

## Stroke Risk Awareness and Preventive Practices among Adults with Diabetes at a Tertiary Centre in Gujarat: A Cross Sectional KAP Study

Ashishkumar B. Prajapati<sup>1</sup>, Jaykumar S. Sahayata<sup>2\*</sup>, Kartik P. Thakkar<sup>3</sup>

<sup>1</sup>Medical officer, Primary health centre, Vadpag, Bhabhar, Banaskantha, Gujarat, India

<sup>2</sup>Medical officer, LG Hospital, Maninagar, Ahmedabad, Gujarat, India

<sup>3</sup>Junior resident, Department of General Medicine, GMERS Medical College and Hospital, Dharpur, Patan, Gujarat, India

Received: 25-05-2025 / Revised: 22-06-2025 / Accepted: 27-07-2025

Corresponding Author: Jaykumar S. Sahayata

Conflict of interest: Nil

### Abstract:

**Introduction:** Stroke, a leading cause of morbidity and mortality worldwide, poses a significant threat to individuals with diabetes mellitus (DM). The bidirectional relationship between diabetes and stroke underscores the critical need for heightened awareness regarding stroke risk factors, warning signs, and preventive practices among diabetic patients.

**Materials & Methods:** A cross-sectional study was conducted among 430 patients with diabetes attending a tertiary care center in Gujarat, India. Data on socio-demographic characteristics, clinical profiles, and knowledge, attitude, and practices (KAP) related to stroke were collected using a structured questionnaire. The study population included patients across various age groups and educational backgrounds. Statistical analysis was performed to determine the prevalence of awareness and preventive practices, and to identify associated factors.

**Results:** Of the 430 diabetic patients, 47.9% demonstrated adequate overall knowledge of stroke, while 52.1% had insufficient knowledge. Specifically, knowledge regarding warning signs and risk factors was 43.7% and 47.4% sufficient, respectively. A positive attitude towards stroke prevention was observed in 67.9% of participants, with 75.3% recognizing the importance of blood pressure monitoring. However, only 40.5% reported good preventive practices, with routine physical exercise (30.7%) and weight loss efforts (34.4%) being particularly low. Hypertension (64.7%) and obesity (47.4%) were prevalent comorbidities.

**Conclusion:** Despite a generally positive attitude towards stroke prevention, a significant gap exists in the knowledge and adoption of preventive practices among diabetic patients in this tertiary care center in Gujarat, India. These findings highlight the urgent need for targeted educational interventions to improve stroke risk awareness and promote effective preventive behaviors among this high-risk population.

**Keywords:** Attitude, Diabetes, Knowledge, Prevention, Stroke, Tertiary Care, Warning signs.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

### Introduction

Stroke, a devastating neurological event, remains a leading cause of death and long-term disability globally [1]. Its impact is particularly pronounced in low- and middle-income countries, where the burden of non-communicable diseases (NCDs) is rapidly increasing [2]. Diabetes mellitus (DM), a chronic metabolic disorder characterized by hyperglycemia, is a well-established and significant independent risk factor for stroke [3, 4]. The global prevalence of DM is on the rise, with projections indicating a substantial increase in affected individuals worldwide [5]. In India, the prevalence of diabetes is also a major public health concern, with recent studies reporting a high overall prevalence [6].

The intricate relationship between diabetes and stroke is multifaceted. Diabetes contributes to vas-

cular aging, leading to microvascular and macrovascular complications that predispose individuals to cerebrovascular events [7]. Diabetic patients face a significantly higher risk of both ischemic and hemorrhagic stroke compared to non-diabetic individuals, and those who experience a stroke often have less favorable outcomes [7, 8]. The high prevalence of comorbidities such as hypertension, dyslipidemia, and obesity among diabetic patients further exacerbates their stroke risk [9, 10].

Despite the clear link between diabetes and stroke, awareness regarding stroke risk factors, warning signs, and preventive practices among diabetic populations remains a critical area of concern. Studies from various regions have consistently highlighted gaps in knowledge and the adoption of preventive behaviors. For instance, a study conducted in Al-

Ahsa, Saudi Arabia, revealed that less than half of diabetic patients had a good awareness level regarding stroke and its related risk factors [11]. Similarly, research in Kerala, India, indicated that more than half of people with diabetes had poor awareness of stroke, its risk factors, and warning signs [12]. These findings underscore the urgent need for targeted educational interventions to improve stroke literacy among high-risk groups.

