuals was calculated based on a 95% confidence level and 80% power. The sample was selected using convenience primarily in northern borders of Saudi Arabia.

Inclusion criteria

- Males and females aged ≥ 20 years
- Saudi in nationality
- Not work or study in medical field
- Agree to fill the questionnaire

The exclusion criteria

- Incomplete responses (i.e., failure to answer more than 80% of the questionnaire).
- People who are not willing to give consent.

Data collection and data collection tool

The data were collected using a self-administered questionnaire specifically designed for the research purpose and distributed online via Google Forms. The survey link was shared through social media platforms such as WhatsApp, Twitter, and email to reach potential participants. Individuals who met the inclusion criteria and agreed to participate accessed the form, read an introductory section explaining the study's purpose and their rights, and provided digital informed consent before proceeding to answer the questions. The form was configured to prevent submission without completing mandatory items (attached in Appendix).

To ensure the validity and reliability of the self-administered questionnaire, we conducted content validity testing using the Content Validity Ratio (CVR) and Content Validity Index (CVI), with input from a panel of six experts in the field. The questionnaire's reliability was assessed using Cronbach's alpha, yielding a value of 0.82, indicating satisfactory internal

consistency. The participants' scores were calculated as percentages: a score of 0–50% was considered "poor knowledge," 51–65% was classified as "moderate knowledge," and 66–100% was considered "good knowledge."

Ethical considerations

Electronic consent was obtained before participants accessed the questionnaire. Participants were assured of anonymity, confidentiality, and the right to withdraw at any time without any consequences.

Statistical Analysis

Frequency tables and charts were used for descriptive statistics. The frequency and percentage calculated for all the participants demographics and answers for the questionnaire with representation for the answers by figures. During data analysis, neutral responses such as don't know were regarded as negative answer.

RESULTS

Demographic characteristics of study participants. The respondents were mainly from Northern Border Region 275 (62%). (Table 1).

Participants' knowledge of stroke risk factors. The overall knowledge of stroke risk factor was moderate (60%), (Table 2)

Knowledge about signs and symptoms of stroke. The overall mean score of knowledge about signs and symptoms of stroke was (58%). (Figure 1).

Overall knowledge of participants regarding stroke treatment. Overall mean knowledge about stroke treatment (60%) (Figure 2).

Source of information about stroke. The internet identified by (53%) of the study group as the main source of information about stroke followed by family and relatives (17%) and physicians (14%). (Figure 3).

DISCUSSION

This study aimed to assess the general public's understanding of stroke in Saudi Arabia. Participants' overall knowledge about stroke was found to be 62%.

Table 1. Demographic characteristics of study participants (n=442)

Variable	Categories	Frequency	Percentage (%)
Sex	Male	163	37%
	Female	279	63%
Education	Intermediate education	31	7%
	Secondary education	77	17%
	University education	334	76%
Age (years)	20-30	142	32%
	31-40	141	32%
	41-50	122	28%
	51-60	37	8%
Occupation	Governmental	120	27%
	Private	200	45%
	Student	122	28%
	Northern border region	275	62%
Residence area	Eastern region	99	22%
	Western region	9	2%
	Southern region	4	1%
	Central region	55	12%
Marital status	Married	309	70%
	Unmarried	133	30%

Table 2. Distribution of participants according to their knowledge of stroke risk factors (n=442)

Variable	Good		Poor	
	Frequency	Percentage(%)	Frequency	Percentage(%)
Knowledge of risk factors				
Stroke is more common among men	225	51%	217	49%
Stroke is more common among children	335	76%	107	24%
A quarter of strokes occur in people under the age of 65	173	39%	269	61%
Diabetes increases chance of stroke	213	48%	229	52%
Hypertension is a risk factor for stroke	358	81%	84	19%
High cholesterol increases chance of stroke	310	70%	132	30%
Obesity increases chance of stroke	288	65%	154	35%
Smoking increases chance of stroke	326	74%	116	26%
Epilepsy increases chance of stroke	144	33%	298	67%
Family history contributes to stroke	130	29%	312	71%
Exercise could help reduce the chance of stroke	322	73%	120	27%
Mean score	256	60%	186	40%

Awareness of Stroke Risk Factors

The findings indicate that the Saudi Arabian population has limited awareness of stroke risk factors, as only 60% of respondents could identify these factors, despite many participants having a high educational background. Furthermore, only 40% of participants acknowledged that the risk of stroke increases with age, which is consistent with results from a similar study conducted in the United States²⁵. Interestingly, 51% of respondents stated that males face a higher risk of stroke, which aligns with research in Asser reporting a higher incidence of stroke among men²⁶. However, it is concerning that 49%

of participants were unaware of the heightened risk faced by males.

