

Stroke knowledge level among patients with ischemic stroke at Universiti Malaya Medical Centre

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Abstract

Background and Objectives: Stroke is a significant public health concern. The rising trend among stroke survivors, middle-aged, and multi-comorbid patients highlights the need for preventive intervention. In Malaysia, stroke survivors had insufficient understanding of stroke, despite being a common illness in the country. **Methods:** A single-centre prospective study was conducted to determine the level of knowledge of stroke, its warning signs and symptoms, risk factors, and its association among stroke survivors who received treatment at the Universiti Malaya Medical Centre (UMMC), Kuala Lumpur, Malaysia. A validated Stroke Knowledge Test (SKT) questionnaire was used to analyse stroke knowledge. **Results:** The participant's mean age was 57.79 (\pm 11.13) years old, with the majority being first-time stroke patients (87.2%), below 60 years of age (55.3%), had multiple comorbidities (93.4%), and male gender (68.1%). Most (71.4%) were non-adherent to their current medications. The study participants scored poorly on identifying warning signs compared to their knowledge of strokes in general and understanding of stroke risk factors. The majority have poor knowledge of smoking (1.8%) and atrial fibrillation (AF) (1.5%) as risk factors. However, there was good knowledge of the purpose of rehabilitation (98.9%).

Conclusions: Participants' knowledge about stroke, warning signs, symptoms, and risk factors were insufficient. Stroke knowledge was significantly associated with education, medication adherence, habitation, and income.

Keywords: Ischemic stroke, risk factor, knowledge, signs, health education

INTRODUCTION

Stroke is a significant health concern in Malaysia, with a growing incidence attributed to an aging population, sedentary lifestyle, unhealthy diet, and smoking.¹ Despite the rising prevalence, studies reveal limited knowledge of stroke, its risk factors, and symptoms amongst stroke survivors and the general population. The trend is particularly concerning among the younger generation with multiple co-morbidities.²⁻⁴ Existing studies highlight the impact of this knowledge gap⁵⁻⁷, leading to delayed treatment, poor outcomes, increased healthcare burden, and negative socio-economic consequences as reported by the National Stroke Registry report.⁸⁻¹¹ This global issue necessitates a thorough understanding of stroke knowledge across

different demographics before implementing an effective health education program.¹²⁻¹⁹ This study, conducted at the UMMC, filled a critical research gap and focused on post-stroke patients. It aimed to assess the knowledge of stroke, its risk factors, warning signs and investigate how socio-demographic characteristics relate to survivors' knowledge. Despite the hospital's improved stroke care, a structured intervention program for stroke education is lacking. The study's findings can potentially assist Malaysian health authorities in enhancing the quality of stroke care by the development of targeted health education initiatives, addressing medication compliance, diet, rehabilitation, and lifestyle adherence among stroke survivors, ultimately minimizing the impact of this debilitating disease.

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METHODS

This prospective quantitative study was conducted at UMMC, via a convenience sampling method to gather data from 273 stroke patients who received treatment at the Department of Rehabilitation Medicine and ward from July 2021 to July 2022. The inclusion criteria were i) ischemic stroke (IS), ii) cognitive assessment scores of Montreal Cognitive Assessment (MoCA) score of 26/30 or a Mini-Mental State Examination (MMSE) score of 26 or higher, and iii) age 18 or older. The exclusion criteria involved i) pre-existing chronic neurological and psychological conditions, ii) progressive neurological impairments such as multiple sclerosis and Parkinsonism, iii) progressive cognitive impairment (e.g., Alzheimer's disease), iv) terminally ill clinical status, and v) profound dysphasia or communication impairment.

Study instrument

Data collection employed a three-section questionnaire covering sociodemographic characteristics, comorbidities, medical and lifestyle history, medication adherence using MyMAAT, pre/post-stroke functional status determined by The Modified Barthel Index (MBI), and the Stroke Knowledge Test (SKT) consisted of 20 questions categorized into general stroke knowledge, risk factors, and warning signs and symptoms. The SKT was validated in Malay, pre-tested, and adapted from a previous study with prior permission from the main author of the study.²⁰

Data collection and analysis

Stroke patients were approached by the researcher, briefed on the research's protocol, objectives, and provided informed consent before participation. The study was administered by face-to-face interview which lasted 15-20 minutes in a private room. The study, was a one-time data collection, without impacting ongoing treatment. The study ensured participant privacy, maintaining anonymity through random code numbers. Data storage was restricted to the research team. The study found no missing data, as all participants were available for data collection. The collected data underwent statistical analysis using Statistical Package for Social Sciences (SPSS) version 26.0 (IBM SPSS, Armonk, NY, USA), with demographic and clinical variables presented descriptively. The SKT was manually scored

with one point for every correct question and zero points for incorrectly answered questions and univariate/multivariate logistic regression analyses were conducted to identify factors associated with demographic characteristics and stroke knowledge. Odds ratios with a 95% confidence interval measured associations, considering $p \leq 0.05$ as statistically significant.

Ethical consideration of the study

This study was approved by the ethics committee of UMMC (MREC Ref. No: 202177-10336). All participants provided written informed consent. No experimental interventions were performed.