In India, the burden of stroke is substantial, with significant mortality and disability rates [13]. While there is growing recognition of the importance of stroke prevention, research on awareness levels and preventive practices, particularly among specific high-risk populations like diabetic patients, is still evolving. Systematic review data across hypertensive and diabetic cohorts underscore wide heterogeneity in knowledge (4.4–79%) and prevention practices (2.4–72%), with consistent deficits in physical activity and weight reduction practices. [14] Given the increasing prevalence of diabetes and the significant burden of stroke in India, understanding the current state of stroke risk awareness and preventive practices among diabetic patients is paramount. This study aims to assess stroke risk awareness, attitudes, and preventive practices among adult patients with diabetes at a tertiary care center in Gujarat.

## Materials and Methods

**Study design and setting:** We conducted a descriptive, cross-sectional study in the outpatient services of a tertiary care center in Gujarat, India. Data were collected from adult patients with diabetes attending routine follow-up visits.

**Participants and sampling:** We enrolled 430 consecutive adult patients (age  $\geq 18$  years) with a clinician-confirmed diagnosis of diabetes mellitus (primarily type 2), attending the diabetes or general medicine clinics during the study period. We excluded patients with cognitive impairment precluding informed consent or reliable questionnaire completion. Informed written consent was obtained from all participants prior to data collection. Confidentiality and anonymity of the participants were maintained throughout the study.

**Instrument and measures:** The KAP instrument was a structured, pretested questionnaire covering: (1) socio-demographics; (2) clinical profile (type and duration of diabetes; comorbidities including hypertension, dyslipidemia, obesity; family history of stroke; HbA1c category); (3) knowledge domains (general concept of stroke, warning signs/symptoms, risk factors, diagnostic testing, treatment, prevention); (4) attitudes (preventability, risk perception, value of monitoring blood pressure, early diagnosis, lifestyle change); and (5) preventive practices

(physical activity, weight control efforts, blood pressure checks, salt limitation, cholesterol control, adherence to antihypertensives when prescribed).

**Scoring and definitions:** Each knowledge item was scored 1 for correct and 0 for incorrect/“don’t know.” For comparability to recent diabetic cohorts in India and the region, we defined “sufficient” knowledge as a total score  $\geq 60\%$  of the maximum attainable points in a given domain and overall; “positive” attitude was defined a priori for favorable responses on key preventive attitude items; “good” practice captured self-reported regular engagement in recommended behaviours, using item-level thresholds consistent with prior KAP work in diabetics.

**Data collection and quality:** Trained staff administered the questionnaire in a face-to-face format, ensuring neutrality and minimizing cueing. Data were checked for completeness at point-of-entry.

**Data Analysis:** All collected data were entered into a Microsoft Excel spreadsheet and subsequently analyzed using SPSS Version 20.0. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the socio-demographic, clinical, knowledge, attitude, and practice variables.

## Results

In this cross-sectional study conducted among 430 diabetic patients at a tertiary care centre in Gujarat, India, the majority of participants were in the 50–65 year age group (60.5%), with a mean age of  $52.8 \pm 10.6$  years, highlighting that most patients belonged to the high-risk age category for stroke. A slightly higher proportion were male (54.9%) compared to females (45.1%). Most patients were married (80%), reflecting a socially stable cohort, while smaller proportions were single (9.8%), widowed (7.4%), or divorced (2.8%). With respect to education, a considerable proportion had studied up to secondary level (46%), while 28.9% had university-level education, and one-fourth (25.1%) had only primary education, suggesting moderate educational attainment overall. Urban residents comprised the majority (62.3%), though a significant fraction (37.7%) were from rural areas, ensuring representation of both community settings. Nearly half (43.3%) were engaged in skilled or unskilled work, while homemakers (29.8%) and unemployed/retired individuals (27%) formed the rest. The socioeconomic profile showed that most participants belonged to the middle (35.3%) and lower-middle classes (22.8%), while 24.2% were in the upper-middle, 9.3% in the lower, and only 8.4% in the upper class (Table 1).