The study evaluated participants' knowledge of eleven stroke-related risk factors, with a personal history of hypertension being the most recognized factor at 81%. This finding supports results from studies in Egypt and Italy, which found hypertension to be the most acknowledged risk factor at 73% and 67.6%, respectively²⁷. In contrast, a study conducted in Jeddah concerning awareness of coronary artery disease indicated that fast-food consumption was the most recognized risk factor at 74.8%²⁸.

The average knowledge score regarding

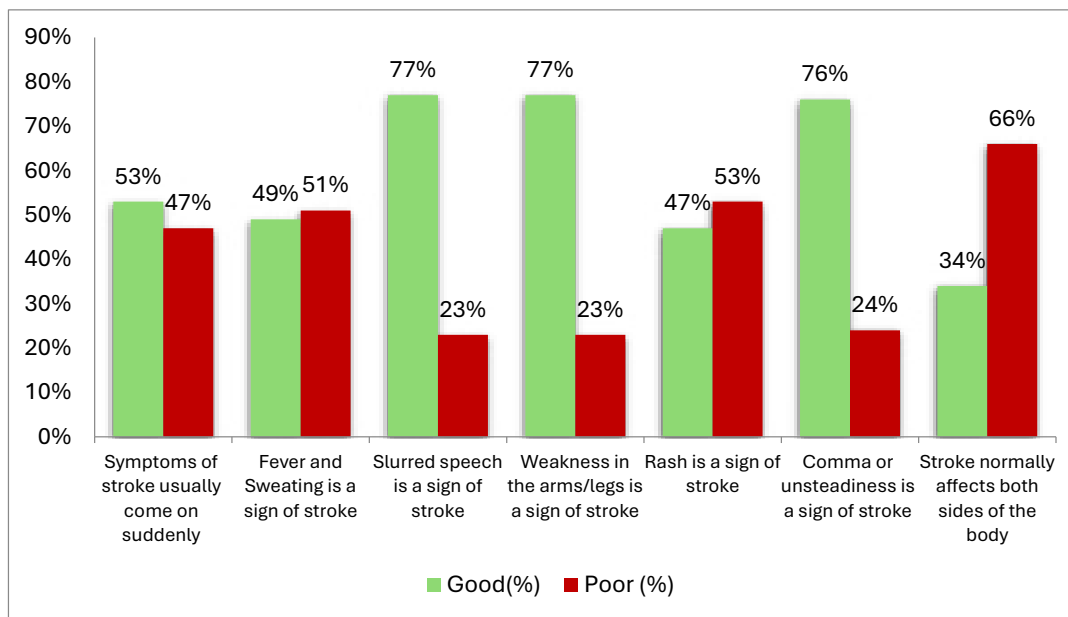


Figure 1. Participants knowledge regarding stroke signs and symptoms

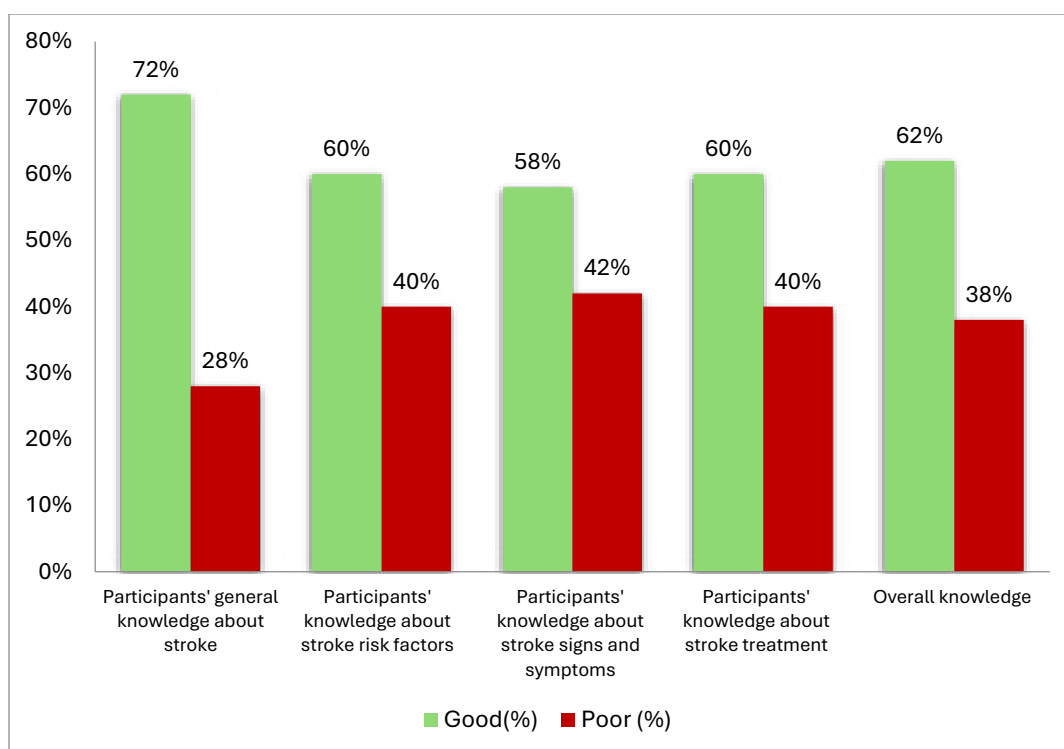


Figure 2. Overall knowledge of participants regarding stroke

stroke risk factors was 60%, reflecting a troubling lack of understanding—particularly since most stroke risk factors are preventable.

In this study, 74% of participants identified