RESULTS

Socio-demographic characteristics of the participants

The participants in this study had a mean age of 57.79 ± 11.13 years, with the majority being 60 years of age and below (55.3%), first-time stroke (87.18%), male (68.1%), Malays (47.3%), and married (76.9%). Most participants had secondary education ($n=158$; 57.9%), were unemployed/retired ($n=172$; 63%), and earned less than RM 1000 per month ($n=127$; 46.5%) (Table 1).

Comorbidities, risk factors, and lifestyle history of the study participants

Comorbidities such as hypertension (80.2%), hypercholesterolemia (61.9%), and diabetes mellitus (DM) (54.6%) were prevalent among the participants. Almost all participants were diagnosed with multiple comorbidities ($n=255$; 93.4%). Interestingly, 23.4% were diagnosed with these comorbidities for the first time after experiencing a stroke. Despite the diagnoses, 61.9% were not on regular follow-up with health facilities (Table 2).

Comparison of BMI, social habits, functional dependency, and medication adherence

The study also compared first-time and recurrent stroke patients in terms of BMI, social habits, functional dependency, and medication adherence. Abnormal BMI was observed in the majority of both groups, of first-time stroke patients (55.9% ($n=133$)) and 54.3% ($n=19$) of recurrent stroke patients, and a significant proportion were non-adherent to medication ($n=195$; 71.4%). Table 3 compares the similarities between the two groups in terms of social habits and medication adherence.

Table 1: Socio-demographic characteristics of the participants (n= 273)

Demographic variables	Frequency (n)	Percentage (%)	Mean (SD)
Incidence of stroke			
First-time stroke	238	87.18	
Recurrent stroke	35	12.82	
Age group			
Below 60 years old	151	55.3	57.79 ± 11.13
60 and above years old	122	44.7	
Gender			
Male	186	68.1	
Female	87	31.9	
Marital status			
Single	35	12.8	
Married	210	76.9	
Divorce/Widow	28	10.3	
Ethnicity			
Malay	129	47.3	
Chinese	75	27.5	
Indian	65	23.8	
Others	4	1.4	
Educational status			
Primary education	34	12.5	
Secondary education	158	57.9	
Tertiary education	81	29.7	
Employment status			
Unemployed/retired	172	63.0	
Non- professional	85	31.1	
Professional	16	5.9	
Habitation			
Rural	11	4.0	
Urban	262	96.0	
Monthly income status (RM)			
Below 1000	127	46.5	
1001 - 3000	82	30.0	
3001 - 5000	39	14.3	
Above 5000	25	9.1	
BMI			
Underweight (Below 18.5)	8	2.9	26.82 ± 11.126
Normal (19.0 -24.9)	115	42.1	
Overweight (25 - 29.9)	91	33.3	
Obese (30 and above)	59	21.6	
Smoking status			
Current smoker	40	14.7	
Former smoker /stopped post-stroke	71	26.0	
Never smoke	162	59.3	
Alcohol			
Drink in moderation	41	15.0	
Binge drinking	9	3.3	
Stopped post-stroke	33	12.1	
Never consume alcohol	190	69.6	

SD: Standard Deviation, RM: Ringgit Malaysia, BMI: Body Mass Index, n: number
 USD 1 = RM 4.6

Table 2: Comorbidities, risk factors, medication adherence, and functional dependency of the study participants (n=273)

Description of the items	Response	Frequency (n)	Percentage (%)
Hypertension	No	54	19.8
	Yes	219	80.2
Diabetes Mellitus	No	124	45.4
	Yes	149	54.6
Hypercholesterolemia	No	104	38.1
	Yes	169	61.9
Atrial Fibrillation	No	261	95.6
	Yes	12	4.4
Previous stroke	No	238	87.2
	Yes	35	12.8
Other comorbidities	No	164	60.1
	Yes	109	39.9
Newly Diagnosed post Stroke incident	No	209	76.6
	Yes	64	23.4
Regular follow-up	No	169	61.9
	Yes	104	38.1
Medication adherence	Adherence	78	28.6
	Non-adherence	195	71.4
Medication only started post-stroke	No	199	72.9
	Yes	74	27.1
Functional dependency before stroke	Independent	273	100.0
	Dependent	0	0
Functional dependency after a stroke	Severe dependency (21 - 60)	29	10.6
	Moderate dependency (61 - 90)	107	39.2
	Slight/ Minimal dependency (91-99)	77	28.2
	Independent (100)	60	22.0

Stroke knowledge level

In this study, the knowledge level is determined by a scoring system of SKT. Good knowledge is indicated by a score of at least 10 points, (50%) and above. The SKT comprises of 20 questions, each carrying one point, resulting in a total possible score of 20. The participant's stroke knowledge score varied from 2 to 18, with an average score of 8.93 ± 2.93 . This study revealed that only 41.39% (117 of 273) of participants achieved level of good knowledge regarding stroke, its risk factors, and warning signs and symptoms. Notably, a mere 1.47% (4 participants) exhibited excellent stroke knowledge, scoring 80% or higher (Figure 1).