**Table 1: Socio-demographic characteristics of diabetic patients**

<b>Socio-Demographic Details</b>	<b>Frequency (n=430)</b>	<b>Percentage (%)</b>
<b>Age (years)</b>		
18–35	52	12.1
36–49	118	27.4
50–65	260	60.5
Mean $\pm$ SD	52.8 $\pm$ 10.6	–
<b>Gender</b>		
Male	236	54.9
Female	194	45.1
<b>Marital Status</b>		
Single	42	9.8
Married	344	80
Divorced	12	2.8
Widowed	32	7.4
<b>Education</b>		
Up to Primary	108	25.1
Higher Secondary	198	46
University or Above	124	28.9
<b>Residence</b>		
Urban	268	62.3
Rural	162	37.7
<b>Occupation</b>		
Skilled/Unskilled	186	43.3
Homemaker	128	29.8
Unemployed/Retired	116	27
<b>Socioeconomic Status</b>		
Class I (Upper)	36	8.4
Class II (Upper Middle)	104	24.2
Class III (Middle)	152	35.3
Class IV (Lower Middle)	98	22.8
Class V (Lower)	40	9.3

**Table 2: Clinical profile of Diabetic patients**

<b>Clinical Profile</b>	<b>Frequency (n=430)</b>	<b>Percentage (%)</b>
<b>Type of Diabetes</b>		
Type 1	28	6.5
Type 2	396	93.1
Gestational	6	1.4
<b>Duration of DM</b>		
$\leq$ 5 years	164	38.1
>5 years	266	61.9
Mean $\pm$ SD	7.9 $\pm$ 4.6 yrs	–
<b>Comorbidities</b>		
Hypertension	278	64.7
Dyslipidemia	196	45.6
Cardiovascular Disease	88	20.5
Obesity (BMI $\geq$ 25)	204	47.4
Chronic Kidney Disease	52	12.1
Smoking >1 year	74	17.2
<b>Family History of Stroke</b>		
Yes	94	21.9
No	336	78.1
<b>HbA1c (%)</b>		
Good Control ( $\leq$ 7.0%)	124	28.8
Fair Control (7.1–8.0%)	132	30.7
Poor Control (>8.0%)	174	40.5

Among the 430 patients studied, the vast majority had Type 2 diabetes mellitus (93.1%), with only 6.5% having Type 1 diabetes and 1.4% reporting gestational diabetes. The mean duration of diabetes was  $7.9 \pm 4.6$  years, with nearly two-thirds of patients (61.9%) living with diabetes for more than five years. Comorbidities were highly prevalent in this group. Hypertension (64.7%) was the most frequent, followed by obesity (47.4%) and dyslipidemia (45.6%). A smaller but notable proportion had cardiovascular disease (20.5%) or chronic

kidney disease (12.1%), both of which further elevate stroke risk. Lifestyle-related risk factors were also observed, with 17.2% reporting smoking history of more than one year. A family history of stroke was noted in 21.9% of participants. Glycemic control was suboptimal in the cohort: only 28.8% achieved good control ( $HbA1c \leq 7.0\%$ ), while 30.7% had fair control, and a significant 40.5% had poor control ( $HbA1c > 8.0\%$ ). [Table 2].