smoking as a stroke risk factor. This contrasts with a study conducted in New Zealand, where Asian and Pacific Island respondents were less likely to recognize smoking as a risk factor²⁹. Recognizing

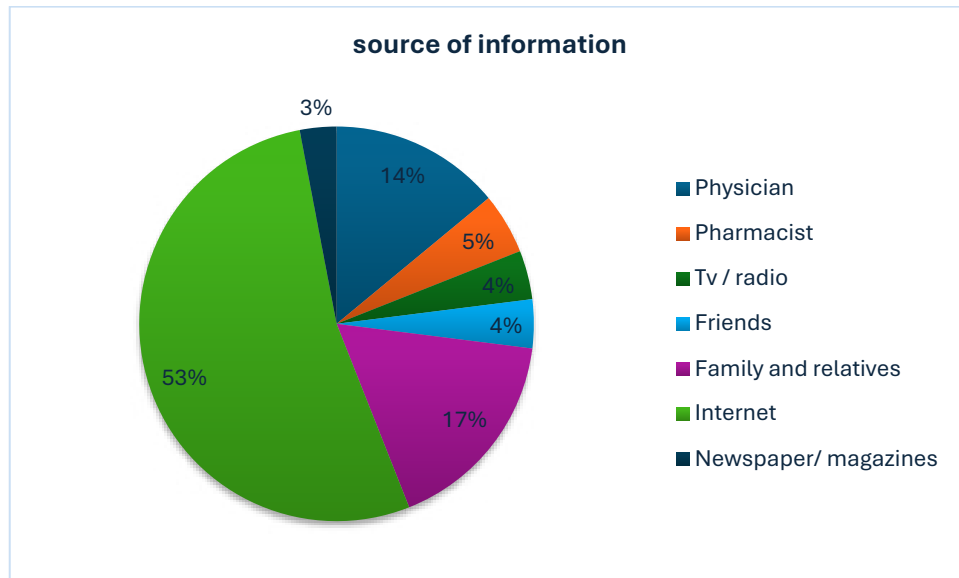


Figure 3. Source of information about stroke

stroke risk factors is crucial for enabling timely evaluation and minimizing delays in patient transport, particularly given Saudi Arabia's implementation of a unified emergency number (911) across different regions.

The results revealed that 83% of participants recognized that strokes occur in the brain, and 82% understood that they result from a lack of blood flow to the brain. These figures surpass those reported by Pandian et al., who found that 45% of respondents in northwest India were unaware that strokes affect the brain³⁰. Nevertheless, 47% of our participants were unaware that stroke symptoms typically arise suddenly, and 66% believed that strokes usually impact both sides of the body.

