

Knowledge and Practices Regarding Stroke and Associated Factors among Patients Attending the Internal Medicine Outpatient Clinic at Al-Thawra General Hospital in Ibb, Yemen

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Research Article

Keywords: Internal Medicine, Stroke, Knowledge, Practice, Stroke, Yemen

Posted Date: October 16th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-11207477/v1>

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Additional Declarations: No competing interests reported.

Abstract

Background

In Yemen, rising stroke prevalence exacerbated by modifiable risks including khat chewing and healthcare constraints underscores a critical scarcity of data on patient awareness and preventive practices, reflecting the disproportionate global burden faced by LMICs.

Objective

This study aimed to assess the level of knowledge and practices regarding stroke and associated factors among patients attending the internal medicine outpatient clinic at Al-Thawra General Hospital in Ibb, Yemen.

Methods

A descriptive cross-sectional study of 400 patients (March–July 2026) used a validated Arabic-adapted questionnaire and convenience sampling; data were analyzed with SPSS v.27.

Results

The mean overall knowledge score was 17.27 ± 3.54 (75.1%), with the highest domain scores for stroke consequences (5.67 ± 1.46 out of 7; 80.9%) and the lowest for general knowledge (3.26 ± 0.96 ; 65.1%). Practice scores were notably poor (9.80 ± 3.30 ; 49.0%), with substantial gaps in regular health monitoring and emergency response. Married status independently predicted nearly fivefold higher odds of adequate knowledge ($p = 0.003$), whereas khat chewing reduced the odds by 44% ($p = 0.014$). For practices, smoking abstinence ($p = 0.034$), khat abstinence ($p = 0.010$), and diabetes mellitus ($p = 0.025$) were significant predictors.

Conclusion

Despite reasonable knowledge, participants demonstrated poor preventive practices, revealing a critical knowledge-practice gap. Culturally tailored interventions addressing the underrecognized risk of khat chewing and promoting prompt emergency response are urgently needed to mitigate the growing stroke burden in Yemen.

Introduction

Stroke is a significant global health concern and a leading cause of mortality, morbidity, and long-term disability worldwide, accounting for approximately 12% of all deaths annually [1]. While global age-standardized stroke mortality rates have declined over the past three decades, low- and middle-income countries (LMICs) bear a disproportionately high burden, experiencing 70% of all strokes and 87% of stroke-related fatalities [2]. Despite a 36% decline in age-standardized mortality rates globally between 1990 and 2019, absolute stroke deaths in LMICs have risen markedly—from 4.8 million in 2010 to a projected 6.1 million by 2025—driven by population growth, increasing metabolic risk factors, and limited access to acute stroke care [2]. In the Middle East and North Africa (MENA) region, stroke prevalence and mortality have decreased slightly since 1990; yet substantial inter-country differences persist, and stroke remains a major public health challenge [3].

Public knowledge and awareness of stroke risk factors, warning symptoms, and appropriate emergency responses are critical determinants of timely treatment and improved clinical outcomes. Rapid thrombolysis therapy administered within the first 4.5 hours of symptom onset significantly reduces disability and enhances recovery in ischemic stroke patients [3–

4]. However, failure to recognize stroke symptoms and delayed response to warning signs can lead to irreversible brain damage, increased mortality, and prolonged disability [1]. Studies conducted across the Arab world have revealed variable and often inadequate levels of stroke awareness. In a multi-country study involving 4,090 participants from seven Arab nations, only 25.2% identified all stroke risk factors, 24.7% recognized all early symptoms, and 37.5% knew all possible consequences of stroke [3]. Similarly, in Ethiopia, 58.1% of the population demonstrated insufficient knowledge, attitudes, and practices regarding stroke, highlighting a significant gap in community awareness [1].

In Yemen, stroke represents a growing health burden, compounded by a high prevalence of modifiable risk factors and limited healthcare resources. Salah et al. [5] reported a stroke prevalence of 6.1% among patients attending a teaching hospital in Dhamar Governorate, with ischemic stroke accounting for 76.9% of cases. Hypertension was present in 57.1% of stroke patients, smoking in 47.3%, and diabetes mellitus in 11.0%. Notably, khat chewing—a culturally ingrained habit in Yemen was reported in 74.7% of stroke patients, making it the most prevalent risk factor identified [5]. A subsequent study conducted in Aden hospitals found that 55.3% of stroke patients were khat chewers, with a statistically significant association between khat chewing and stroke occurring before the age of 55 years, suggesting that this habit may contribute to premature stroke onset [6]. This finding aligns with international evidence indicating that amphetamine-like substances can induce ischemic strokes through cerebral vasospasm and vasculitis [6]. Yet, despite the high prevalence of khat use and its association with stroke in Yemen, there is a striking lack of studies assessing public awareness of this culturally specific risk factor.

The knowledge-practice gap in stroke prevention is well documented globally; however, the specific factors driving this discrepancy in Yemeni settings remain unexplored. Recent systematic reviews have consistently reported low stroke risk factor awareness in high-income countries, with hypertension most frequently identified, followed by smoking, dyslipidemia, and diabetes [7]. Sedentary lifestyle, alcohol consumption, ethnicity, and atrial fibrillation were the least recognized risk factors [7]. In the Yemeni context, the prevalence of khat chewing among stroke patients (74.7%) surpasses that of hypertension (57.1%) and smoking (47.3%), making it the most prevalent modifiable risk factor [8]. Despite this alarming statistic, community awareness of khat's role in stroke pathogenesis remains critically low, representing a unique public health challenge that demands targeted investigation. Therefore, this study aimed to assess the level of knowledge and practices regarding stroke and associated factors among patients attending the internal medicine outpatient clinic at Al-Thawra General Hospital in Ibb, Yemen.