**Table 3: Knowledge, Attitude, and Preventive practices related to Stroke among Diabetic patients**

<b>Knowledge</b>	<b>Sufficient (%)</b>	<b>Insufficient (%)</b>
General knowledge	210 (48.8%)	220 (51.2%)
Warning sign/symptom knowledge	188 (43.7%)	242 (56.3%)
Risk factor knowledge	204 (47.4%)	226 (52.6%)
Diagnostic test knowledge	138 (32.1%)	292 (67.9%)
Treatment knowledge	154 (35.8%)	276 (64.2%)
Prevention knowledge	192 (44.7%)	238 (55.3%)
Overall knowledge (adequate)	206 (47.9%)	224 (52.1%)
<b>Attitude</b>	<b>Positive (%)</b>	<b>Negative (%)</b>
Stroke is preventable	286 (66.5%)	144 (33.5%)
Affects only rich people (agree)	54 (12.6%)	376 (87.4%)
Monitoring BP is essential	324 (75.3%)	106 (24.7%)
Lifestyle changes help prevention	298 (69.3%)	132 (30.7%)
Heart disease should be treated	276 (64.2%)	154 (35.8%)
Early diagnosis prevents complications	338 (78.6%)	92 (21.4%)
<b>Overall Attitude</b>	292 (67.95)	224 (52.1%)
<b>Practice</b>	<b>Good (%)</b>	<b>Poor (%)</b>
Routine physical exercise	132 (30.7%)	298 (69.3%)
Trying to lose weight	148 (34.4%)	282 (65.6%)
Check BP regularly	178 (41.4%)	252 (58.6%)
Avoid extra salt	204 (47.4%)	226 (52.6%)
Control cholesterol levels	168 (39.1%)	262 (60.9%)
Take prescribed anti-hypertensive meds	192 (44.6%)	238 (55.4%)
<b>Overall Practice</b>	174 (40.5%)	256 (59.5%)

The assessment of stroke-related knowledge among diabetic patients revealed considerable gaps. Less than half of the participants demonstrated adequate overall knowledge (47.9%), while a slight majority (52.1%) were insufficiently informed. Within specific domains, knowledge about general aspects of stroke (48.8%) and risk factors (47.4%) was relatively better, but awareness of warning signs and symptoms (43.7%), prevention (44.7%), and especially diagnostic tests (32.1%) and treatment options (35.8%) remained suboptimal. This indicates that while patients may recognize stroke as a condition, detailed knowledge required for timely recognition and management is lacking (Table 3).

In terms of attitude, most patients expressed positive beliefs towards stroke prevention. Nearly two-thirds (66.5%) believed stroke is preventable, while a large majority (75.3%) recognized the importance of monitoring blood pressure. Similarly, 69.3% agreed that lifestyle changes such as diet and exercise play

a preventive role, and 78.6% emphasized early diagnosis as crucial to avoid complications. Notably, only a small proportion (12.6%) held the misconception that stroke affects only wealthy individuals, suggesting that socio-cultural myths are less pervasive in this cohort. Overall, 67.9% displayed a positive attitude towards stroke prevention (Table 3).

When preventive practices were examined, the findings highlighted a clear knowledge–practice gap. Only 40.5% reported good preventive practices, with specific behaviors such as regular physical activity (30.7%) and weight loss attempts (34.4%) being particularly low. Slightly better adherence was seen in avoiding excess salt (47.4%), monitoring blood pressure (41.4%), and taking prescribed anti-hypertensive medications (44.6%). However, consistent control of cholesterol levels was observed in less than 40% of patients. (Table 3)

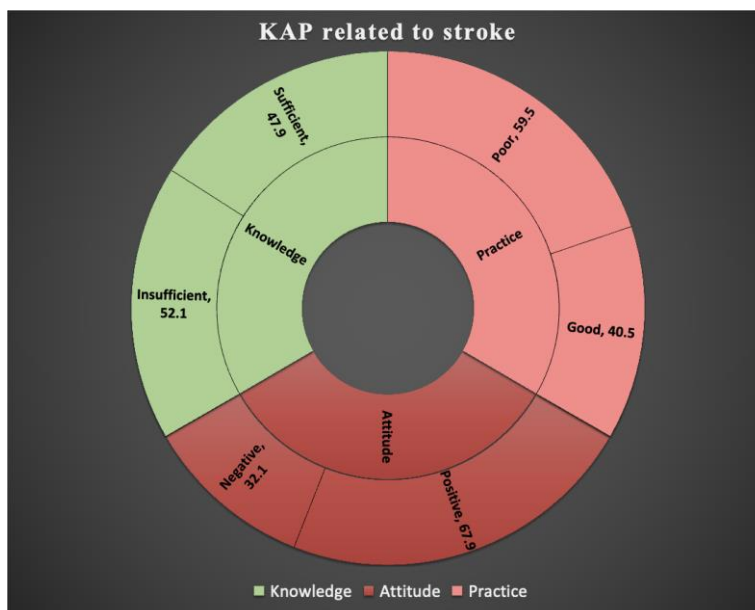


Figure 1: Overall Knowledge, Attitude, and Preventive practices among Diabetic patients