Assessment of general stroke knowledge

The study assessed participants' general knowledge of stroke using ten questions that consisted of the mechanism of stroke formation, stroke epidemiology, stroke management and prevention, immediate stroke response, and stroke rehabilitation. While participants demonstrated good understanding in certain areas, such as recognizing the common cause of stroke (n=150; 55%), and the primary goal of rehabilitation (n=270; 98.9%), notable knowledge gaps were also observed. Specifically, participants showed limited knowledge regarding the increased risk of stroke after a transient ischemic attack

Table 3: Comparison of first-time and recurrent stroke patients' medication adherence, BMI, social habits, and functional dependency (n=273)

Description	Study population (n=273)	First-time stroke (n=238)	Recurrent stroke (n=35)
BMI Mean (SD)		26.82 ± 11.126	
Underweight (below 18.5)	7 (2.6)	4 (1.70)	3 (8.60)
Normal (18.5 – 24.9)	114 (41.76)	101 (42.40)	13 (37.10)
Overweight (25 – 29.9)	93 (34.1)	85 (35.70)	8 (22.90)
Obese (30 and above)	59 (21.6)	48 (20.20)	11 (31.40)
Smoking			
Current smoker	40 (14.7)	34 (14.3)	6 (17.1)
Ex-smoker / stopped post-stroke	71 (26.0)	63 (26.5)	8 (22.9)
Never smoker	162 (59.3)	141 (59.2)	21 (60.0)
Alcohol use			
Drink in moderation	41 (15.0)	38 (16.0)	3 (8.6)
Binge drinking	9 (3.3)	9 (3.8)	0
Stopped post-stroke	33 (12.1)	28 (11.8)	5 (14.3)
Never consume alcohol	190 (69.6)	163 (68.5)	27 (77.1)
Never smoke and consume alcohol	124 (45.4)	108 (45.4)	16 (45.7)
Functional dependency post-stroke			
Severe dependency (21 - 60)	29 (10.6)	26 (10.9)	3 (8.6)
Moderate dependency (61 - 90)	107 (39.2)	91 (38.2)	16 (45.7)
Slight/Minimal dependency (91-99)	77 (28.2)	69 (29.0)	8 (22.9)
Independent (100)	60 (22.0)	52 (21.9)	8 (22.9)
Medication Adherence			
Adherence (Score: 12- 53)	78 (28.60)	67 (28.3)	11 (31.4)
Non-adherence (Score: 54 - 60)	195 (71.40)	171 (71.8)	24 (68.6)

BMI: Body Mass Index

(TIA) (n=223; 81.7%) and the use of surgical intervention to prevent future strokes (n=230; 84.2%) (Table 4).

Assessment of knowledge of stroke risk factors

The assessment of stroke risk factor knowledge comprised eight questions examining i) general

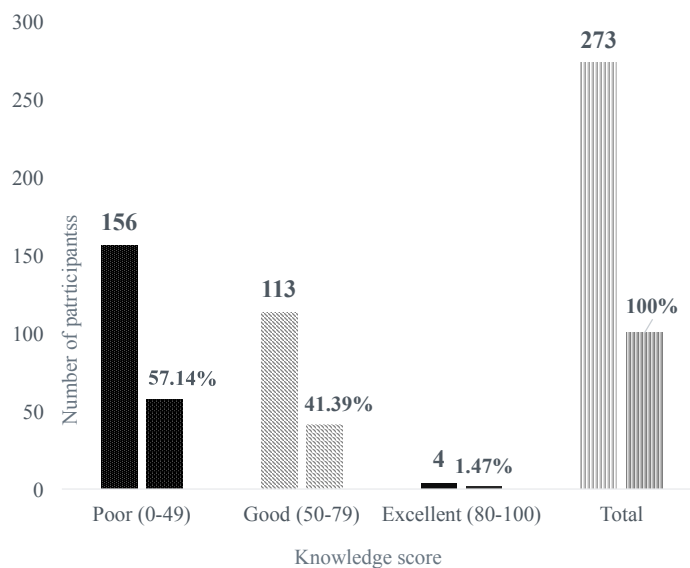


Figure 1. The overall distribution of stroke knowledge scores among the study participants

Table 4: Assessment of stroke knowledge among the participants (n=273)

Q. No	Questions	Frequency (n)	Percentage (%)
	When does the most common type of stroke occur?		
1)	A. The blood supply to the brain is blocked. (c)	150	55
	B. You are having a heart attack	6	2.2
	C. There is bleeding in the brain	39	14.3
	D. You've had too much sun	5	1.8
	E. I don't know	73	26.7
	For someone who has had a stroke, the primary purpose of rehabilitation is to ...		
7)	A. Make sure they don't take drugs.	0	0
	B. Keep them in hospital as long as possible.	1	0.4
	C. Improve their level of daily functioning. (c)	270	98.9
	D. Keep their mind off it.	1	0.4
	E. I don't know	1	0.4
	Taking aspirin assists in preventing stroke by...		
8)	A. Stopping the formation of blood clots. (c)	148	54.2
	B. Getting rid of a headache.	9	3.3
	C. Settling your stomach.	1	0.4
	D. Relieving stress.	15	5.5
	E. I don't know	100	36.6
	Once you have suffered a transient ischemic attack (TIA) ...		
10)	A. You are less likely to have a major stroke.	6	2.2
	B. You are more likely to have a major stroke. (c)	40	14.7
	C. You are less likely to have a heart attack.	1	0.4
	D. You are more likely to have a heart attack.	3	1.1
	E. I don't know	223	81.7
	Surgery can sometimes help to prevent another stroke by ...		
11)	A. Giving a transfusion.	3	1.1
	B. Cutting off the supply of blood to the brain.	4	1.5
	C. Unblocking the arteries in the neck. (c)	34	12.5
	D. Removing the arteries.	2	0.7
	E. I don't know	230	84.2
	What method of treatment is available for people who have had a stroke?		
12)	A. Medication	86	31.5
	B. Rehabilitation	41	15.0
	C. An operation	2	0.7
	D. All of the above (c)	131	48.0
	E. I don't know	13	4.8
	Approximately how many Malaysians are affected by stroke every year?		
14)	A. 500	0	0
	B. 1,000	3	1.1
	C. 10,000	2	0.7
	D. 50,000 (c)	8	2.9
	E. I don't know.	260	95.2
	Which of the following is classed as a physical disability caused by stroke?		
16)	A. The right arm is paralysed. (c)	123	45.1
	B. There are problems with memory	10	3.7
	C. Unable to speak properly	92	33.7
	D. Having trouble doing things in the correct order	18	6.6
	E. I don't know	30	11.0