Methods

Study Design, Setting, and Duration

This descriptive cross-sectional investigation evaluated stroke-related knowledge and practices among patients attending the Internal Medicine Clinic at Al-Thawra Hospital in Ibb City, Yemen, conducted between March 28 and July 9, 2026. The design was selected to enable the efficient, simultaneous assessment of multiple health outcomes and exposures within a defined population at a single time point [9–10].

Study Population and Selection Criteria

The target population comprised all adult patients attending the internal medicine outpatient clinics within Ibb City hospitals throughout the designated study period. Explicit eligibility criteria were applied to ensure internal validity by minimizing confounding variables and delineating a clearly defined, homogeneous cohort for analysis.

Inclusion and exclusion criteria

All patients aged 18 years or older who provided voluntary informed consent to participate were included in this study. However, patients who were younger than 18 years, refused to participate, failed to provide informed consent, had language barriers impeding comprehension of the questionnaire, or presented with acute clinical instability or severe illness precluding survey completion were excluded.

Sample Size and Sampling Technique

A non-probability convenience sampling strategy was deliberately adopted. While probability-based approaches are theoretically optimal for maximizing population generalizability, their execution in routine clinical settings is frequently constrained by logistical realities, including finite study timelines and budgetary limitations [11–12]. Convenience sampling is widely endorsed in exploratory health behavior research, where the primary objective is preliminary hypothesis generation rather than strict population parameter estimation [13]. To attenuate inherent selection biases, all eligible patients presenting during the study period were systematically approached.

The minimum required sample size was computed a priori using the standard formula for estimating a single population proportion, predicated on a 95% confidence level and a 5% allowable margin of error. Employing the stroke prevalence of 6.1% documented by **Salah et al.** [5] among patients attending a teaching hospital in Dhamar Governorate, Yemen, this calculation yielded a baseline target of 85 participants. However, to substantially elevate statistical power, enhance the precision of confidence intervals, and accommodate robust subgroup and multivariable analyses, the final analytical sample was deliberately expanded to 400 participants—approximately a fivefold increase. This expansion mitigates the inherent limitations of non-probability sampling by augmenting representativeness and ensuring that the Central Limit Theorem assumptions hold for parametric inferential procedures [14].

Data Collection Tool

The data collection instrument was a structured, self-administered questionnaire, primarily adapted from the validated tool employed by Malaeb et al. [3] in their multi-national investigation of stroke knowledge among Arabic-speaking adults. While retaining the core psychometric architecture, the instrument was judiciously tailored to the Yemeni context, incorporating culturally specific risk behaviors, most notably the endemic practice of khat chewing. The finalized questionnaire was systematically organized into three principal sections.

Sociodemographic and Clinical Characteristics

The first section procured comprehensive sociodemographic and clinical characteristics, including age, gender, residence, educational attainment, marital status, monthly income, smoking status, khat and tobacco chewing habits, and detailed medical history of diabetes mellitus, cardiac diseases, hypertension, hyperlipidemia, prior stroke or thrombotic events, and familial predisposition to stroke.

Knowledge Domain: The second section comprised 23 binary items (Correct/Incorrect) assessing knowledge across four fundamental dimensions: general awareness of stroke (5 items), recognition of early warning prodromal symptoms (5 items), identification of etiological risk factors (6 items), and understanding of clinical consequences alongside supplementary risk determinants (7 items). Scoring followed a dichotomous system wherein each correct response received 1 point and each incorrect response received 0, generating a cumulative knowledge score ranging from 0 to 23.

Practice Domain

The third section assessed health practices pertinent to stroke prevention across ten items, encompassing blood pressure self-monitoring, adherence to routine medical follow-up, dietary prudence, physical activity engagement, weight

maintenance, substance use avoidance, and emergency response behaviors. Responses were measured on a three-point frequency scale (Never = 0, Sometimes = 1, Always = 2), yielding an aggregate practice score ranging from 0 to 20.

Validity and Reliability

Validity

Content validity was established through expert review by three specialists in internal medicine and public health, who assessed the questionnaire for clarity, relevance, and comprehensiveness. Minor modifications were implemented based on their feedback. The instrument underwent forward translation from English to Arabic and independent back-translation to ensure linguistic accuracy and conceptual equivalence with the original version.

Pilot Study

A pilot study was conducted on 30 participants to assess the clarity, length, and flow of the questionnaire. The mean completion time was 15–20 minutes, and no modifications were required. Item-total correlation analysis using Pearson's correlation coefficient demonstrated that all items correlated significantly with their respective domain total scores ($p < 0.001$), confirming item homogeneity within each domain.

Reliability

Internal consistency was assessed using Cronbach's alpha coefficient. The pilot study yielded Cronbach's alpha coefficients of 0.76 for the knowledge domain and 0.73 for the practice domain, with an overall scale reliability of 0.75, indicating acceptable internal consistency [15]. Reliability was subsequently reassessed on the final study sample ($n = 400$), confirming the instrument's robustness and consistency.

Data Collection Procedure

Data were procured via structured, face-to-face interviews, a modality widely endorsed for augmenting respondent engagement and optimizing data veracity. Patients attending the internal medicine outpatient clinics were systematically approached by rigorously trained data collectors who elucidated the research objectives, guaranteed strict confidentiality, and solicited verbal informed consent, consistent with the Declaration of Helsinki [16]. To curtail information bias and standardize administration, all collectors underwent comprehensive training on the questionnaire's application and ethical provisions.

