KNOWLEDGE AND AWARENESS LEVEL OF KSA POPULATION TOWARDS WARNING SIGNS, FIRST AID, AND RF OF STROKE

Omar Babateen[1], Norah Almuzil[2*], Abdulrahman Alhazmi[3], Ryan Alghamdi[4], Suha Alkhazaim[5], Rand Alanazi[6], Hadeel Alabdulqader[4], Ashjan Al Mansour[5], Khames Alzahrani[7], Abdullah Tawakul[8]

1. *Department of Physiology, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia.*
2. *College of Medical, Jeddah University, Jeddah, Saudi Arabia.*
3. *College of Medical, Umm Al-Qura University, Qunfudhah, Saudi Arabia.*
4. *College of Medical, King Abdulaziz University, Jeddah, Saudi Arabia.*
5. *College of Medical, Najran University, Najran, Saudi Arabia.*
6. *College of Medical, Imam Mohammad Ibn Saud Islamic University, Riyadh, Saudi Arabia.*
7. *Saudi Board of Endodontic SR, King Faisal Specialist Hospital &Research Center, Riyadh, Saudi Arabia.*
8. *Department of Medicine, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia.*

ARTICLE INFO

ABSTRACT

A stroke is a severe medical condition resulting from a thrombus that obstructs the blood to the brain. Furthermore, it is widely recognized as the second leading cause of mortality and the third most significant cause of disability worldwide. This study aims to understand the general population's knowledge and awareness level of warning signs, first aid, and risk factors related to strokes in Saudi Arabia. A cross-sectional study was conducted in Saudi Arabia. The study utilized a structured questionnaire in both English and Arabic language, which was designed using Google Forms to collect the participant's data and distribute it through social media platforms. A minimum sample size of 385 was necessary for our study. Data analysis was conducted using SPSS. The study included a total of 1815 participants, with 66.1% of them being females and 33.9% being males. Among the participants, 49.5% were 20- 30 years old. Only 0.5% of participants had a history of stroke. A significant association was observed between the awareness scores for strokes and various demographic factors, including age, marital status, residence region, and educational level among the participants. These results underscore the necessity for tailored awareness campaigns aimed at the population at the highest risk for strokes. Simultaneously, Simultaneously, there is a pressing need to educate the general public about the symptoms of this condition, their potential severity, the importance of addressing modifiable risk factors, and the correlation between prompt hospital visits and improved prognosis.

Introduction

A stroke can be defined as a neurological dysfunction caused by an obstruction of blood flow in the brain due to a thrombus [1]. It is a significant public health concern worldwide, characterized by its sudden onset and potential for devastating consequences. Stroke is considered as one of the most serious illnesses with the highest disability rate, and its high morbidity, mortality, and disability rates place a significant burden on society, families, and individuals [2]. Stroke is the second-leading cause of disability and death globally, and low- and middle-income countries bear the greatest illness burden. There were 13.7 million new stroke incidents worldwide in 2016 [3]. Stroke hospitalizations are thought to affect 140,000 people in France annually [4]. In Saudi Arabia, as in many countries, stroke ranks among the leading causes of morbidity and mortality.

Corresponding Author: Norah Almuzil; College of Medical, Jeddah University, Jeddah, Saudi Arabia. E-mail: nourasaleh0077@gmail.com.

According to a study in Saudi Arabia conducted in 2021, there are 43.8 strokes per 100,000 people in Riyadh and 29.8 per 100,000 people in Eastern Province [5].

There are numerous predisposing factors for stroke. The most common risk factors for stroke include hypertension, high cholesterol, diabetes, cardiovascular disease, and blood clotting problems [6, 7]. The therapeutic window in which treatment can be effective is limited, so early detection is critical [8]. Studies have shown that 80% of stroke cases can be prevented through knowledge of first aid [9]. Therefore, it is assumed that stroke is a disease that can be prevented if a healthy lifestyle and other modifiable risk factors are targeted, whether at the community or individual level.

In 2020, Ewa Krzystanek *et al.* conducted a study on the knowledge of stroke symptoms, risk factors, and required actions. The study reported that an essential aspect of having sufficient information about strokes is the previous incidence of stroke in family members or friends [10]. Another study conducted in 2020 about stroke knowledge and associated factors found that lower knowledge of stroke was independently correlated with factors such as illiteracy, primary education, rural residence, no history of stroke among respondents, and no history of stroke among relatives, acquaintances, or neighbors [11].

In 2020, Rania Naguib *et al.* conducted an observational cross-sectional study in Riyadh to assess the awareness level of stroke among adults. The result revealed a persistent knowledge gap about the risk factors for stroke and the significance of seeking emergency medical care. This finding is notable given previous reports suggesting that the public has a relatively higher degree of knowledge about stroke [12].

Limited research has been undertaken in Saudi Arabia concerning our specific topic, with previous studies focusing on a specific subset of cities within the country. To the best of our knowledge, no prior research has comprehensively encompassed all cities in Saudi Arabia, and there has also been an imbalance in sample sizes between males and females. Understanding the significance of knowing first aid for a stroke lies in its potential to expedite hospital attendance for patients, thereby enhancing their treatment and reducing the likelihood of complications.

Through this cross-sectional survey, this study aims to assess and analyze the knowledge and awareness levels of the Saudi Arabian population regarding the warning signs, first aid practices, and risk factors associated with stroke. By achieving these aims, this study sought to provide valuable insights into the current state of stroke awareness in Saudi Arabia, inform healthcare policies and educational programs, and ultimately contribute to reducing the burden of stroke through improved prevention and early intervention strategies.