	If someone has a stroke, when should they ring for an ambulance?		
	A. Only ring if the symptoms stay after 24 hours	12	4.4
19)	B. Always ring for an ambulance straight away (c)	253	92.7
	C. Just see your doctor when you can	2	0.7
	D. You don't need to ring an ambulance	1	0.4
	E. I don't know	5	1.8
	Rehabilitation can assist someone who has suffered ...		
	A. Loss of movement	7	2.6
20)	B. Loss of speech or language	0	0
	C. Loss of balance	2	0.7
	D. All of the above (c)	260	95.2
	E. I don't know	4	1.5

(c): Correct answer

knowledge of the comorbidities, ii) age considerations for stroke, and iii) social habits contributing to the occurrence and prevention of strokes. Participants showed a good awareness of the association between DM and stroke (n=183; 67.0%) and acknowledged lifestyle modifications (proper diet and exercise) as effective measures for reducing stroke risk (96.0%, n=262) but lacked knowledge about AF significantly increasing stroke risk (n=256; 94%). Knowledge gaps were also evident concerning the impact of excessive alcohol consumption (n=240; 87.9%) and smoking on stroke risk (n=234; 85.7%). Among eight questions, four questions (2, 9, 13, and 17) were answered correctly and scored more than 50%. The participants incorrectly responded to four other questions (3, 4, 15, and 18) and scored below 50% suggesting areas of insufficient knowledge (Table 5).

Assessment of knowledge of stroke warning signs and symptoms

The knowledge of warning signs of stroke consists of 2 questions, most participants answered only question six correctly, but they scored less than the desired score for a good knowledge level of 50%. The assessment of warning signs and symptoms of stroke revealed a lack of awareness among participants (Table 6).

Comparison of stroke knowledge between first-time and recurrent participants

Participants with a history of recurrent stroke (n=35) demonstrated only slightly better stroke knowledge compared to those experiencing a first-time stroke (n=238). Recurrent stroke patients answered 6 out of 10 questions correctly, while first-time stroke patients answered 5 out of 10 questions accurately. The overall comparison

suggested slightly poorer general stroke knowledge among first-time stroke patients, with recurrent stroke patients averaging marginally higher correct responses on the Stroke Knowledge Test (SKT) (9.37 vs. 8.87 out of 20) (Figures 2–5).

Factors associated with low-level stroke knowledge among the study participants

The study delved into factors associated with the level of stroke knowledge, employing univariate and multivariate logistic regression analyses. Findings revealed tertiary education and secondary education are less likely to have poor knowledge (p<0.05; 95% CI 0.013 - 0.125) as compared to primary school education (p<0.05; 95% CI 0.086 -0.621) and rural areas were associated with better knowledge levels (p<0.05; 95% CI 1.617 -11.163). Additionally, participants with higher incomes had better stroke knowledge levels. Those who were non-adherent to medication were twice as likely to have poor knowledge levels (Table 7).

DISCUSSION

Socio-demographic characteristics of the participants

This study identified significant associations between stroke incidence in Malaysia with socio-demographic factors. The National Stroke Registry (2009 to 2016) reported that 60% of strokes in Malaysians occurred over 60 years old.⁶ However, in this study, 57% of participants were under 60 years old. Recent Malaysian research has reported a notable increase in stroke rates among younger age groups, with higher incidences found in those under 65¹ and specifically in the age groups of 35-44 and 55-64-year-olds.³ Rising comorbidities like hypertension, hypercholesterolemia, and DM, and

Table 5: Assessment of the knowledge of stroke risk factors (n=273)