Statistical Analysis

Raw responses were systematically encoded into a pre-structured database using a formalized codebook [17]; binary knowledge items (with two reverse-scored) and three-point practice items (with three reverse-scored) yielded aggregate scores of 0–23 and 0–20, respectively [18]. Applying Bloom's modified 70% threshold, scores were dichotomized into "good" versus "poor" using domain-specific cut-offs (e.g., $\geq 17/23$ for overall knowledge), consistent with established stroke KAP literature [19–21]. Data were analyzed via the Statistical Package for the Social Sciences SPSS version 27.0 (IBM® Corp., US), with descriptive statistics summarizing participant profiles and bivariate associations examined using chi-square or Fisher's exact tests ($p < 0.05$). Binary logistic regression identified independent predictors through a two-step selection process, retaining covariates with univariate $p < 0.20$ for multivariable modeling [22]. Variance inflation factor (VIF) diagnostics confirmed the absence of multicollinearity, ensuring robust parameter estimation [23]. Adjusted odds ratios (OR) with 95% confidence intervals (CI) were reported, with two-tailed significance determined at $\alpha = 0.05$.

Results

Characteristics of Participants

Of the total 400 participants enrolled in the study, 217 (54.3%) were males and 183 (45.8%) were females. The largest age group was 31–50 years (43.8%), followed by those over 50 years (30.5%) and those under 30 years (25.8%). Regarding marital status, the majority were married (66.8%), while 22.3% were single, 6.5% divorced, and 4.5% widowed. Residence was nearly evenly distributed between rural (50.3%) and urban (49.7%) areas. Concerning education, 37.3% had a university level or higher, 29.8% had secondary education, 21.8% primary, and 11.3% were illiterate. Monthly income was moderate in 51.0%, low in 43.0%, and high in 6.0% of the participants. Regarding lifestyle factors, 28.0% were current smokers, 68.3% chewed khat, and 13.5% chewed tobacco. The most common concomitant diseases were hypertension (29.0%), followed by diabetes mellitus (20.0%), heart diseases (19.0%), and hyperlipidemia (15.3%). A personal history of stroke was reported in 10.0% and thrombosis in 8.5% of the participants, while a family history of stroke was present in 27.8%. T in Table 1.

Table 1
Distribution of Characteristics of Participants (N = 400)

Variable	Category	Frequency (n)	Percentage (%)
Age	< 30 years	103	25.8
	31–50 years	175	43.8
	> 50 years	122	30.5
Gender	Female	183	45.8
	Male	217	54.3
Residence	Rural	201	50.3
	Urban	199	49.7
Educational Level	Illiterate	45	11.3
	Primary	87	21.8
	Secondary	119	29.8
	University or Higher	149	37.3
Marital Status	Single	89	22.3
	Married	267	66.8
	Divorced	26	6.5
	Widowed	18	4.5
Monthly Income	Low	172	43.0
	Moderate	204	51.0
	High	24	6.0
Smoking	No	288	72.0
	Yes	112	28.0
Chewing Khat	No	127	31.8
	Yes	273	68.3
Chewing Tobacco	No	346	86.5
	Yes	54	13.5
Diabetes Mellitus	No	320	80.0
	Yes	80	20.0
Heart Diseases	No	324	81.0
	Yes	76	19.0
Hypertension	No	284	71.0
	Yes	116	29.0
Hyperlipidemia	No	339	84.8
	Yes	61	15.3

Variable	Category	Frequency (n)	Percentage (%)
History of Stroke	No	360	90.0
	Yes	40	10.0
History of Thrombosis	No	366	91.5
	Yes	34	8.5
Family History of Stroke	No	289	72.3
	Yes	111	27.8

Participants' knowledge regarding stroke

The overall stroke knowledge scores ranged from 5 to 23, with a mean of 17.27 (SD = ± 3.54), yielding a mean percentage score of 75.1%. At the domain level, the highest mean score was recorded for the Consequences/Additional Knowledge domain (5.67 ± 1.46 out of 7, 80.9%), followed by the Early Symptoms domain (3.87 ± 1.26 out of 5, 77.5%) and the Risk Factors domain (4.47 ± 1.36 out of 6, 74.5%). In contrast, the General Knowledge domain demonstrated the lowest mean score (3.26 ± 0.96 out of 5, 65.1%), falling below the 70% threshold. The highest correct recognition rates were observed for item a20 ("Movement or functional problems") at 91.0%, followed by item a1 ("Stroke is a disease of the brain") at 90.0%. Conversely, the lowest correct response rates were identified for item a2 ("Stroke is a hereditary disease") at 34.5%, item a4 ("Stroke is an old person's disease") at 44.3%, and item a13 ("Khat chewing") at 54.3%, as presented in Table 2.

Table 2
Knowledge of participants regarding stroke (N = 400)

Item	Statement	Incorrect n (%)	Correct n (%)
General Knowledge (Mean $\pm$ SD: 3.26 $\pm$ 0.96; 65.1% – Poor Knowledge)			
a1	Stroke is a disease of the brain.	40 (10.0)	360 (90.0)
a2*	Stroke is a hereditary disease.	262 (65.5)	138 (34.5)
a3	Stroke can be prevented.	85 (21.3)	315 (78.8)
a4*	Stroke is an old person's disease.	223 (55.8)	177 (44.3)
a5	Sudden difficulty speaking/understanding.	88 (22.0)	312 (78.0)
Early Symptoms (Mean $\pm$ SD: 3.87 $\pm$ 1.26; 77.5% – Good Knowledge)			
a6	Sudden weakness of limbs.	55 (13.8)	345 (86.3)
a7	Sudden loss of consciousness.	80 (20.0)	320 (80.0)
a8	Severe headache.	106 (26.5)	294 (73.5)
a9	Sudden blindness/double vision.	121 (30.3)	279 (69.8)
a10	Sudden dizziness.	89 (22.3)	311 (77.8)
Risk Factors (Mean $\pm$ SD: 4.47 $\pm$ 1.36; 74.5% – Good Knowledge)			
a11	High Blood Pressure.	50 (12.5)	350 (87.5)
a12	Smoking.	77 (19.3)	323 (80.8)
a13	Khat chewing.	183 (45.8)	217 (54.3)
a14	Diabetes Mellitus.	135 (33.8)	265 (66.3)
a15	Heart diseases.	71 (17.8)	329 (82.3)
a16	Obesity.	95 (23.8)	305 (76.3)
Consequences/Additional Knowledge (Mean $\pm$ SD: 5.67 $\pm$ 1.46; 80.9% – Good Knowledge)			
a17	Physical inactivity.	89 (22.3)	311 (77.8)
a18	Old age.	92 (23.0)	308 (77.0)
a19	Psychological stress.	68 (17.0)	332 (83.0)
a20	Movement or functional problems.	36 (9.0)	364 (91.0)
a21	Cognitive or memory problems.	64 (16.0)	336 (84.0)
a22	Visual problems (e.g., loss of sight).	94 (23.5)	306 (76.5)
a23	Emotional or personality changes.	91 (22.8)	309 (77.3)
Total Knowledge Score (out of 23)		17.27 $\pm$ 3.54 (75.1% – Good Knowledge)	
Note: Items marked with * were reverse-coded.			