A survey in New Delhi, India, in 2012, involving 476 participants, similarly demonstrated a significant lack of knowledge about stroke symptoms among educated young individuals of higher socioeconomic status³¹. In our study, only 76% of participants recognized altered consciousness or coma as warning signs of stroke, compared to 58% in Hong Kong³² and 80% in Spain³³. Additionally, 77% identified speech disturbances as a symptom, which is higher than the findings from a study in Ireland³⁴ but lower than the 88% recognition rate reported in Oman³⁵. Furthermore, 69% of participants

understood that individuals experiencing a stroke should not delay seeking medical attention—lower than the 94% awareness rate noted in Spain³⁶.

Sources of Information

The primary sources of stroke-related knowledge among participants were the internet (53%) and family or relatives (17%), while only 14% obtained information from healthcare professionals. This observation aligns with previous research demonstrating variations in stroke information sources. For instance, a study in Benin indicated that 25.1% of participants learned about stroke from relatives, whereas 11.8% received information from healthcare providers³⁷. Likewise, research conducted in Pakistan found that 56% of participants sourced their information from television, with just 4.5% obtaining it from health professionals³⁸. These results suggest that healthcare providers may lack the time or resources needed to effectively educate caregivers.

Conclusion

Stroke is a significant global health challenge that requires a comprehensive understanding of its risk factors, symptoms, and treatment for effective prevention and management. The

research distinguishes between modifiable and non-modifiable risk factors, highlighting the importance of lifestyle changes and medical interventions in stroke prevention. Early recognition of stroke symptoms—emphasized by the F.A.S.T. acronym—is crucial for timely medical intervention and improved recovery outcomes. Genetic predispositions and environmental influences necessitate tailored prevention strategies. Lifestyle modifications, particularly dietary changes and physical activity, are essential in reducing stroke risk. Public awareness and education are vital for encouraging proactive health behaviors and prompt responses to symptoms, leading to better health outcomes. The findings advocate for ongoing research into emerging risk factors and innovative treatments, underscoring the need for a multifaceted approach to address the burden of stroke. Integrating awareness, lifestyle changes, and medical management can enhance prevention efforts and improve the quality of life for those at risk.

Limitations

This study is subject to certain limitations. The use of self-administered questionnaires may have introduced self-reporting bias. Additionally, the sample was not evenly distributed across regions, with 62% of participants from the Northern region, which may limit the generalizability of the findings. The cross-sectional design also restricts causal interpretations.

Acknowledgements

The authors extend their appreciation to the Deanship of Scientific Research at Northern Border University, Arar, KSA for funding this research work through the project number “NBU-FFR- 2025-2934-08.

Conflict of interests

The authors declare no conflict of interest.

Funding

This work was supported by the Deanship of Scientific Research at Northern Border University,

Arar, KSA (Project No. NBU-FFR-2025-2934-07).

Author’s Contributions

Study Conception or Design: LE; ESH

Data Acquisition: NA; SA; SHA

Data Analysis or Interpretation: LE, ESH

Manuscript Drafting: LE; EAA

Critical Manuscript Revision: LE; ESH; NA; SA; SHA; EAA

All authors have approved the final manuscript and are responsible for all aspects of the work.

References

1. Rizal II, Octaviantie G. The study of risk factor and strategies for prevention of recurrent ischemic stroke: a comprehensive systematic review. *J Adv Res Med Health Sci*. 2024. <https://doi.org/10.61841/w0n2j027>
2. Kasperski R, Piekarska M, Pacek K, Pikulicka A, Szulc I, Jedlina K, et al. Stroke prevention – review of the latest reports. *J Educ Health Sport*. 2023;13(2):037. <https://doi.org/10.12775/jehs.2023.13.02.037>
3. Dopler B. Stroke Prevention. *Del J Public Health*. 2023;9(8):003. <https://doi.org/10.32481/djph.2023.08.003>
4. Saini N, Gurvendra AL. Stroke-Related Risk Factors: A Review. *Asian Pac J Health Sci*. 2022;9(3):102-7. <https://doi.org/10.21276/apjhs.2022.9.3.21>
5. Goldstein LB, Seshadri S, Sacco RL. Risk Factors and Prevention. In: *Stroke (7th ed)*. Pathophysiology, Diagnosis, and Management. 2022:187-206. e6. <https://doi.org/10.1016/B978-0-323-69424-7.00016-8>.
6. Zhang S, Zhang W, Zhou G. Extended Risk Factors for Stroke Prevention. *J Natl Med Assoc*. 2019 Aug;111(4):447-56. <https://doi.org/10.1016/j.jnma.2019.02.004>
7. Akindahunsi T, Ogunseye OO, Idowu OA, Lawal TA. Early signs of stroke: How your body warns you. *World J Adv Res Rev*. 2019;3(2):91-100. <https://doi.org/10.30574/wjarr.2019.3.2.0045>
8. Meschia JF, Fornage M. Genetic Basis of Stroke Occurrence, Prevention, and Outcome. *Stroke (7th ed)*. Pathophysiology, Diagnosis, and Management. Philadelphia: Elsevier; 2022. <https://doi.org/10.1016/B978-0-323-69424-7.00019-3>
9. Khasanova LT, Stakhovskaya LV, Koltsova EA, Shamalov NA. Genetic Features of Cerebral Stroke. *Neurosci Behav Physiol*. 2020;50(7):873-80. <https://doi.org/10.1007/S11055-020-00997-W>
10. Khasanova LT, Stakhovskaya LV, Koltsova EA, Shamalov NA. Genetic characteristics of