Q. No	Questions	Frequency (n)	Percentage (%)
	Which of the following will double your risk of stroke?		
2)	A. If you are asthmatic	5	1.8
	B. If you are diabetic (c)	183	67.0
	C. If you exercise too much	6	2.2
	D. All of the above	34	12.5
	E. I don't know	45	16.5
	A type of irregular heartbeat known as atrial fibrillation (AF)		
3)	A. Decreases the risk of stroke	0	0
	B. Doubles the risk of stroke	9	3.3
	C. Increases the risk of stroke by more than 5 times (c)	4	1.5
	D. Is not a risk factor of stroke	4	1.5
	E. I don't know	256	93.8
	Which age group is more at risk of stroke?		
4)	A. 20–30 years	0	0
	B. 31 - 50 years	62	22.7
	C. 51 – 60 years	155	56.8
	D. more than 61 years (c)	45	16.5
	E. I don't know	11	4.0
	You are at greater risk of having a stroke if ...		
9)	A. You are obese. (c)	194	71.1
	B. You exercise regularly.	0	0
	C. You give up smoking.	18	6.6
	D. All of the above	15	5.5
	E. I don't know	46	16.8
	One of the major risk factors of stroke is ...		
13)	A. Genetic.	16	5.9
	B. Heart attack.	16	5.9
	C. High blood pressure. (c)	192	70.3
	D. Old age.	11	4.0
	E. I don't know	38	13.9
	If you drink alcohol excessively you are ...		
15)	A. Less likely to have a stroke.	0	0
	B. Twice as likely to suffer stroke. (c)	9	3.3
	C. Three times more likely to suffer stroke.	7	2.6
	D. Four times more likely to suffer stroke.	17	6.2
	E. I don't know	240	87.9
	To reduce the risk of stroke, you need to ...		
17)	A. Eat well and exercise regularly.	2	0.7
	B. Ensure your blood pressure is not too high.	4	1.5
	C. Monitor your cholesterol levels.	2	0.7
	D. All of the above (c)	262	96.0
	E. I don't know	3	1.1
	Smoking 20 cigarettes per day increases the risk of stroke by ...		
18)	A. 2 times	9	3.3
	B. 4 times	6	2.2
	C. 6 times (c)	5	1.8
	D. 8 times	19	7.0
	E. I don't know	234	85.7

(c): Correct answer

Table 6: Assessment of knowledge of stroke warning signs and symptoms (n=273)

No	Questions	Frequency (n)	Percentage (%)
	The warning signs of a transient ischaemic attack (TIA) disappear _____.		
	A. Within 24 hours (c)	23	8.4
	B. Within 48 hours	3	1.1
5)	C. After several days	13	4.8
	D. After several years	3	1.1
	E. I don't know	231	84.6
	Which of the following is a warning sign of stroke?		
	A. Sudden blurred vision	25	9.2
	B. Paralysis on one side of the body	98	35.9
6)	C. Severe headache	21	7.7
	D. All of the above(c)	104	38.1
	E. I don't know	25	9.2

(c): Correct answer

lifestyle factors like sedentary lifestyle, smoking, poor diet, and stressful life events were the main causes of stroke in younger adults, emphasizing the need for targeted prevention to address the unique risk factors associated with strokes in younger populations.

This study revealed that gender, education level, and employment status significantly influence stroke incidence and outcomes. Males exhibited higher stroke rates, consistent with previous researches.^{21,22} Education's impact on stroke incidence was inversely reported. In this study, secondary and tertiary education levels were related to higher stroke incidents, while primary education levels were associated with reduced stroke rates. However, previous studies revealed education levels were linked to both increased and decreased stroke incidences,^{10,23-26}

emphasizing the need for context-specific studies.

In this study, it was found that unemployment or retirement after a stroke was prevalent, with a return-to-work rate of 37%. Previous Malaysian studies have shown varying rates of return to work, ranging from 9% to 49%.^{10,27,28} Financial challenges were notable, particularly among older individuals, highlighting the economic impact of stroke. The study underscores the necessity for age and gender-specific education, the relevance of rehabilitation program to return to full function, and economic support system to address the diverse challenges faced by stroke survivors. Targeted preventive strategies, context-specific interventions, and improved socio-economic support are crucial for optimizing recovery and reintegration across demographic groups.

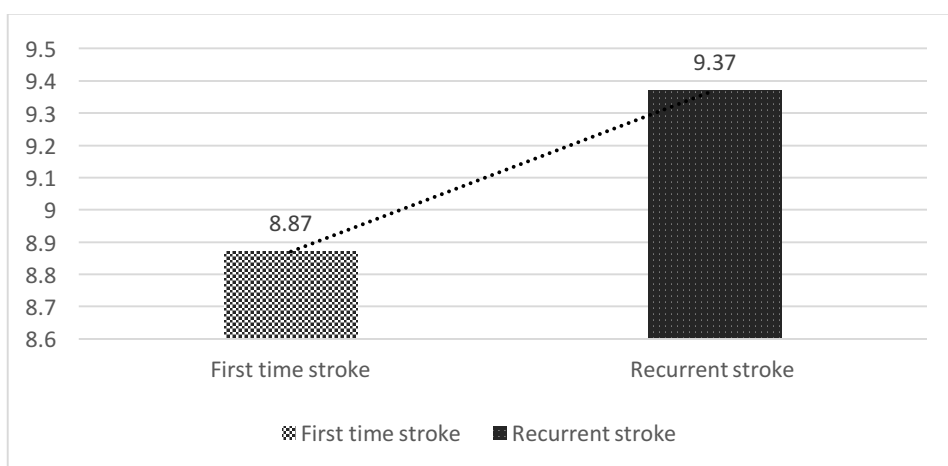


Figure 2. Average stroke knowledge level among first-time and recurrent stroke patients