Table 4: Sources of Information on Stroke Awareness Among Diabetic Patients

Source of Information	Frequency (n=430)	Percentage (%)
Healthcare staff	186	43.3
TV and Radio	158	36.7
Family and friends	148	34.4
Health education material, posters & brochures	92	21.4
Internet	74	17.2
Newspaper and magazine	62	14.4

When asked about their primary sources of information regarding stroke, most patients reported learning from healthcare staff (43.3%), followed by television/radio (36.7%) and family and friends (34.4%). Traditional sources such as newspapers and magazines (14.4%) and printed health education materials like posters and brochures (21.4%) played a relatively smaller role. Meanwhile, the internet (17.2%) was cited by fewer patients, reflecting moderate penetration of digital health information in this semi-urban/rural cohort (Table 4).

**Discussion**

This study aimed to assess stroke risk awareness and preventive practices among 430 patients with diabetes attending a tertiary care center in Gujarat, India.

**Knowledge of Stroke:** Our study found that 47.9% of diabetic patients had adequate overall knowledge of stroke, with specific knowledge gaps in warning signs (43.7% sufficient) and risk factors (47.4% sufficient). This level of awareness is comparable to, and in some aspects slightly better than, findings from other studies in similar settings. For instance, Elshebiny et al. (2023) reported an overall good awareness level of 43.1% among diabetic patients in Saudi Arabia [11]. Jayakrishna B et al. (2024) found

a similar figure of 45.1% good awareness among diabetic patients in Kerala, India [12]. Mekuria AB et al. (2022) reported an even lower 36.65% good knowledge among diabetic and hypertensive patients in Ethiopia [13]. These consistent findings across different regions suggest a widespread deficit in stroke knowledge among diabetic populations, underscoring the global challenge in disseminating crucial health information.

However, our findings also indicate specific areas where knowledge is particularly low. For example, diagnostic test knowledge (32.1% sufficient) and treatment knowledge (35.8% sufficient) were notably poor. This aligns with Paramasivam et al. (2025), who noted that while three-fourths of their participants could identify at least one warning symptom, only 22.3% knew the brain was the primary organ involved, and only 21.6% correctly identified hypertension and diabetes as risk factors [15]. This suggests that general awareness of stroke symptoms might be present, but a deeper understanding of the disease’s mechanisms, diagnosis, and management is often lacking. The latest Indian studies, such as those highlighted by PMC (2024) and SPRINT INDIA (2025), emphasize the strong association between diabetes, hypertension, and dyslipidemia with stroke incidence [16, 17]. Despite

this, our study, and others, show that knowledge of these fundamental risk factors remains suboptimal among the target population.

**Attitude Towards Stroke Prevention:** Our study revealed a generally positive attitude towards stroke prevention, with 67.9% of participants exhibiting a positive outlook. A significant majority (66.5%) believed stroke is preventable, and 75.3% recognized the importance of blood pressure monitoring. This positive attitude is a valuable asset for future interventions. Osman et al. (2024) also reported that 68.5% of their hypertensive participants believed stroke is preventable, and 86.2% acknowledged the importance of regular blood pressure monitoring [18]. This suggests that while knowledge might be fragmented, there is a foundational belief in the efficacy of preventive measures. The challenge lies in translating this positive attitude into concrete, consistent preventive practices.

**Preventive Practices:** Despite the positive attitudes, the adoption of preventive practices was found to be suboptimal, with only 40.5% of participants reporting good practices. Specific areas of concern include routine physical exercise (30.7% good practice) and efforts to lose weight (34.4% good practice). This gap between attitude and practice is a common theme in public health research. Mekuria AB et al. (2022) reported a good prevention practice rate of 42.67%, which is very similar to our findings, further highlighting this discrepancy [13]. Osman et al. (2024) also found that despite good knowledge, their participants struggled to convert it into positive practice, with only 41.9% checking their blood pressure regularly and 37% taking their medications consistently [19]. Our study's results for checking BP regularly (41.4% good) and taking prescribed anti-hypertensive medications (44.6% good) are consistent with these observations.