- stroke. Zh Nevrol Psikiatr Im S S Korsakova. 2019;119(12):65-71. <https://doi.org/10.17116/JNEURO201911912265>
11. Wang M, Sun F, Ren A, Ge R, Chen J, Wang H. The involvement of genetic variation in the cAMP pathway in the family- based cerebral infarction. 15 April 2022, PREPRINT (Version 1) available at Research Square <https://doi.org/10.21203/rs.3.rs-1410294/v1>
12. Francis J, Raghunathan S, Khanna P. The role of genetics in stroke. Postgrad Med J. 2007 Sep;83(983):590-5. <https://doi.org/10.1136/pgmj.2007.060319>
13. Ghodeshwar GK, Dube A, Khobragade DS. Impact of Lifestyle Modifications on Cardiovascular Health: A Narrative Review. Cureus. 2023;15(9):e42616. <https://doi.org/10.7759/cureus.42616>
14. Sese LVC, Guillermo M. Strengthening stroke prevention and awareness in the Philippines: a conceptual framework. Front Neurol. 2023;14:1258821. <https://doi.org/10.3389/fneur.2023.1258821>
15. Miller ET. Stroke awareness: take preventive action. Rehabil Nurs. 2014;39(5):211-2. <https://doi.org/10.1002/RNJ.163>
16. Slark J, Sharma P. Risk awareness in secondary stroke prevention: a review of the literature. JRSM Cardiovasc Dis. 2014 Feb 4;3:2048004013514737. <https://doi.org/10.1177/2048004013514737>
17. Volpe M, Rosei EA, Ambrosioni E, Leonetti G, Trimarco B, Mancina G. Reduction in estimated stroke risk associated with practice-based stroke-risk assessment and awareness in a large, representative population of hypertensive patients: results from the ForLife study in Italy. J Hypertens. 2007 Dec;25(12):2390-7. <https://doi.org/10.1097/hjh.0b013e3282efc5a2>
18. Jackson SL, Legvold B, Vahratian A, Blackwell DL, Fang J, Gillespie C, et al. Sociodemographic and Geographic Variation in Awareness of Stroke Signs and Symptoms Among Adults - United States, 2017. MMWR Morb Mortal Wkly Rep. 2020 Nov 6;69(44):1617-21. <https://doi.org/10.15585/mmwr.mm6944a1>
19. Alromail NMA, Halawani MS, Malawi IA, Almutairi AM, Alsaib AA, AL-Osaimi BN, et al. Emergency Management of Stroke. Egypt J Hosp Med. 2017;69(8):3100-5. <https://doi.org/10.12816/0042257>
20. Langingi ARC. Pemberdayaan masyarakat dalam upaya pencegahan stroke di kelurahan taratara satu. 2024;1(2):13-23. <https://doi.org/10.34304/joehr.v2i2.224>
21. Nikita HJ, Suraj BK. Gender Wise Difference in Presenting Signs and Symptoms of Stroke: Observational Study. J Forensic Med. 2020;14(3):10379. <https://doi.org/10.37506/IJFMT.V14I3.10379>
22. Bhatia K, Bhagavan S, Bains N, French B, Siddiq F, Gomez CR, et al. Current Endovascular Treatment of Acute Ischemic Stroke. Mo Med. 2020 Sep-Oct;117(5):480-9.
23. Campbell BC. Advances in stroke medicine. Med J Aust. 2019 May;210(8):367-74. <https://doi.org/10.5694/mja2.50137>
24. Zaremba B, Gorecka A, Wysokińska O, Cholewa K, Milanowska J. New directions in treatment of the ischemic stroke. J Educ Health Sport. 2020;10(7):66-77. <https://doi.org/10.12775/JEHS.2020.10.07.006>
25. Ovbiagele B, Nguyen-Huynh MN. Stroke epidemiology: advancing our understanding of disease mechanism and therapy. Neurotherapeutics. 2011;8(3):319-29. <https://doi.org/10.1007/s13311-011-0053-1>
26. Alhazzani AA, Mahfouz AA, Abolyazid AY, Awadalla NJ, Aftab R, Faraheen A, et al. Study of Stroke Incidence in the Aseer Region, Southwestern Saudi Arabia. Int J Environ Res Public Health. 2018 Jan 26;15(2):215. <https://doi.org/10.3390/ijerph15020215>
27. Feigin VL, Norrving B, Mensah GA. Global Burden of Stroke. Circ Res. 2017 Feb 3;120(3):439-48. <https://doi.org/10.1161/circresaha.116.308413>
28. Almalki MA, AlJishi MN, Khayat MA, Bokhari HF, Subki AH, Alzahrani AM, et al. Population awareness of coronary artery disease risk factors in Jeddah, Saudi Arabia: a cross-sectional study. Int J Gen Med. 2019 Jan 11;12:63-70. <https://doi.org/10.2147/ijgm.s184732>
29. Kamran S, Bener AB, Deleu D, Khoja W, Jumma M, Al Shubali A, et al. The level of awareness of stroke risk factors and symptoms in the Gulf Cooperation Council countries: Gulf Cooperation Council stroke awareness study. Neuroepidemiology. 2007;29(3-4):235-42. <https://doi.org/10.1159/000112856>
30. Pandian JD, Jaison A, Deepak SS, Kalra G, Shamsher S, Lincoln DJ, et al. Public awareness of warning symptoms, risk factors, and treatment of stroke in northwest India. Stroke. 2005 Mar;36(3):644-8. <https://doi.org/10.1161/01.str.0000154876.08468.a0>
31. Monaliza MA, Srivastava A. Awareness of risk factors and warning symptoms of stroke in general population. Nurs Midwifery Res J. 2012;8(2):149-61. <https://doi.org/10.1177/0974150X20120203>
32. Cheung RT, Li LS, Mak W, Tsang KL, Lauder IJ, Chan KH, Fong GC. Knowledge of stroke in Hong Kong Chinese. Cerebrovasc Dis. 1999 Mar-Apr;9(2):119-23. <https://doi.org/10.1159/000015909>
33. Segura T, Vega G, López S, Rubio F, Castillo J. Public perception of stroke in Spain. Cerebrovasc Dis. 2003;16(1):21-6. <https://doi.org/10.1159/000015909>