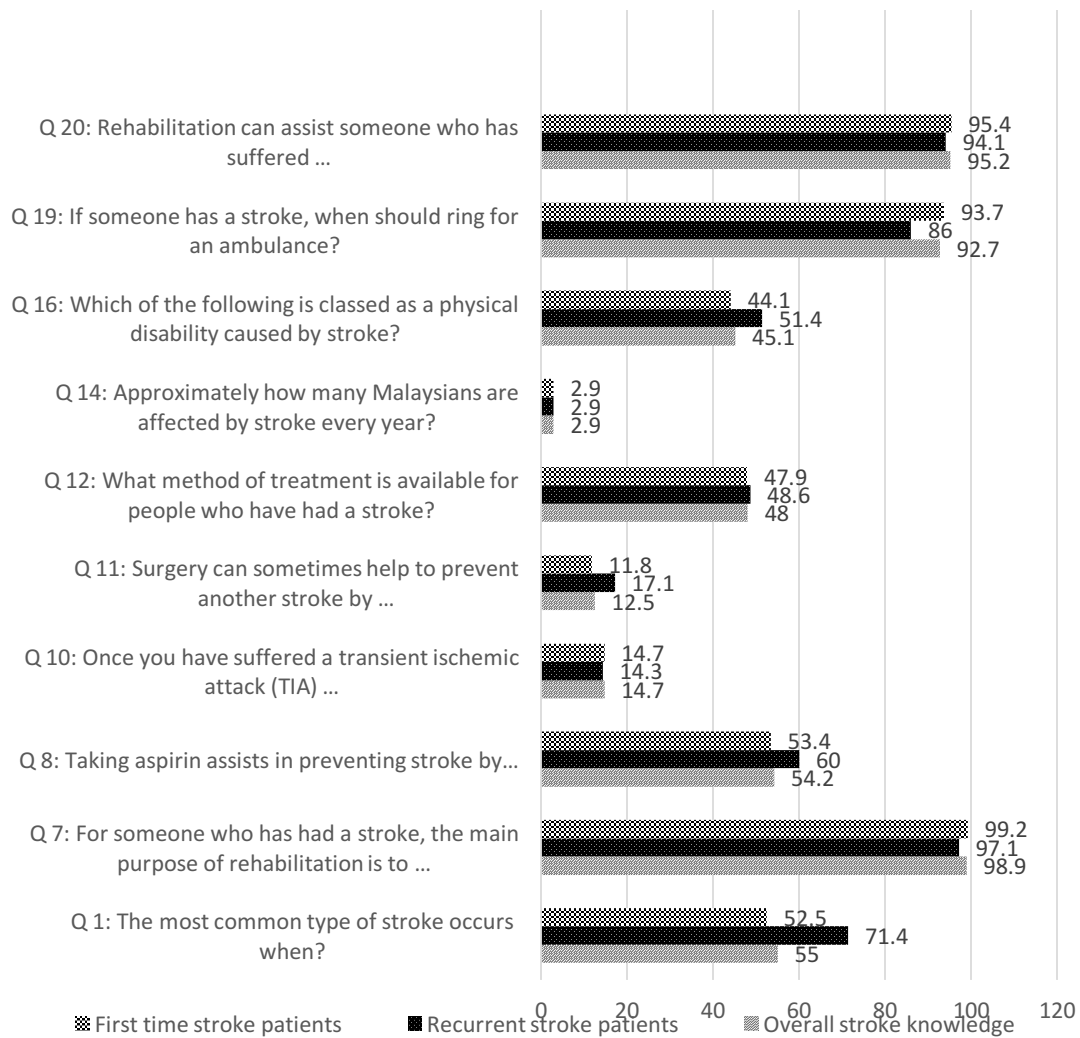


Figure 3. Comparison of general stroke knowledge among the participants

Risk factors (Comorbidities and lifestyle history) of the participants

This study highlights the prevalence of common comorbidities associated with stroke. hypertension stands out as a significant risk factor for stroke, aligning with existing research.²⁹⁻³¹ This study raised concern about the trend of multiple comorbidities in participants under 60 who exhibited poor medical follow-up. The combination of hypertension and hypercholesterolemia was found to be common among participants, observed by previous studies too³²⁻³⁴ providing a potential avenue for improving stroke risk factor management.

Overweight and obesity were identified as additional risk factors, amplifying the prevalence of associated comorbidities.³⁵⁻³⁷ The

study highlights the importance of public health promotion and education programs targeting obesity observed in the study population.

Behavioral risk factors such as smoking or excessive alcohol intake were identified in over half of the stroke patients. This is aligned with the 2019 National Health and Morbidity Survey³⁸ of Malaysians that smoke (21%) and 20% of millennials were binge consumers.³⁹ This study underscores the need for public health initiatives, including smoking and alcohol cessation campaigns and enhanced smoking and alcohol-related health education, to mitigate the impact of these behaviors on stroke incidence.