The low engagement in physical activity and weight management is particularly concerning given the high prevalence of obesity (47.4%) and the well-established role of lifestyle modifications in diabetes and stroke prevention. The latest Indian studies, such as the SPRINT INDIA trial (2023), reinforce that recurrent stroke and coronary artery disease are major predictors of mortality in India, with hypertension and diabetes being significant risk factors [17]. This emphasizes the critical need for improved adherence to preventive practices, beyond just awareness. The Podder et al. (2020) study in North-west India also found a surprisingly low level of awareness regarding diabetic comorbidities, including stroke, and highlighted the need for policy changes to increase awareness and screening programs [20]. This aligns with our findings, suggesting that despite the prevalence of these conditions, the practical application of preventive knowledge is lacking.

**Implications for Public Health:** The persistent gap between knowledge, attitude, and practice highlights the need for comprehensive and multi-faceted public health interventions. Simple awareness campaigns may not be sufficient; instead, programs should focus on translating knowledge into actionable behaviors. This could involve patient education that is not only informative but also practical, providing clear guidance on how to incorporate preventive measures into daily life. Culturally tailored educational materials, as suggested by the Frontiers (2025) study on improving stroke awareness, could be particularly effective in the Indian context [18]. Furthermore, healthcare providers play a crucial role in reinforcing these messages and supporting patients in adopting healthier lifestyles. The findings from our study, combined with the insights from other Indian research, provide a strong rationale for developing and implementing targeted educational programs and policy changes to improve stroke risk awareness and preventive practices among diabetic patients in Gujarat and across India.

### Limitations

This study has some limitations. Its cross-sectional design prevents causal inferences, and the single-center setting in Gujarat, India, may limit generalizability. Convenient sampling could introduce selection bias. Reliance on self-reported questionnaires raises risks of recall and social desirability bias. Lastly, while knowledge, attitude, and practice were assessed, the study did not explore specific barriers or facilitators of preventive behaviors.

### Conclusion

This study highlights a significant gap between positive attitudes towards stroke prevention and the actual adoption of preventive practices among diabetic patients in a tertiary care center in Gujarat, India. While nearly half of the participants demonstrated adequate overall stroke knowledge, and a majority held positive attitudes, their engagement in crucial preventive behaviors like regular exercise and weight management was notably low. These findings underscore the urgent need for comprehensive, culturally sensitive educational interventions that not only enhance knowledge but also actively facilitate the translation of this knowledge into consistent, actionable preventive practices. Addressing this gap is crucial for reducing the burden of stroke in this vulnerable population.

### References

1. World Health Organization. Stroke [Internet]. Geneva: World Health Organization; [cited on 10<sup>th</sup> April 2025]. Available from: [https://iris.who.int/bitstream/handle/10665/43420/9241594047\\_eng.pdf](https://iris.who.int/bitstream/handle/10665/43420/9241594047_eng.pdf)
2. Feigin VL, Nguyen G, Cercy K, et al. Global, regional, and national burden of stroke, 1990–