Materials and Methods

Study Design
This observational cross-sectional study, based on a structured questionnaire, was conducted in Saudi Arabia. The study focused on the general population in Saudi Arabia aged 18 and above with equal representation of both genders.

Inclusion and Exclusion Criteria
This study included the adult population in Saudi Arabia aged 18 and above who had not experienced a stroke and agreed to participate in our study. People who were younger or had a history of stroke were excluded.

Sample Size
The General Authority for Statistics provided the entire population of Saudi Arabia, which was used to calculate the sample size totaling almost 34,110,821. The Raosoft software was used to determine the minimum sample size needed for our study, which was determined to be 385, using a normal standard deviation of 1.96 for a 95 % confidence interval.

Data Collection Technique and Tools
A structured questionnaire served as the study tool. This tool was available in both English and Arabic, ensuring ease of comprehension. It had been designed using Google Forms and was distributed through various social media platforms. The questionnaire comprised 36 questions categorized into sections. The initial section included consent, followed by sociodemographic questions in the second section. The third part consisted of questions aimed at assessing stroke knowledge, and the last section contained questions to evaluate awareness regarding stroke. Most of the questions were based on Three-Point Scales (Yes, No, I don't know). On average, participants could complete this questionnaire in 3 to 4 minutes. The data were collected from participants through the survey distributed on social media platforms, with any missing data subsequently deleted.

Scoring System
There were 12 questions used to evaluate knowledge about the general concept of stroke, including aspects such as the definition, types, onset of symptoms, and risk factors. Each question provided three options, with one point awarded for the correct answer and zero for an incorrect one. The knowledge scores ranged from 1 to 12 points, and they were categorized into three levels: a low level of knowledge (0-4 points), a moderate level of knowledge (5-8 points), and a high level of knowledge (9-12 points).

Awareness

This section included questions aimed at measuring the population's awareness of the seriousness of stroke, its warning signs, and the appropriate actions to take if a stroke was suspected. Respondents had the option of answering "yes," "no," or "I don't know" to each question. A correct answer received one point, while an incorrect answer or selecting "I don't know" resulted in zero points. The awareness scores ranged from 0 to 15 and were divided into three levels: 0-5 points for a poor awareness level, 6-10 points for a fair level, and 11-15 points for a good level of awareness field [13].

Analyzes and Entry Method

In this study, "Microsoft Office Excel Software" program (2017) for Windows was used to enter the data, and then the data were transferred to the statistical package of the Social Science Software (SPSS) program, specifically version 20 (IBM SPSS Statistics for Windows, version 20.0. Armonk, NY: IBM Corp). Quantitative variables were calculated using the mean, median, and standard deviation. Conversely, qualitative data were presented in the form of frequencies and percentages. To ascertain statistical significance, the P-value was set at $P < 0.05$. In our study we used analytical test of significance to calculate the P-value is the (Chi-square test).

Results and Discussion

The study encompassed a total of 1,815 participants, with the majority being females, constituting 66.1% of the sample, while males accounted for 33.9%. In terms of age distribution, nearly half of the participants, 49.5%, fell within the 20-30 years age group, and 17.5% were in the 31-40 years age bracket. Regarding marital status, 42.5% of the participants were married, while the remaining 54.5% were single. A substantial majority, 96.1%, were of Saudi nationality. In terms of educational attainment, 56.6% held a bachelor's degree. When it came to employment, 40.1% identified themselves as employees **(Table 1)**.

Table 1. Sociodemographic characteristics of participants (n=1815)

Parameters		No.	%
Age distribution	less than 20	229	12.6
	20 - 30	899	49.5
	31 - 40	317	17.5
	41 - 50	231	12.7
	51 - 60	113	6.2
	more than 60	26	1.4
Gender	Male	615	33.9
	Female	1200	66.1
Marital status	Single	989	54.5
	Married	772	42.5
	Divorced	42	2.3
	Widow	12	0.7
Nationality	Saudi	1744	96.1
	Non -Saudi	71	3.9
Region	South	460	25.3
	Eastern	295	16.3
	North	42	2.3
	Western	759	41.8
	Central	259	14.3
Education level	Uneducated	1	0.1
	Primary	15	0.8
	Middle	29	1.6
	Secondary	436	24.0
	Bachelor's	1028	56.6
	Diploma	175	9.6
	Postgraduate	131	7.2
Employment status	Employee	727	40.1
	Not an employee	1088	59.9

As depicted in **Table 2**, which presents the Prevalence and Awareness of Stroke among the study participants, only 0.5% of the respondents reported a prior history of stroke. Interestingly, a significant proportion of participants, amounting to 33.4%, gained awareness about stroke through media outlets, while 25.2% acquired knowledge about it through educational programs or studies. Furthermore, 13.7% of participants credited their understanding of stroke to information provided by healthcare professionals, particularly doctors.