Medication adherence emerged as a critical concern⁴⁰⁻⁴³, with over two-thirds of participants not adhering to their regular medication regimen.⁴⁴⁻⁴⁶ Forgetfulness, lack of understanding,

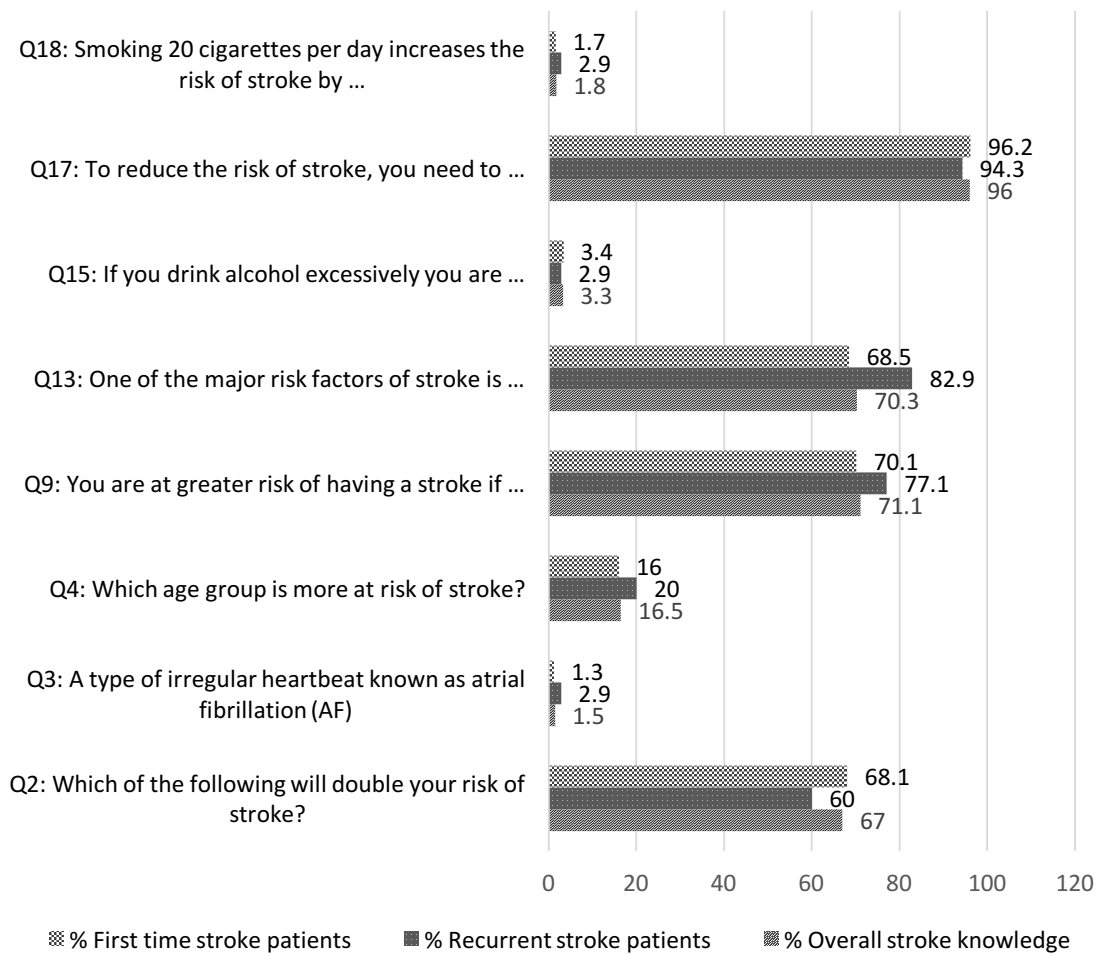


Figure 4. Comparison of understanding of stroke risk factors among the participants

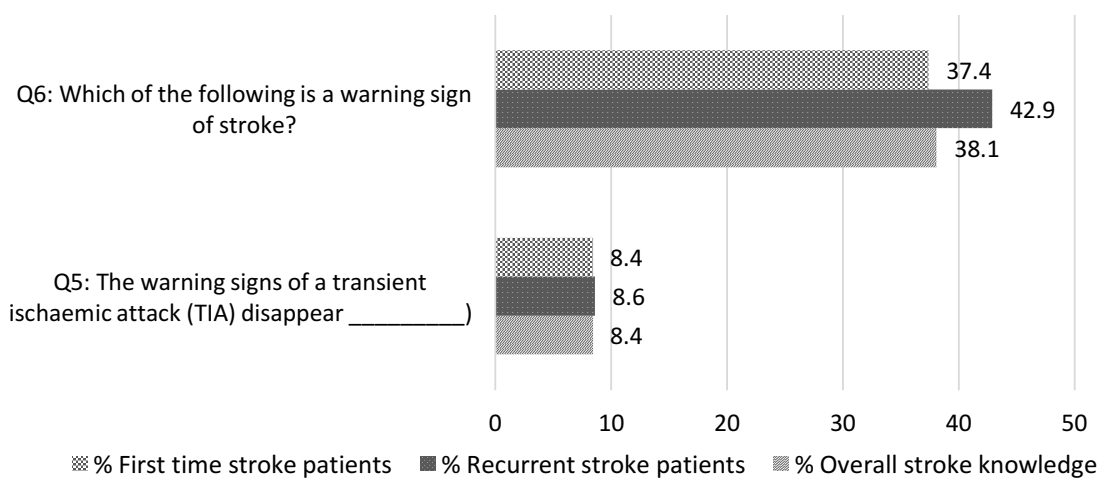


Figure 5. Comparison of understanding of stroke risk factors among the participants

Table 7: Association between stroke knowledge and demographic characteristics of the participants (n=273)