Practices toward stroke prevention among participants

The overall practice scores ranged from 0 to 20, with a mean of 9.80 (SD = $\pm$ 3.30), corresponding to a mean percentage score of 49.0%, which was classified as poor practice. Regarding individual preventive behaviors, the highest proportion of participants reporting "Always" engaging in a behavior was observed for item P6 (smoking and tobacco use) at 64.0%,

followed by item P10 (taking home remedies when experiencing stroke symptoms) at 44.0%, and item P7 (khat chewing) at 32.5%. In contrast, the lowest rates of "Always" practicing recommended preventive behaviors were reported for item P2 (adhering to regular doctor visits) at 16.5%, item P3 (eating a healthy diet) at 19.8%, and item P1 (measuring blood pressure and sugar regularly) at 21.5%, as listed in Table 3.

With regard to health maintenance practices, the majority of participants reported "Never" or "Sometimes" for routine preventive measures, including blood pressure and sugar monitoring (78.6%), regular doctor visits (83.5%), and maintaining a healthy weight (75.1%). Regarding acute stroke response, 50.3% of participants reported "Never" calling emergency services (P9), while only 27.0% reported doing so "Always." Furthermore, 49.8% reported "Sometimes" going to the hospital immediately when symptoms appear (P8), and only 29.8% reported doing so "Always." Notably, 44.0% of participants "Always" relied on home remedies during stroke symptoms (P10), while only 15.8% "Never" engaged in this inappropriate practice (Table 3).

Table 3
Practices of Participants About Stroke (N = 400)

Item	Practice	Never n (%)	Sometimes n (%)	Always n (%)
P1	I measure blood pressure and sugar regularly	169 (42.3)	145 (36.3)	86 (21.5)
P2	I adhere to regular doctor visits	162 (40.5)	172 (43.0)	66 (16.5)
P3	I eat a healthy diet	114 (28.5)	207 (51.8)	79 (19.8)
P4	I practice physical activity regularly	119 (29.8)	172 (43.0)	109 (27.3)
P5	I maintain a healthy weight	147 (36.8)	153 (38.3)	100 (25.0)
P6*	I smoke and use tobacco products	77 (19.3)	67 (16.8)	256 (64.0)
P7*	I chew khat regularly	175 (43.8)	95 (23.8)	130 (32.5)
P8	I go to the hospital immediately if symptoms appear	82 (20.5)	199 (49.8)	119 (29.8)
P9	I call emergency services as soon as stroke signs appear	201 (50.3)	91 (22.8)	108 (27.0)
P10*	I take home remedies when I experience stroke symptoms	63 (15.8)	161 (40.3)	176 (44.0)
Total Practice Score (out of 20)		9.80 ± 3.30 (49.0% – Poor Practice)		
Note: Items marked with * were reverse-coded for scoring.				

Factors Associated with Stroke Knowledge and Practice

Regarding general knowledge, statistically significant associations were observed with age ($p = 0.009$), gender ($p = 0.021$), monthly income ($p = 0.010$), smoking ($p = 0.014$), chewing tobacco ($p = 0.022$), heart diseases ($p = 0.037$), hypertension ($p = 0.039$), and family history of stroke ($p = 0.037$). The highest percentage of people with good general knowledge were aged > 50 years (50.8%), males (44.7%), and those who chewed tobacco (53.7%). The lowest percentages were participants with low income (47.7%) and smokers (49.1%). Regarding early symptoms knowledge, significant associations were found with marital status ($p = 0.005$), monthly income ($p = 0.017$), and heart diseases ($p = 0.005$). Married participants demonstrated the highest proportion of good knowledge (73.8%), while widowed participants had the lowest (50.0%). Participants with moderate income (70.1%) and those with heart diseases (81.6%) also exhibited higher proportions of good knowledge compared to their counterparts. For risk factor knowledge, significant associations were identified with age ($p = 0.048$) and family history of stroke ($p = 0.012$). Participants aged > 50 years (63.9%) and those with a family history of stroke (64.9%) had higher proportions of good risk factor knowledge compared to younger participants and those without a family history. In the Consequences/Additional Knowledge domain, significant associations were observed with gender ($p = 0.035$) and chewing khat ($p = 0.010$). Males had a higher proportion of good knowledge (83.9%) compared to females (75.4%), and

participants who chewed khat demonstrated better knowledge (83.5%) than those who did not (72.4%), as showed in Table (4).