Table 2. Prevalence and awareness of stroke among study participants (n=1815)

Parameters		No.	%
Had stroke before	Yes	9	.5
	No	1806	99.5
Heard of stroke	had a history of stroke	335	18.5
	From doctors	249	13.7
	Media	606	33.4
	Studies programs	457	25.2
	I've never heard of it	168	9.3
Best sentence describing a stroke	Epileptic seizure	129	7.1
	Blockage of the brain vessels due to a stroke	1426	78.6
	Lack of oxygen in the brain due to cardiac arrest	781	43.0
	Bleeding in the brain due to a burst blood vessel	630	34.7

In **Table 3**, which provides insights into the Knowledge of participants regarding risk factors and symptoms of stroke, it is evident that 68% of participants acknowledged the existence of different types of strokes. In terms of recognizing risk factors, 42.7% identified a family history of stroke as a significant contributor to stroke risk, while 58.6% cited diabetes, 80.6% correctly identified hypertension, 74.7% recognized smoking, and 28.3% considered male gender as a risk factor. Regarding symptoms, 26.7% of respondents believed that stroke symptoms manifest gradually. Moreover, 73.4% correctly reported difficulty speaking as a sign of a stroke, 67.5% identified sudden weakness in the face, arm, or leg, 61.3% associated numbness with one side of the body, 45.8% recognized sudden dizziness, and 44.8% linked sudden headache to stroke. Additionally, 32.3% noted constant pain in the left shoulder, 30.5% mentioned a stiff neck, and 31% reported vomiting as a potential symptom of a stroke.

Table 3. Knowledge of participants of risk factors, and symptoms of stroke (n=1815)

Parameters	Yes n (%)	No n (%)	Don't know n (%)
There are other names for stroke	948 / 52.2%	212 / 11.7%	655 / 36.1%
There are types of strokes	1235 / 68.0%	116 / 6.4%	464 / 25.6%
Family history of stroke is an important risk factor for stroke	775 / 42.7%	531 / 29.3%	509 / 28.0%
Stroke injuries affect people under 65 years of age	927 / 51.1%	349 / 19.2%	539 / 29.7%
Diabetics are prone to strokes	1064 / 58.6%	163 / 9.0%	588 / 32.4%
Male gender is a factor in having a stroke	513 / 28.3%	506 / 27.9%	796 / 43.9%
Hypertension can lead to strokes	1463 / 80.6%	78 / 4.3%	274 / 15.1%
Smoking is one of the risks of strokes	1356 / 74.7%	98 / 5.4%	361 / 19.9%
Stroke symptoms appear gradually	485 / 26.7%	960 / 52.9%	370 / 20.4%
Early arrival of a stroke patient to the hospital cure completely	847 / 46.7%	436 / 24.0%	532 / 29.3%
Reducing risk factors prevents strokes	1452 / 80.0%	124 / 6.8%	239 / 13.2%
Strokes are the most important cause of death	1477 / 81.4%	157 / 8.7%	181 / 10.0%
Difficulty speaking is a sign of a stroke	1332 / 73.4%	180 / 9.9%	303 / 16.7%

Sudden weakness of the face, arm, or leg is a sign of a stroke	1226	191	398
	67.5%	10.5%	21.9
Numbness in one side of the body is one of the signs of a stroke	1113	265	437
	61.3%	14.6%	24.1%
Sudden dizziness is a sign of a stroke	832	384	599
	45.8%	21.2%	33.0%
A sudden headache is a sign of a stroke	814	432	569
	44.8%	23.8%	31.3%
Do you think sudden heat is a sign of a stroke?	373	730	712
	20.6%	40.2%	39.2%
Constant pain in the left shoulder is a sign of a stroke	587	532	696
	32.3%	29.3%	38.3%
A stiff neck is a sign of a stroke	553	470	792
	30.5%	25.9%	43.6%
Vomiting is a sign of a stroke	562	551	702
	31.0%	30.4%	38.7%

In **Table 4**, which outlines the actions participants would take when suspecting a stroke, it is notable that 37.6% would opt to call an ambulance, 55.6% would head to the emergency department, and a mere 0.6% would choose to remain at home. Additionally, 46.2 of the respondents expressed awareness regarding the availability of clot-dissolving drugs, while an impressive 81.3% correctly acknowledged that thrombosis treatment is time-sensitive.

Table 4. Awareness of participants of management of stroke (n=1815)

Parameters		No.	%
	Use alternative medications such as antihypertensives	19	1.0
	Call an ambulance	682	37.6
Best course of action to take when suspecting a stroke	Go to the emergency	1010	55.6
	Staying at home	10	.6
	I don't know	94	5.2
	Within the first 4 hours	1408	77.6
How long do you need to go to the hospital when a stroke is suspected?	4 hours later	102	5.6
	I don't know	305	16.8
Aware of the availability of clot-dissolving drugs	Yes	838	46.2
	No	977	53.8
Stroke can be treated using catheters or a simple surgical procedure	Yes	999	55.0
	No	816	45.0
Thrombosis treatment is time-sensitive	Yes	1476	81.3
	No	339	18.7

37.2% of participants achieved a good knowledge score of strokes, 47.3% demonstrated moderate knowledge, and 15.5% exhibited poor knowledge.

37.2% of participants achieved a good knowledge score of strokes, 47.3% demonstrated moderate knowledge, and 15.5% exhibited poor knowledge. A significant association was observed between knowledge scores of strokes and the age, marital status, residence region, and educational level of participants (P < 0.05), as depicted in **Table 5**.