- 2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Neurol.* 2019;18(5):439-58.
3. Tun NN, Arunagirinathan G, Munshi SK, Pappachan JM. Diabetes mellitus and stroke: a clinical update. *World journal of diabetes.* 2017 Jun 15;8(6):235.
  4. American Diabetes Association. 10. Cardiovascular disease and risk management: standards of medical care in diabetes—2021. *Diabetes Care.* 2021;44(Suppl 1):S125-50. [cited on 12<sup>th</sup> May 2025]. Available from: [https://care.diabetesjournals.org/content/44/Supplement\\_1/S125](https://care.diabetesjournals.org/content/44/Supplement_1/S125)
  5. International Diabetes Federation. *IDF Diabetes Atlas.* 10th ed. Brussels: International Diabetes Federation; 2021. [cited on 6<sup>th</sup> May 2025] Available from: <https://diabetesatlas.org/>
  6. Anjana RM, Deepa M, Pradeepa R, et al. Prevalence of diabetes and prediabetes in 15 states of India: results from the ICMR-INDIAB population-based cross-sectional study. *Lancet Diabetes Endocrinol.* 2017;5(8):585-96.
  7. Ergul A, Kelly-Cobbs A, Abdalla M, C Fagan S. Cerebrovascular complications of diabetes: focus on stroke. *Endocrine, Metabolic & Immune Disorders-Drug Targets (Formerly Current Drug Targets-Immune, Endocrine & Metabolic Disorders).* 2012 Jun 1;12(2):148-58.
  8. Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, Biller J, Brown M, Demaerschalk BM, Hoh B, Jauch EC. 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: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke.* 2019.
  9. Chen R, Ovbiagele B, Feng W. Diabetes and stroke: epidemiology, pathophysiology, pharmaceuticals and outcomes. *The American journal of the medical sciences.* 2016 Apr 1;351(4):380-6.
  10. GBD 2016 Stroke Collaborators. Global, regional, and national burden of stroke, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet. Neurology.* 2019 May;18(5):439.
  11. Elshebiny A, Almuhamma M, AlRamadan M, Aldawood M, Aljomeah Z, Al-Ramadan MS, Aldawood MA, Aljomeah ZA. Awareness of stroke risk factors, warning signs, and preventive behaviour among diabetic patients in Al-Ahsa, Saudi Arabia. *Cureus.* 2023 Feb 22;15(2).
  12. Jayakrishnan B, Sivasankaran AK. Evaluating Stroke Awareness Among People with Diabetes in Kerala: A Cross-Sectional Study. *International Journal of Life Sciences, Biotechnology and Pharma Research.* 2024;13 (10): 392-5.
  13. Mekuria AB, Kifle ZD, Melak AD. Level of knowledge, prevention practice, and predictors towards stroke among diabetic and hypertensive patients having a follow up at University of Gondar Comprehensive Specialized Referral Hospital, Northwest Ethiopia. A cross-sectional study. *Clinical Epidemiology and Global Health.* 2022 Jan 1;13:100950.
  14. Melak AD, Wondimseggn D, Kifle ZD. Knowledge, prevention practice and associated factors of stroke among hypertensive and diabetic patients—a systematic review. *Risk Management and Healthcare Policy.* 2021 Aug 11:3295-310.
  15. Paramasivam S, Ramalingam G, Gani AP. Awareness of Symptoms and Risk Factors of Stroke among Patients Attending a Tertiary Care Hospital, Tamil Nadu, India. *Journal of Applied Sciences and Clinical Practice.* 2025 Jan 1;6(1):27-31.
  16. Behera DK, Rahut DB, Mishra S. Analyzing stroke burden and risk factors in India using data from the Global Burden of Disease Study. *Scientific reports.* 2024 Sep 30;14(1):22640.
  17. Verma SJ, Kaur G, Devi A, Arora D, Dhasan A, Sylaja PN, Khurana D, Pamidimukkala V, Ray BK, Nambiar V, Aaron S. Educational and Socioeconomic Correlates of Stroke Risk Behaviors: Findings from the SPRINT INDIA Trial. *Annals of Indian Academy of Neurology.* 2025 May 19:10-4103.
  18. Cherfane M, Safwan J, Haddad C, Sacre H, Salameh P, Elkerenawy R, Abou El Kheir T, Al Nuaimi M, Abou Mattar L, Hosseini H, Sakr F. Improving stroke awareness through a culturally adapted audiovisual intervention in the United Arab Emirates. *Frontiers in Neurology.* 2025 Jul 23;16:1608381.
  19. Osman WA, Ahmed HM, Abdullahi MM, Kuule AA, Hassan QB. Knowledge, Attitude, and Practice of Stroke Among Hypertensive Patients in Selected Hospitals, Mogadishu: A Cross-Sectional Study. *Health Science Reports.* 2024 Dec;7(12):e70242.
  20. Podder V, Srivastava V, Kumar S, Nagarathna R, Sivapuram MS, Kaur N, Sharma K, Singh AK, Malik N, Anand A, Nagendra HR. Prevalence and awareness of stroke and other comorbidities associated with diabetes in Northwest India. *Journal of neurosciences in rural practice.* 2020 Jun 4;11(3):467.