Regarding total overall knowledge, significant associations were found with marital status ($p < 0.001$), monthly income ($p = 0.009$), heart diseases ($p = 0.006$), and chewing khat ($p = 0.012$). Married participants (70.8%) and those with heart diseases (77.6%) had the highest proportions of good overall knowledge, while widowed participants had the lowest (33.3%). Participants with low income (69.2%) and those who chewed khat (68.1%) also demonstrated higher proportions of good total knowledge (Table 4).

For the overall Practice score, significant associations were observed with monthly income ($p = 0.003$), smoking ($p = 0.009$), and chewing khat ($p < 0.001$). The highest proportion of good practice was found among participants with moderate income (17.6%), non-smokers (14.9%), and those who did not chew khat (21.3%). Conversely, participants with low income (6.4%), smokers (5.4%), and those who chewed khat (8.1%) demonstrated the lowest proportions of good practice. Several factors did not demonstrate statistically significant associations with any of the outcome domains. These included residence ($p > 0.05$ for all domains), educational level ($p > 0.05$ for all domains), diabetes mellitus ($p > 0.05$ for all domains), hyperlipidemia ($p > 0.05$ for all domains), personal history of stroke ($p > 0.05$ for all domains), and personal history of thrombosis ($p > 0.05$ for all domains). Additionally, family history of stroke was not significantly associated with total knowledge ($p = 0.105$) or practice ($p = 0.220$), despite its significant associations with general knowledge and risk factors (Table 4).

Table 4
Association of factors with stroke knowledge and practice (N = 400)

Factor	Category	N	General Knowledge (% Good)	Early Symptoms (% Good)	Risk Factors (% Good)	Consequences (% Good)	Total Knowledge (% Good)	Practice (% Good)
Age	< 30 Y	103	35.0	66.0	49.5	79.6	61.2	12.6
	31–50 Y	175	34.3	70.3	51.4	81.7	64.6	10.3
	> 50 Y	122	50.8	66.4	63.9	77.9	65.6	14.8
	p-value		0.009*	0.687	0.048*	0.713	0.773	0.508
Gender	Female	183	33.3	64.5	56.8	75.4	59.6	12.6
	Male	217	44.7	71.0	53.0	83.9	67.7	12.0
	p-value		0.021*	0.166	0.443	0.035*	0.090	0.858
Residence	Rural	201	41.8	70.1	59.2	82.1	65.7	13.4
	Urban	199	37.2	65.8	50.3	77.9	62.3	11.1
	p-value		0.346	0.354	0.072	0.294	0.484	0.468
Education	Illiterate	45	37.8	66.7	60.0	73.3	68.9	6.7
	Primary	87	40.2	60.9	52.9	82.8	62.1	8.0
	Secondary	119	43.7	66.4	47.9	77.3	62.2	11.8
	University	149	36.2	73.8	59.7	82.6	65.1	16.8
	p-value		0.656	0.212	0.224	0.422	0.836	0.133
Marital Status	Single	89	36.0	58.4	53.9	75.3	53.9	13.5
	Married	267	41.6	73.8	56.9	82.4	70.8	12.0
	Divorced	26	34.6	53.8	53.8	80.8	50.0	15.4
	Widowed	18	33.3	50.0	27.8	66.7	33.3	5.6
	p-value		0.684	0.005*	0.120	0.240	< 0.001*	0.769
Income	Low	172	47.7	69.2	56.4	83.1	69.2	6.4
	Moderate	204	34.3	70.1	52.9	78.4	62.7	17.6
	High	24	25.0	41.7	58.3	70.8	37.5	8.3
	p-value		0.010*	0.017*	0.748	0.268	0.009*	0.003*
Smoking	No	288	35.8	67.0	54.9	78.1	63.9	14.9
	Yes	112	49.1	70.5	54.5	84.8	64.3	5.4
	p-value		0.014*	0.498	0.943	0.133	0.941	0.009*
Chewing Khat	No	127	33.9	63.8	53.5	72.4	55.1	21.3
	Yes	273	42.1	70.0	55.3	83.5	68.1	8.1
	p-value		0.115	0.217	0.741	0.010*	0.012*	< 0.001*
Tobacco	No	346	37.3	68.2	53.5	80.1	63.6	13.0

Factor	Category	N	General Knowledge (% Good)	Early Symptoms (% Good)	Risk Factors (% Good)	Consequences (% Good)	Total Knowledge (% Good)	Practice (% Good)
Diabetes Mellitus	Yes	54	53.7	66.7	63.0	79.6	66.7	7.4
	p-value		0.022*	0.821	0.192	0.942	0.661	0.243
	No	320	40.9	67.8	55.3	79.1	63.1	11.3
	Yes	80	33.8	68.8	52.5	83.8	67.5	16.3
	p-value		0.240	0.872	0.651	0.349	0.466	0.222
Heart Diseases	No	324	37.0	64.8	53.1	78.7	60.8	12.7
	Yes	76	50.0	81.6	61.8	85.5	77.6	10.5
	p-value		0.037*	0.005*	0.168	0.181	0.006*	0.611
Hypertension	No	284	36.3	66.2	54.2	79.9	62.0	13.4
	Yes	116	47.4	72.4	56.0	80.2	69.0	9.5
	p-value		0.039*	0.226	0.742	0.956	0.186	0.281
Hyperlipidemia	No	339	40.4	67.0	55.2	80.2	63.4	12.1
	Yes	61	34.4	73.8	52.5	78.7	67.2	13.1
	p-value		0.379	0.294	0.696	0.781	0.570	0.823
History of Stroke	No	360	40.8	67.5	55.0	80.3	63.6	13.1
	Yes	40	27.5	72.5	52.5	77.5	67.5	5.0
	p-value		0.102	0.520	0.763	0.677	0.627	0.140
History of Thrombosis	No	366	40.4	68.3	54.6	80.3	64.2	12.6
	Yes	34	29.4	64.7	55.9	76.5	61.8	8.8
	p-value		0.208	0.667	0.890	0.591	0.777	0.524
Family History of Stroke	No	289	36.3	68.9	50.9	79.9	61.6	13.5
	Yes	111	47.7	65.8	64.9	80.2	70.3	9.0
	p-value		0.037*	0.553	0.012*	0.955	0.105	0.220

*Note: $p < 0.05$ (statistically significant).