Table 5. Association between knowledge score with sociodemographic characters of participants

		Knowledge score			Total (N=1815)	P value
		Poor	Moderate	Good		
	Less than 20	25	132	72	229	
		1.4%	7.3%	4.0%	12.6%	
	20 - 30	115	365	419	899	
		6.3%	20.1%	23.1%	49.5%	
Age	31 - 40	61	173	83	317	0.001
		3.4%	9.5%	4.6%	17.5%	
	41- 50	58	122	51	231	
		3.2%	6.7%	2.8%	12.7%	

	51 -60	18	56	39	113	
		1.0%	3.1%	2.1%	6.2%	
	More than 60	4	10	12	26	
		0.2%	0.6%	0.7%	1.4%	
Marital status	Single	155	401	216	772	
		8.5%	22.1%	11.9%	42.5%	
	Married	113	427	449	989	
		6.2%	23.5%	24.7%	54.5%	0.001
	Divorced	9	24	9	42	
		0.5%	1.3%	0.5%	2.3%	
	Widow	4	6	2	12	
		0.2%	0.3%	0.1%	0.7%	
Nationality	Saudi	271	819	654	1744	
		14.9%	45.1%	36.0%	96.1%	0.409
	Non -Saudi	10	39	22	71	
		0.6%	2.1%	1.2%	3.9%	
Gender	Male	107	277	231	615	
		5.9%	15.3%	12.7%	33.9%	0.201
	Female	174	581	445	1200	
		9.6%	32.0%	24.5%	66.1%	
Region	South	93	238	129	460	
		5.1%	13.1%	7.1%	25.3%	
	Eastern	44	143	108	295	
		2.4%	7.9%	6.0%	16.3%	
	North	4	24	14	42	
		0.2%	1.3%	0.8%	2.3%	0.001
	Western	113	333	313	759	
		6.2%	18.3%	17.2%	41.8%	
	Central	27	120	112	259	
		1.5%	6.6%	6.2%	14.3%	
Education level	Uneducated	0	0	1	1	
		0.0%	0.0%	0.1%	0.1%	
	Primary	6	8	1	15	
		0.3%	0.4%	0.1%	0.8%	
	Middle	6	18	5	29	
		0.3%	1.0%	0.3%	1.6%	
	Secondary	77	205	154	436	
		4.2%	11.3%	8.5%	24.0%	0.001
	Bachelor's	138	471	419	1028	
		7.6%	26.0%	23.1%	56.6%	
	Diploma	38	100	37	175	
		2.1%	5.5%	2.0%	9.6%	
	Postgraduate	16	56	59	131	
		0.9%	3.1%	3.3%	7.2%	
Employment status	Employee	124	355	248	727	
		6.8%	19.6%	13.7%	40.1%	0.056
	Not an employee	157	503	428	1088	
		8.7%	27.7%	23.6%	59.9%	

Figure 1 shows 22.8% had a good awareness score, 47.9% had moderate awareness and 29.3% had poor awareness of stroke.
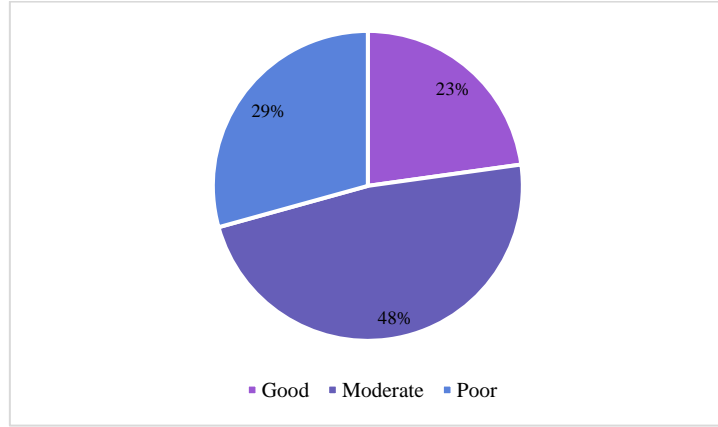
Figure 1. Awareness score of participants of risk factors, and symptoms of stroke

As shown in **Table 6**, a significant association was observed between awareness scores of strokes and the age, marital status, residence region, and educational level of participants (P < 0.05).

Table 6. Association between awareness score with sociodemographic characteristics of participants

		Awareness score			Total (N=1815)	P value
		Poor	Moderate	Good		
Age	Less than 20	69	126	34	229	0.001
		3.8%	6.9%	1.9%	12.6%	
	20 - 30	225	405	269	899	
		12.4%	22.3%	14.8%	49.5%	
	31 - 40	102	160	55	317	
		5.6%	8.8%	3.0%	17.5%	
	41- 50	91	107	33	231	
		5.0%	5.9%	1.8%	12.7%	
	51 -60	37	60	16	113	
		2.0%	3.3%	0.9%	6.2%	
	More than 60	8	12	6	26	
		0.4%	0.7%	0.3%	1.4%	
Marital status	Single	250	470	269	989	0.001
		13.8%	25.9%	14.8%	54.5%	
	Married	269	368	135	772	
		14.8%	20.3%	7.4%	42.5%	
	Divorced	9	26	7	42	
		0.5%	1.4%	0.4%	2.3%	
	Widow	4	6	2	12	
		0.2%	0.3%	0.1%	0.7%	
Nationality	Saudi	508	836	400	1744	0.563
		28.0%	46.1%	22.0%	96.1%	
	Non -Saudi	24	34	13	71	
		1.3%	1.9%	0.7%	3.9%	
Gender	Male	188	302	125	615	0.204
		10.4%	16.6%	6.9%	33.9%	
	Female	344	568	288	1200	
		19.0%	31.3%	15.9%	66.1%	
Region	South	169	208	83	460	0.001
		9.3%	11.5%	4.6%	25.3%	
	Eastern	88	146	61	295	
		4.8%	8.0%	3.4%	16.3%	
	North	17	17	8	42	