- [org/10.1159/000070110](https://doi.org/10.1159/000070110)
34. Parahoo K, Thompson K, Cooper M, Stringer M, Ennis E, McCollam P. Stroke: awareness of the signs, symptoms and risk factors--a population-based survey. *Cerebrovasc Dis.* 2003;16(2):134-40. <https://doi.org/10.1159/000070593>
35. Al Shafae MA, Ganguly SS, Al Asmi AR. Perception of stroke and knowledge of potential risk factors among Omani patients at increased risk for stroke. *BMC Neurol.* 2006 Oct 20;6:38.<https://doi.org/10.1186/1471-2377-6-38>
36. Mokhtar MH, Eltayeb EM, Satta MS, Eltaib Lina SA, Nourein IH. Assessment of Sudanese cardiac health-care professionals' competency and adherence to the current anticoagulation guidelines with non-valvular atrial fibrillation Sudanese patients. *Int J Med Sci Public Health* 2018;7(8):626-9. <https://doi.org/10.5455/ijmsph.2018.0412729042018>
37. Aly Z, Abbas K, Kazim SF, Taj F, Aziz F, Irfan A, et al. Awareness of stroke risk factors, signs and treatment in a Pakistani population. *J Pak Med Assoc.* 2009 Jul;59(7):495-9.