Binary logistic regression analysis

In the multivariable model for overall knowledge (Table 5), marital status (overall $p = 0.004$), monthly income (overall $p = 0.018$), chewing khat ($p = 0.014$), and heart diseases ($p = 0.030$) emerged as significant independent predictors. Married participants demonstrated nearly fivefold higher odds of good knowledge (OR = 4.89, 95% CI: 1.69–14.17, $p = 0.003$). Both low (OR = 3.87, 95% CI: 1.51–9.91, $p = 0.005$) and moderate income (OR = 3.02, 95% CI: 1.19–7.67, $p = 0.020$) were positively associated with good knowledge compared to high income. Chewing khat was associated with a 44% reduction in the odds of good knowledge (OR = 0.56, 95% CI: 0.35–0.89, $p = 0.014$), while heart diseases reduced the odds by 52% (OR = 0.48, 95% CI: 0.25–0.93, $p = 0.030$).

For the practice model (Table 5), monthly income (overall $p = 0.019$), smoking ($OR = 2.75$, 95% CI: 1.08–7.03, $p = 0.034$), chewing khat ($OR = 2.37$, 95% CI: 1.23–4.58, $p = 0.010$), and diabetes mellitus ($OR = 0.41$, 95% CI: 0.19–0.89, $p = 0.025$) were statistically significant predictors. Smoking and khat chewing (reverse-coded as abstaining from these harmful behaviors) increased the likelihood of good practice, whereas the presence of diabetes substantially decreased it. Gender, hypertension, family history of stroke, and educational level did not reach statistical significance in either model ($p > 0.05$ for all), while a personal history of stroke approached borderline significance for practice ($p = 0.053$, $OR = 4.49$, 95% CI: 0.98–20.50).

Table 5
Binary Logistic Regression Analysis (N = 400)

Variable	Category	B	Sig.	Exp(B)	95% C.I. for EXP(B)
Overall Stroke Knowledge					
Gender	Female (ref: Male)	-0.190	0.393	0.827	(0.535–1.279)
Marital Status (ref: Widowed)	(Overall)		0.004*		
	Married	1.588	0.003*	4.893	(1.690–14.170)
	Single	1.091	0.057	2.979	(0.970–9.148)
	Divorced	0.720	0.279	2.055	(0.558–7.571)
Monthly Income (ref: High)	(Overall)		0.018*		
	Low	1.352	0.005*	3.865	(1.508–9.911)
	Moderate	1.106	0.020*	3.023	(1.192–7.668)
Chewing Khat	Yes (ref: No)	-0.580	0.014*	0.560	(0.353–0.889)
Heart Diseases	Yes (ref: No)	-0.725	0.030*	0.484	(0.251–0.933)
Hypertension	Yes (ref: No)	-0.086	0.754	0.918	(0.536–1.570)
Family History of Stroke	Yes (ref: No)	-0.268	0.296	0.765	(0.463–1.265)
Overall Stroke Practice					
Educational Level (ref: University)	(Overall)		0.360		
	Illiterate	-0.933	0.169	0.393	(0.104–1.485)
	Primary	-0.657	0.176	0.519	(0.200–1.343)
	Secondary	-0.374	0.339	0.688	(0.320–1.479)
Monthly Income (ref: High)	(Overall)		0.019*		
	Low	-0.244	0.768	0.784	(0.155–3.968)
	Moderate	0.807	0.306	2.242	(0.478–10.528)
Smoking	Yes (ref: No)	1.013	0.034*	2.754	(1.079–7.028)
Chewing Khat	Yes (ref: No)	0.862	0.010*	2.368	(1.225–4.577)
Diabetes Mellitus	Yes (ref: No)	-0.885	0.025*	0.413	(0.191–0.893)
History of Stroke	Yes (ref: No)	1.501	0.053	4.488	(0.982–20.504)
Family History of Stroke	Yes (ref: No)	0.334	0.402	1.397	(0.639–3.053)

*Note: $p < 0.05$ (statistically significant).

Discussion

The present findings reveal a significant knowledge-practice gap: while participants demonstrated moderate to good knowledge of stroke symptoms and risk factors, their preventive practices were alarmingly poor. This discrepancy has critical implications for stroke prevention and management in Yemen, particularly given the country's fragile healthcare system and high burden of modifiable risk factors. Regarding general knowledge, the moderate overall knowledge score (75.1%) in this study is encouraging and comparable to findings from other Arab countries. The high proportion of participants who correctly identified stroke as a brain disease aligns with findings from Saudi Arabia [20, 24] and Nepal [25], suggesting that basic stroke awareness has penetrated even resource-limited settings. Similarly, 78.8% of the participants recognized that stroke can be prevented, which is consistent with the findings from Ethiopia, where 78.7% acknowledged preventability [1].

Concerning misconceptions persisted; over one-third incorrectly believed that stroke is hereditary, and 44.3% considered it an "old person's disease." These misconceptions are particularly dangerous, as they may lead younger individuals to underestimate their stroke risk and delay seeking medical attention when symptoms occur. Similar findings were reported in Saudi Arabia, where 12.2% incorrectly believed stroke affects only the elderly [21]. The belief that stroke is hereditary may stem from cultural perceptions of familial disease patterns and the observation of clustering within families due to shared environmental and lifestyle risk factors rather than true genetic transmission.