		0.9%	0.9%	0.4%	2.3%	
	Western	203	361	195	759	
		11.2%	19.9%	10.7%	41.8%	
	Central	55	138	66	259	
		3.0%	7.6%	3.6%	14.3%	
Education level	Uneducated	0	0	1	1	0.001
		0.0%	0.0%	0.1%	0.1%	
	Primary	8	6	1	15	
		0.4%	0.3%	0.1%	0.8%	
	Middle	17	10	2	29	
		0.9%	0.6%	0.1%	1.6%	
	Secondary	139	220	77	436	
		7.7%	12.1%	4.2%	24.0%	
	Bachelor's	260	498	270	1028	
		14.3%	27.4%	14.9%	56.6%	
	Diploma	81	74	20	175	
		4.5%	4.1%	1.1%	9.6%	
	Postgraduate	27	62	42	131	
		1.5%	3.4%	2.3%	7.2%	
Employment status	Employee	213	350	164	727	0.984
		11.7%	19.3%	9.0%	40.1%	
	Not an employee	319	520	249	1088	
		17.6%	28.7%	13.7%	59.9%	

Acute therapy for stroke is time-sensitive and requires early diagnosis as a medical emergency [14]. The majority of research conducted worldwide has concluded that public knowledge about stroke is not acceptable [15]. Thus, this cross-sectional survey aimed to comprehensively assess the knowledge and awareness of the Saudi Arabian population regarding stroke warning signs, first aid practices, and risk factors. The findings reveal several key insights into the current state of stroke awareness and underscore the need for targeted educational initiatives.

According to our study results, 37.2% of participants exhibited a good knowledge score of stroke, 47.3% had moderate knowledge and 15.5% demonstrated poor knowledge. In terms of awareness, 22.8% achieved a good awareness score, 47.9% had moderate awareness and 29.3% had poor awareness of stroke. Comparatively, a Saudi study conducted in Taif, reported that 69.7% of the participants had inadequate general understanding about stroke [16]. Another study by Mousa *et al.* found that 76.6% of the participants had inadequate knowledge of stroke [17]. Similarly, research by Al-Beladi *et al.* reported that many high-risk patients were unaware of the risk factors and symptoms of a stroke [18]. A study conducted in the Qassim region of Saudi Arabia revealed a comparable percentage of low awareness among hypertension participants [19]. Another study that assessed high school girls' stroke knowledge in the Eastern region of the Kingdom of Saudi Arabia revealed that the majority of participants (91.1%) had low knowledge scores [20].

Poor levels of knowledge were also noted in Tabuk, Saudi Arabia [21]. In comparison to prior studies, Saudi research has shown improved general stroke knowledge [16]. This is probably because a bigger proportion of our participants fell between the 15–39 age range, which is more exposed to contemporary developments in various technologies, such as the internet, which may work in concert to raise public awareness of a variety of health issues [22]. The younger generation's desire to learn and educate themselves about various health-related issues, as evidenced in a recent systematic review may also play a role in this improvement [23].

There are two types of risk factors for stroke: modifiable and non-modifiable. Age, sex, and race/ethnicity are risk factors for both ischemic and hemorrhagic stroke that cannot be changed. However, more frequently documented risk factors that can be modified include hypertension, smoking, nutrition, and physical inactivity. In recent years, additional risk factors and causes of stroke have been recognized, such as inflammatory diseases, infections, pollutants, and cardiac atrial problems, aside from atrial fibrillation [24, 25].

In our study, 42.7% of participants recognized a family history of stroke as an important risk factor for stroke, 58.6% acknowledged diabetes, 80.6% correctly identified hypertension, 74.7% recognized smoking, and 28.3% associated male gender with stroke risk. These findings align with a previous Saudi study that reported the most commonly identified risk factor as a personal history of hypertension (81.7%) [16]. This pattern is consistent with research from Egypt and Italy, which also identified hypertension as the most prevalent recognized risk factor (73.0% and 67.6%, respectively) [26]. In contrast, a study in Jeddah about coronary artery disease awareness used the same risk factors and found that fast-food consumption was the most popular risk factor (74.8%) [27]. However, the distinction between the two issues could be to blame for the discrepancy between the two results. Only 2.2% of individuals recognized all 14 risk variables, whereas the majority of

participants (12.6%) only identified five of the 14 risk factors. While smoking was widely acknowledged as a risk factor in this study, Asian and Pacific Island respondents to a New Zealand survey were less likely to do so [28]. Compared to the first risk factor, individuals in the Brazilian Study [29] preferred smoking alone by a percentage of 50.1% and alcohol by a percentage of 20.5%. The findings of the current study are most consistent with Pancioli's [30] study, which identified hypertension as the greatest risk factor for the development of a stroke. The Jeyaraj [31] Pandian study also revealed that stress was the second most common risk factor for stroke, coming in at 40.9%, after hypertension.

As for symptoms, 26.7% of our study participants agreed that stroke symptoms appear gradually. 73.4% reported difficulty speaking as a sign of a stroke, 67.5% reported sudden weakness of the face, arm, or leg, 61.3% numbness in one side of the body, 45.8% sudden dizziness, 44.8% sudden headache, 32.3% constant pain in the left shoulder, 30.5% stiff neck, and 31% reported vomiting as a sign of a stroke. According to a Saudi study, over half of the participants were aware of the symptoms and indicators of a stroke [17]. Another study identified speech slurring (49%) and weakness in the arms and legs (46%) as stroke symptoms. Participants are also aware of the quick onset of symptoms (53.6%) and the fact that stroke can affect either the right or left side of the body (51.7%) [32]. One of the alert indicators on the list—inaudible speech—was only recognized by more than half of the participants, according to a study by Hickey A [14]. These results diverge slightly from those of the Sug Yoon study, which found that vision disturbance was the most frequently recognized warning indication [32]. This is consistent with research carried out by Hatem Shehata in Egypt in 2016 [33]. However, a 2018 study conducted in Nigeria by Odiase Ehidiamen reported that only a small percentage of individuals could recognize stroke symptoms [34]. This disparity might be attributed to the extensive number of stroke symptoms and indicators included in our study questionnaire. These findings underscore the importance of further research into post-stroke behavior and lifestyle changes among stroke patients.