Variables		p value	Adjusted OR	95% C.I.for EXP(B)	
				Lower	Upper
Education level	Primary school education	0.000*			
	Secondary school education	0.004*	0.231	0.086	0.621
	Tertiary education	<0.001*	0.041	0.013	0.125
Habitation	Rural				
	Urban	0.003*	4.248	1.617	11.163
Income status	Below RM 1000	0.182			
	RM 1000- RM 3000	0.493	0.770	0.365	1.625
	RM 3001- RM 5000	0.212	0.511	0.178	1.467
	Above RM 5000	0.033*	0.202	0.046	0.879
Medication adherence	Adherence				
	Non-adherence	0.016*	2.072	1.145	3.750

*p-value less than 0.05 considered statistically significant
USD 1 = RM 4.6

medication side effects, and inadequate social support were cited as primary factors aligning with other studies' findings.^{5,18,24} This study highlights the importance of taking a holistic approach to improving medication adherence. This includes considering the complexity of medication regimens, as well as the need for comprehensive monitoring, education, and ongoing support from healthcare practitioners.

The majority of participants were found to be assistant-dependent similar to earlier studies^{1,47} highlighting the importance of early rehabilitation, caregiver support programs, and policy initiatives to enhance post-stroke care and improve the health-related quality of life for stroke survivors.

The stroke knowledge level of the participants

This study highlights significant gaps in stroke knowledge among participants, specifically identifying the warning signs and symptoms. Similar findings of low stroke knowledge have been observed in previous studies, indicating a need for enhanced patient education and awareness campaigns.^{9,16,48}

In terms of general knowledge, participants expressed good knowledge of rehabilitation purposes may be because most Malaysian hospitals offer rehabilitation services, and patients are often exposed to various forms of rehabilitation by healthcare professionals (HCPs) during their in-patient stay.^{10,49} Although participants are well aware of the importance of seeking emergency help, by calling ambulances it was noted that

this knowledge was often acquired post-stroke, with HCPs as key sources. This underscores the importance of continuous patient education efforts to improve pre-stroke knowledge and ensure timely response during stroke incidents.

The study revealed varying levels of knowledge regarding stroke mechanisms, with a lower percentage than in a previous study conducted in Malaysia.⁹ While awareness of aspirin usage was higher, compared to existing studies^{9,50} with a notable proportion lacked knowledge about the rest of their medications, posing a risk of non-adherence and increased stroke risk.

As for stroke risk factors, participants correctly identified obesity, hypertension, and DM, in line with previous study findings,^{9,16,18,19,51} but a significant proportion remained unaware of these risk factors. Furthermore, knowledge about behavioral risk factors like smoking and excessive alcohol consumption was extremely low. Despite a history of stroke, the majority were found to have a lack of perceived urgency, fear of change, lack of awareness, or misinformation about the association between smoking, alcohol consumption, and stroke, which may put them at high risk of recurrent stroke. Similar to previous studies,^{9,52} AF was poorly identified as a stroke risk factor in this study maybe due to its otherwise 'silent' presentation. The study highlights the need for patient awareness and hence empowerment that can lead to self-initiation for health checks and change of lifestyle.

A significant lack of knowledge regarding

identifying stroke warning signs and symptoms was found among this study's participants and previous studies.^{9,11,53-55} Failure to recognize the primary stroke symptoms creates significant knowledge gaps in this area, and contributes to delayed hospital arrival, impacting prognosis.

Associated factors with stroke knowledge

The study identified that educational level, income, habitation, and medication adherence are significant factors influencing stroke knowledge. Lower education levels were linked to poorer stroke knowledge, possibly due to limited exposure to relevant information emphasizing education as a crucial determinant of health literacy. Higher-income individuals demonstrated increased knowledge aligned with previous studies,^{56,57} as their financial status provided better access to healthcare, education, and information resources. Despite having better access to resources, urban dwellers often have limited stroke knowledge, likely due to the demands of urban life overshadowing health priorities.^{58,59} These results highlight the importance of education, economic stability, and effective medication management in enhancing stroke knowledge and prevention.

Strengths, limitations, Recommendations for further study

The study's strength lies in its valuable contribution to Malaysia's limited literature on stroke survivors' knowledge, offering comprehensive insights into socio-demographic, lifestyle, and health-related aspects associated with good stroke knowledge. However, limitations include a focus on a specific population from UMMC's Rehabilitation Department, utilizing convenience sampling, and a small participant pool, hindering broad generalization. In addition, contextual factors like cultural beliefs and healthcare accessibility may introduce biases. The Stroke Knowledge Test used may have limitations, and future research should consider longitudinal studies, diverse demographic sampling, and incorporation of advanced technology for more robust and applicable insights into stroke knowledge.

In conclusion, this study highlights a significant deficit in stroke-related knowledge among stroke patients, particularly concerning behavioral risk factors, warning signs, symptoms, and a lack of awareness about risk factor management, follow-ups, and medication adherence. Notably, younger individuals experiencing their first

stroke exhibit limitations in understanding these crucial factors. Recognizing the association between socioeconomic status and health literacy underscores the need for healthcare providers to prioritize early detection, education, and preventative measures. This is particularly important for younger patients, to prevent first-time strokes. Well-organized periodic intervention programmes, public awareness campaigns, lifestyle modifications, digital health technologies, integrating stroke awareness into school curricula, and bedside teaching to stroke patients during their hospital stay can collectively mitigate the occurrence and impact of both first-time and recurrent strokes.

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DISCLOSURE

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