Regarding knowledge of early symptoms, participants demonstrated a relatively good level of knowledge concerning early stroke symptoms (77.5%). The most commonly recognized symptom was sudden limb weakness (86.3%)—a finding consistent with a previous study conducted in Saudi Arabia [20] but differing from other reports [26–27]. This high level of symptom recognition likely reflects the acute and disabling nature of motor impairments, making them more memorable to the general public. As for sudden loss of consciousness, it was identified as a symptom by 80.0% of participants—a figure comparable to results recorded in Saudi Arabia, where 86.7% of participants recognized this symptom [23].

Furthermore, the low recognition of sudden blindness or double vision (69.8%) and severe headache (73.5%) is concerning. These symptoms, particularly sudden visual changes, may be less intuitively linked to stroke in the public's mind, as they are often attributed to ophthalmological or neurological conditions. The FAST campaign (Face, Arm, Speech, Time) may need to be expanded to include these additional warning signs to improve comprehensive stroke symptom recognition. A study from Thailand demonstrated that exposure to the FAST campaign significantly improved symptom recognition among participants [28].

The most widely recognized risk factor was high blood pressure (87.5%), consistent with global studies where hypertension is consistently identified as the leading stroke risk factor [1, 20]. Among university students in Saudi Arabia, high blood pressure was also the most recognized risk factor (85.1%) [29]. Heart diseases (82.3%) and smoking (80.8%) were also well-recognized, reflecting the effectiveness of public health messaging on cardiovascular risk factors.

Furthermore, the most striking finding was the low recognition of khat chewing as a stroke risk factor (54.3%). Despite khat being the most prevalent risk factor in this population (68.3% reported chewing regularly), less than two-thirds of participants recognized it as a risk factor. This represents a critical knowledge gap, as khat chewing has been identified as a significant stroke risk factor by 74.73% in Yemen [8]. The mismatch between the high prevalence of khat chewing and the low recognition of its risk underscores the urgent need for targeted health education campaigns addressing culturally specific risk factors. Additionally, earlier literature confirms that khat chewing is an independent risk factor for stroke, with khat chewers having a significantly higher risk of stroke and mortality [30].

Only two-thirds of the participants recognized diabetes as a risk factor; this finding aligns with a study conducted in Saudi Arabia, in which 67% of participants identified diabetes as a risk factor [24]. However, this result contrasts with reports showing rates of 45.3% in Ethiopia [1], 28.6% in Nigeria [31], and 57.4% in India [27], suggesting a global pattern of poor diabetes awareness as a stroke risk factor.

The poor practice score (49.0%) reveals significant gaps in preventive health behaviors. Only 21.5% of participants regularly measured their blood pressure and blood sugar, and only 16.5% adhered to regular doctor visits. These findings are particularly concerning given the high prevalence of hypertension (29.0%) and diabetes (20.0%) in this population. Poor self-monitoring and follow-up likely contribute to uncontrolled risk factors and increased stroke risk. Among university students in Saudi Arabia, the study highlighted moderate knowledge but inadequate preventive practices, emphasizing the need for structured educational programs [29].

While 51.8% of participants "sometimes" followed a healthy diet, only 19.8% did so consistently. Similarly, only 27.3% exercised regularly. The high proportion of sedentary behavior aligns with findings from Saudi Arabia, where physical inactivity was identified as a leading risk factor [20], and from Ethiopia, where lack of awareness of risk factors was associated with poor practices [1].

The most concerning finding relates to substance use: 64.0% of participants reported always smoking or using tobacco products, and 32.5% chewed khat always. These high rates of substance use, despite knowledge of their harmful effects, suggest strong cultural and social factors that override health considerations. In Saleh et al. [8] study, 74.73% of stroke patients reported khat chewing, and 47.3% were smokers. These figures highlight the need for targeted interventions addressing these culturally ingrained behaviors. The prevalence of khat chewing has been estimated at 80% for males and 50% for females in the capital Sana'a at age fifteen and above [6].

Married participants demonstrated significantly higher knowledge across all domains, while widowed participants had the lowest scores. This may reflect the social support and shared health information within marriages, while widowed individuals may have less access to health information due to social isolation. Similar findings were reported in Ghana, where marital status was associated with stroke knowledge [31], and in Saudi Arabia, where being married was associated with better general awareness [24].

The paradoxical finding that low and moderate income were associated with better knowledge compared to high income warrants careful interpretation. This may reflect the concentration of high-income individuals in urban areas where access to healthcare information may paradoxically be lower due to reliance on private practitioners who spend less time on preventive education, or it may reflect a selection bias where low-income patients attending public clinics receive more structured health education. Similar paradoxical findings have been reported in other LMIC settings where the relationship between socioeconomic status and health knowledge is not linear [3].

The finding that khat chewing was associated with a 44% reduction in the odds of good knowledge ($OR = 0.56$) is particularly concerning. While this may seem counterintuitive, it likely reflects the normalization of khat chewing in Yemeni culture, where its health risks are not widely recognized or discussed. The social nature of khat sessions may not facilitate health discussions, as previously hypothesized. This finding underscores the urgent need for targeted health education campaigns that specifically address the stroke risk associated with khat chewing, using culturally sensitive messaging that does not stigmatize users but rather educates them about the health consequences.

The unexpected finding that heart diseases were associated with a 52% reduction in the odds of good knowledge ($OR = 0.48$) warrants further investigation. This may reflect the severity of heart disease in this population, where patients may be overwhelmed by their primary condition and less attentive to stroke prevention education. Alternatively, it may indicate that patients with heart disease receive focused education on their cardiac condition but not on stroke prevention, representing a missed opportunity for integrated cardiovascular risk reduction. Further research is needed to explore this paradoxical association.

In the practice model, abstinence from smoking and khat chewing were significant predictors of good practice, indicating that those who avoid these harmful behaviors are more likely to engage in other preventive practices. This aligns with the Health Belief Model, where individuals who perceive their risk and believe in the benefits of preventive actions are more likely to adopt healthy behaviors.