Regarding action to take when suspecting a stroke, 37.6% call an ambulance, 55.6% go to the emergency, and 0.6% stay at home. 46.2% of participants are aware of the availability of clot-dissolving drugs. 81.3% reported that thrombosis treatment is time-sensitive. Similar to a prior study that emphasized the necessity for immediate medical care for stroke patients [35], participants in a previous Jordanian study were advised to travel to a hospital as soon as possible once a stroke is discovered (89.0%) [1]. In a previous study from Oman with 400 participants, 73% of participants said they would head straight to the emergency room if they suspected a stroke [36]. Though figures from international research may vary, just 47% of respondents said they would visit a hospital if they had any reason to suspect they were having a stroke [37].

In our study, a significant association was noted between both knowledge and stroke scores and the age, marital status, residence region, and educational level of participants. Consistent with previous Saudi research, a statistically significant relationship has been reported between stroke knowledge and age and occupation [17]. Additionally, another study revealed a robust correlation with income, level of education, and employment status [38]. According to Basfar *et al.* residing in an urban area, being single, being female, and having a university education are all factors associated with stroke knowledge [39]. Furthermore, another study identified a substantial correlation between participants' Knowledge, Attitudes, and Practices (KAP) and their level of education and youthfulness [40]. It is worth noting that different age groups have shown varying degrees of connection with KAP in different countries, as younger individuals often tend to possess more knowledge on the subject [37, 38].

However, because older participants have more strokes, they demonstrated a higher level of sufficient knowledge [31, 32, 41-44]. According to earlier research [38] better education and wise knowledge were found to have a beneficial relationship [32, 42]. Another comparison study on KSA revealed that there were neither gender- or age-related significantly different knowledge or attitudes concerning stroke [45]. A Jordanian study revealed that there was no gender-specific difference in awareness of stroke risk factors and symptoms and that women had better knowledge of the effects of stroke than men did [1]. Additionally, individuals who had diabetes, high levels of education, or both showed a desire to transport a patient right away to the hospital if they suspected a stroke, which is partly predicted given that a better understanding of the repercussions of a stroke would justify urgent care [1]. The female gender was linked to a superior general grasp of stroke risk factors and symptoms in a systematic evaluation conducted up until 2008 [46]. According to a different study, men seem to have more advanced knowledge [47]. It's still debatable whether there are gender-specific knowledge disparities, and more thorough causality analyses are required because prior studies haven't consistently found a link between gender and knowledge gaps regarding stroke risk factors, symptoms, or outcomes [48-50]. Even so, women are more likely than men to be aware, show a greater interest in health-related issues, and even spend more time looking up information [14].

The Saudi public needs to utilize various media channels to raise their level of knowledge and awareness., particularly in the context of stroke prevention and improved outcomes through health education. Moreover, all patients must receive health-related messages about the warning signs, risk factors, and appropriate responses to stroke. Furthermore, it is advisable to implement awareness-raising initiatives targeting diverse age groups and educational levels.

While this study offers valuable insights, several limitations should be acknowledged. The data collected in this survey rely on self-reporting by participants. This introduces the potential for recall bias and social desirability bias, where respondents may provide answers, they believe are socially acceptable. Although efforts were made to achieve diversity in the sample, there may still be sampling bias present. Respondents who chose to participate may differ in some way from those who declined, potentially affecting the generalizability of the findings.

Despite these limitations, this cross-sectional survey contributes to our understanding of stroke awareness in Saudi Arabia, providing a foundation for targeted educational interventions and future research endeavors. Firstly, the study encompassed a substantial sample size of 1,815 participants, representing diverse demographics and geographic regions within Saudi Arabia.

This robust sample size enhances the generalizability of the findings to a broader population, increasing the external validity of the study. Additionally, the study examined various dimensions of stroke awareness, including knowledge of warning signs, risk factors, and appropriate first-aid responses. This comprehensive approach provides a holistic view of stroke awareness levels among the Saudi population.

Conclusion

The study indicated that the Saudi population possesses moderate knowledge and awareness of stroke. A significant association was observed between knowledge scores and stroke with factors such as age, marital status, residence region, and educational level among participants. This underscores the importance of targeted awareness campaigns, focusing on populations most at risk for stroke, while simultaneously educating the general public about the disease's symptoms, their potential severity, the importance of managing modifiable risk factors, and the correlation between timely hospital visits and improved prognosis. Considering the sociocultural context of the audience, it is crucial to employ concise, consistent, and repetitive messaging, conveyed in plain, straightforward language that is easy to remember and adapt.

Ethics statement: Ethical approval was obtained from the Research Ethical Committee at the Faculty of Medicine at Umm Al-Qura University, Saudi Arabia (Ethical approval number: HAPO-02-K-012-2022-11-1358). Participants were informed that their participation is voluntary and filling the questionnaire indicates their consent to participate.
Written informed consent was obtained from all individual participants included in the study.