The presence of diabetes substantially decreased the odds of good practice (OR = 0.41), suggesting that individuals with chronic conditions may face barriers to adopting preventive behaviors despite their increased risk. This may reflect the burden of managing a chronic condition, financial constraints, or competing health priorities. Similar findings have been reported in other settings where diabetes was associated with poor medication adherence and self-care practices [32].

The knowledge–practice chasm delineates a critical imperative for healthcare providers to transcend didactic risk communication and implement structured, theory-driven behavioral counseling addressing perceived barriers to prevention [33–34]. The pervasive underrecognition of khat chewing, despite its endemic prevalence, necessitates culturally adapted, multi-platform educational campaigns leveraging mass media, religious institutions, and clinical settings to mitigate this overlooked risk factor—given that up to 80% of strokes are preventable through lifestyle modification [35–36]. The markedly suboptimal emergency response, characterized by 44% reliance on home remedies and only 27% calling emergency services, compels urgent public messaging extending beyond the FAST mnemonic to prioritize immediate medical attention [37]. Moreover, the robust marital–knowledge association underscores the strategic value of family-centered interventions in Yemen's collectivist social fabric, while the paradoxical inverse relationship between heart disease and knowledge signals a missed opportunity to embed stroke prevention counseling within routine cardiovascular care.

Our findings are broadly consistent with studies from other Arab countries and LMICs. The moderate knowledge scores (75.1%) are comparable to those reported in Saudi Arabia [20, 24], Lebanon [3], and the UAE [38], but higher than those reported in Ethiopia [1] and Nigeria [26]. The poor practice scores in this result are similar to those reported in Ethiopia [1] and India [27], suggesting that the knowledge-practice gap is a global phenomenon, particularly in LMICs. The high prevalence of khat chewing (68.3%) in our sample is unique to the Yemeni and Horn of Africa context. While studies from Somalia have reported similar rates of khat use among stroke patients [39], the low recognition of khat as a risk factor (54.3%) is a finding that has not been extensively documented elsewhere. This highlights the importance of context-specific research to inform targeted interventions.

Study significant and limitation

The significance of these data lies in bridging a critical knowledge gap in the medical literature regarding stroke in a country with limited healthcare resources and a lack of local data. The study revealed a disparity between patients' knowledge and their actual behavior concerning stroke, highlighting the need for stakeholders to focus on behavioral change rather than mere theoretical awareness. Furthermore, this study adds scientific value by identifying a unique local risk factor, khat chewing, alongside demographic and health determinants that negatively impact stroke prevention practices. This provides preliminary scientific evidence to assist health institutions in designing and implementing awareness programs and preventive interventions tailored to the local sociocultural context, thereby contributing to mitigating the growing burden of stroke and reducing the associated financial costs. Despite the importance of this study, there are some limitations. The cross-sectional, single-centre design precludes causal inference and restricts generalizability beyond Ibb, while self-reported data introduce social desirability and recall biases, particularly for stigmatized behaviors such as khat chewing and smoking. Convenience sampling may have introduced selection bias, and the limited sample size in certain subgroups likely reduced statistical power for stratified analyses. Furthermore, the omission of attitude assessment constrains a holistic KAP evaluation; nonetheless, these findings furnish essential baseline data on stroke awareness and practices in this conflict-affected, low-resource context.

Conclusions

This study confirms a pronounced knowledge-practice chasm: adequate symptom recognition is vitiated by persistent misconceptions regarding heredity and aging, and most critically a profound cultural unawareness of the stroke risk posed by endemic khat chewing. Identified independent predictors (marital status, income, substance use, and cardiometabolic comorbidities) delineate priority intervention targets. To bridge this gap, culturally adapted, low-literacy community campaigns must foreground khat-related dangers, while clinicians integrate stroke prevention counseling into routine

chronic disease management. Public health messaging should extend beyond the FAST mnemonic to encompass atypical symptoms and unequivocally prioritize emergency medical response over home remedies. Concurrently, rigorous longitudinal research is essential to corroborate these strategies, supplemented by policy-level fiscal and regulatory measures on tobacco/khat and community-based programs tackling their sociocultural determinants.

Abbreviations

- 95% CI
- 95% Confidence Intervals
- aOR
- Adjusted Odds Ratios
- FAST
- Face, Arm, Speech, Time
- LMICs
- Middle-Income Countries
- MENA
- Middle East and North Africa
- P value
- Probability value
- SD
- Standard Deviations
- VIF
- Variance Inflation Factor

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Institutional Review Board (IRB) at the Faculty of Medicine and Health Sciences, Ibb University, on February 10, 2026 (Reference No. REC/IBB/2026/022). Furthermore, the study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and Yemeni health regulations. All participants provided informed consent prior to participation and were assured of data confidentiality and anonymity; they were also informed of their right to withdraw from the study at any time without consequence.

Clinical trial number

Not applicable.

Consent for publication

Not applicable.

Competing Interests

Not applicable

Conflict of interest

The authors declare that they have no competing interests.

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Funding

Not applicable

Author Contribution

Al-Tahesh S and Alshabani A conceived the study; Shomais A and Al-Tahesh S collected the data; Alshabani A, Al-Tahesh S, and Al-Shehari W processed the data; Al-Tahesh S, Shomais A, and Edrees W analyzed and interpreted the data. Alshabani A, Al-Tahesh S, and Al-Shehari W wrote the first draft manuscript. Shomais A and Edrees W reviewed and edited the final manuscript. All authors revised and approved the manuscript for submission.

Data Availability

The datasets used and analyzed during this analysis are available from the corresponding author, who will provide any relevant data upon reasonable request.

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