References

1. Barakat M, A AlSalamat H, Jirjees F, Al-Obaidi H, K Hussain Z, El Hadidi S, et al. Factors Associated with Knowledge and Awareness of Stroke Among the Jordanian Population: A Cross-Sectional Study. F1000Res. 2021;10:1242.
2. Zhong X, Wang J, He L, Xu R. Recognition of stroke-related knowledge among community residents and the improvement after intensive health education: a cross-sectional study. BMC Neurol. 2020;20(1):373.
3. Saini V, Guada L, Yavagal DR. Global Epidemiology of Stroke and Access to Acute Ischemic Stroke Interventions. Neurology. 2021;97(20 Suppl 2):S6-S16.
4. Boursin P, Paternotte S, Dercy B, Sabben C, Maïer B. Semantics, epidemiology and semiology of stroke. Soins; Rev Ref Infirm. 2018;63(828):24-7.
5. Abdalla SM, Mohamed EY, Almehmadi BA, Alanazi MA, Elsabagh HM. Stroke prevention: knowledge of the general population in Riyadh Region, Saudi Arabia. Eur Rev Med Pharmacol Sci. 2021;25(17):5424-8.
6. Poopitukkul J, Jokkrajai P, Ruangkhruawong S. Recognition of stroke signs and symptoms among stroke victims and their families. Interdiscip Res Rev. 2018;13(6):38-43.
7. Bakraa R, Aldhaheri R, Barashid M, Benafeef S, Alzahrani M, Bajaba R, et al. Stroke Risk Factor Awareness Among Populations in Saudi Arabia. Int J Gen Med. 2021;14:4177-82.
8. Kabbani AH, Albuali AA, Aljughaiman MS, Alfrayyan AA, Althomali AE, Alghamdi MA, et al. The level of knowledge, awareness, and attitude of stroke among people visiting King Fahad University Hospital. Int J Med Dev Countr. 2021;5(1):324-9.
9. Silberberg M, Goldstein LB, Weaver S, Blue C. Increasing stroke knowledge and decreasing stroke risk in a Latino immigrant population. J Immigr Minor Health. 2018;20:1490-9.
10. Krzystanek E, Krzak-Kubica A, Świat M, Galus W, Gawryluk J. Adequate knowledge of stroke symptoms, risk factors, and necessary actions in the general population of Southern Poland. Brain Sci. 2020;10(12):1009.
11. Kharbach A, Obtel M, Achbani A, Bouchriti Y, Hassouni K, Lahlou L, et al. Level of Knowledge on Stroke and Associated Factors: A Cross-Sectional Study at Primary Health Care Centers in Morocco. Ann Glob Health. 2020;86(1):83.
12. Naguib R, Fayed A, AlFadhliah AB, AlMansour NS, AlDakheel RM, AlQahtani RM. Awareness about Stroke and Proper Actions to Be Taken; A room for Improvement. J Stroke Cerebrovasc Dis. 2020;29(6):104794.
13. Abdullahi A, Hassan A, Kadarman N, Saleh A, Baraya YS, Lua PL. Food safety knowledge, attitude, and practice toward compliance with abattoir laws among the abattoir workers in Malaysia. Int J Gen Med. 2016;9:79-87.
14. Hickey A, O'Hanlon A, McGee H, Donnellan C, Shelley E, Horgan F, et al. Stroke awareness in the general population: knowledge of stroke risk factors and warning signs in older adults. BMC Geriatr. 2009;9:35.

15. Krishnamurthi RV, Barker-Collo S, Barber PA, Tippett LJ, Dalrymple-Alford JC, Tunnage B, et al. Community Knowledge and Awareness of Stroke in New Zealand. J Stroke Cerebrovasc Dis. 2020;29(3):104589.

16. Mubaraki AA, Alqahtani AS, Almalki AA, Almalki AH, Alamri HM, Aburass MK, et al. Public knowledge and awareness of stroke among adult population in Taif city, Saudi Arabia. Neurosciences (Riyadh). 2021;26(4):339-45.

17. Mousa O, Almujhem AA, AlJumaan RO, AlOthman MA, Sayed A. Public awareness of stroke among adult people in eastern region of saudi arabia, community-based cross-sectional study. Merit Res J Med Med Sci. 2020;8:319.

18. Al-Beladi BA, Al-oufi KM, Alhazmi AM, Nafea RM, Ibrahim HM. Awareness of stroke among diabetic and hypertensive patients at King Fahad Hospital in Al-Madinah, KSA, 2016. Int J Med Res Prof. 2018;4:172-6.

19. Mersal FA, Tork HM. Stroke risk perception and its awareness among hypertensive patients in Qassim region Saudi Arabia. Majmaah J Health Sci. 2020;8(1):9.

20. Alsubaie F, Alobaidallah F, Almustafa S, Alhazyim B, Ola Mousa AA. Assessing the knowledge of high school students about stroke as a leading cause of death in Saudi Arabia. South Asian Res J Nurs Healthcare. 2020;2:17-22.

21. Alzahrani FA, Alenzy AE, Alghamdi AM. Stroke in Tabuk, KSA: awareness and prevalence of risk factors. Life Sci J. 2019;16(6):256.

22. Miyamatsu N, Okamura T, Nakayama H, Toyoda K, Suzuki K, Toyota A, et al. Public awareness of early symptoms of stroke and information sources about stroke among the general Japanese population: the Acquisition of Stroke Knowledge Study. Cerebrovasc Dis. 2013;35(3):241-9.

23. Park E, Kwon M. Health-Related Internet Use by Children and Adolescents: Systematic Review. J Med Internet Res. 2018;20(4):e120.

24. Boehme AK, Esenwa C, Elkind MS. Stroke Risk Factors, Genetics, and Prevention. Circ Res. 2017;120(3):472-95.

25. Reeves MJ, Rafferty AP, Aranha AA, Theisen V. Changes in knowledge of stroke risk factors and warning signs among Michigan adults. Cerebrovasc Dis. 2008;25(5):385-91.

26. Feigin VL, Norrving B, Mensah GA. Global Burden of Stroke. Circ Res. 2017;120(3):439-48.

27. 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;12:63-70.

28. 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.

29. Pontes-Neto OM, Silva GS, Feitosa MR, de Figueiredo NL, Fiorot JA Jr, Rocha TN, et al. Stroke awareness in Brazil: alarming results in a community-based study. Stroke. 2008;39(2):292-6.

30. Pancioli AM, Broderick J, Kothari R, Brott T, Tuchfarber A, Miller R, et al. Public perception of stroke warning signs and knowledge of potential risk factors. JAMA. 1998;279(16):1288-92.

31. 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;36(3):644-8.

32. Sug Yoon S, Heller RF, Levi C, Wiggers J, Fitzgerald PE. Knowledge of stroke risk factors, warning symptoms, and treatment among an Australian urban population. Stroke. 2001;32(8):1926-30.

33. Shehata HS, Ahmed SM, Abdelalim AM, El Sherbiny N. Knowledge and attitude towards stroke among workers in Cairo University Hospitals. Egypt J Neurol Psychiatr Neurosurg. 2016;53(1):54-9.

34. Ehidiamen OF, Ehinwenma OJ. Awareness of stroke risk factors and warning symptoms amongst hypertensive patients in Benin City. Ann Med Health Sci Res.(Online). 2018;8:40-4.

35. Khalil HM, Lahoud N. Knowledge of Stroke Warning Signs, Risk Factors, and Response to Stroke among Lebanese Older Adults in Beirut. J Stroke Cerebrovasc Dis. 2020;29(5):104716.

36. Al Shafaee 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;6:38.

37. Jones SP, Jenkinson AJ, Leathley MJ, Watkins CL. Stroke knowledge and awareness: an integrative review of the evidence. Age Ageing. 2010;39(1):11-22.

38. Ramírez-Moreno JM, Alonso-González R, Peral Pacheco D, Millán-Nuñez MV, Roa-Montero A, Constantino-Silva AB, et al. Effect of socioeconomic level on knowledge of stroke in the general population: A social inequality gradient. Neurologia. 2016;31(1):24-32.

39. Basfar WM, Al-Sebyani AE, Aljawi GA, Milyani HA, Jan MM. Public knowledge of stroke amongst a saudi population. World J Res Rev. 2016;3(2):262912.

40. Alreshidi FM, Alrashidi AS, Alshammari FN, Qadi AB, Alrashidi AG, Alghaythi SM, et al. Knowledge, attitude and practicetowards stroke risk factors and warning symptoms in Saudi Arabia, 2017. The Egypt J Hosp Med. 2017;69(3):2082-7.

41. Neau JP, Ingrand P, Godeneche G. Awareness within the French population concerning stroke signs, symptoms, and risk factors. Clin Neurol Neurosurg. 2009;111(8):659-64.

42. Weltermann BM, Homann J, Rogalewski A, Brach S, Voss S, Ringelstein EB. Stroke knowledge among stroke support group members. Stroke. 2000;31(6):1230-3.

43. Schneider AT, Pancioli AM, Khoury JC, Rademacher E, Tuchfarber A, Miller R, et al. Trends in community knowledge of the warning signs and risk factors for stroke. JAMA. 2003;289(3):343-6.

44. Jood K, Redfors P, Rosengren A, Blomstrand C, Jern C. Self-perceived psychological stress and ischemic stroke: a case-control study. BMC Med. 2009;7:53.

45. Campos-Sousa RN, Soares VY, Almeida KJ, Carvalho LI, Jacobina KS, Athayde Netto AE, et al. Knowledge of stroke among a Brazilian urban population. Arq Neuropsiquiatr. 2007;65(3A):587-91.

46. Kothari R, Sauerbeck L, Jauch E, Broderick J, Brott T, Khoury J, et al. Patients' awareness of stroke signs, symptoms, and risk factors. Stroke. 1997;28(10):1871-5.

47. Das K, Mondal GP, Dutta AK, Mukherjee B, Mukherjee BB. Awareness of warning symptoms and risk factors of stroke in the general population and in survivors stroke. J Clin Neurosci. 2007;14(1):12-6.

48. Ospel JM, Schaafsma JD, Leslie-Mazwi TM, Amin-Hanjani S, Asdaghi N, Gordon-Perue GL, et al. Toward a Better Understanding of Sex- and Gender-Related Differences in Endovascular Stroke Treatment: A Scientific Statement from the American Heart Association/American Stroke Association. Stroke. 2022;53(8):e396-e406.

49. Liu X, Gui H, Yao S, Li Z, Zhao J. Age-Related Disparities in Stroke Knowledge Among Community Older Adults. Front Neurol. 2021;12:717472.

50. Yu AYX, Penn AM, Lesperance ML, Croteau NS, Balshaw RF, Votova K, et al. Sex Differences in Presentation and Outcome After an Acute Transient or Minor Neurologic Event. JAMA Neurol. 2019;76(8):962-8.