Original Article

Stroke Literacy in Singapore: Data From a Survey of Public Housing Estate Residents

Wei-Yen Lim, [1]*MBBS, MPH, PhD*, Ding Fang Chuang, [2], Koy Min Chue, [2], Damian Z Lee, [2], Nicholas J Leong, [2], Zhi Guang Ng, [2], Kailing Peng, [2], Xiayan Shen, [2], Ye Ni Tham, [2], Kangjie Wang, [2], Deidre Anne De Silva, [3]*MBBS, MMed (Int Med)*

Abstract

Introduction: Knowledge of stroke symptoms is associated with seeking medical attention early, and knowledge of risk factors is an essential factor in stroke prevention. In this study, we evaluated the level of stroke literacy in Singapore. Materials and Methods: A cross-sectional study of Singapore citizens and permanent residents aged 21 years and above was conducted in a public housing estate. Participants were randomly sampled using multi-stage stratified sampling. Assessment of awareness of stroke symptoms and risk factors was performed using open-ended questions. In total, 687 respondents were recruited, with a response rate of 69.7%. Results: Overall, 52.4% of respondents identified the brain as the source of pathology, and 47.6% could cite at least 1 of the 3 FAST symptoms (facial droop, arm weakness and speech difficulty), while 40% could name 2 or more of 7 established risk factors for stroke (high blood pressure, high cholesterol, cigarette smoking, diabetes mellitus, older age, previous heart attacks and stroke). Respondents at higher risk of stroke (older individuals and those with stroke risk factors) did not have greater awareness of stroke symptoms and risk factors. The majority of respondents reported they would seek immediate medical care if they experienced stroke symptoms. Only 59.4% knew the emergency ambulance service telephone number. Conclusion: In a sample of Singaporean adults residing in a public housing estate, we found evidence of poor stroke literacy, highlighting the need for comprehensive population-based education efforts. There is a role for opportunistic education among those at higher risk of stroke.

Ann Acad Med Singapore 2014;43:454-63

Key words: Health education, Health promotion

Introduction

Stroke is a leading cause of adult disability worldwide[1] and the second most common cause of disease burden for Singaporeans aged 65 years and older.[2] Acute thrombolytic treatment with intravenous tissue plasminogen activator (rtPA) within 4.5 hours of stroke onset is proven to reduce poststroke disability.[3,4] However its utilisation in many parts of the world, including Singapore, is very low,[5] with the main reason being delayed arrival to hospital due to patients' failure to recognise stroke symptoms and realise the urgency of the situation.[6] Stroke risk can be reduced with control of known modifiable risk factors such as hypertension and healthy lifestyle measures.[7] Hence improved stroke literacy can reduce stroke incidence and improve stroke outcomes, but there are currently limited data on stroke literacy in Singapore. So far, there has only been one published study comparing public awareness of sepsis and stroke in Singapore.[8] However, this study did not explore comprehensively the various dimensions of stroke literacy (for example using vignettes to explore participants' responses to specific stroke-related scenarios), nor did it explore comprehensively potential factors associated with stroke literacy. We aimed to study the level of awareness

[1]Saw Swee Hock School of Public Health, National University of Singapore
[2]Yong Loo Lin School of Medicine, National University of Singapore
[3]Singapore General Hospital campus, National Neuroscience Institute, Singapore
Address for Correspondence: Dr Wei-Yen Lim, Saw Swee Hock School of Public Health, National University of Singapore, MD3, 16 Medical Drive, Singapore 117597.
Email: ephlwy@nus.edu.sg

of stroke symptoms and risk factors among Singapore residents in a public housing estate and its associations with sociodemographic factors, and personal and family medical history.

Materials and Methods

A population-based cross-sectional study of Singapore citizens and permanent residents aged 21 years and above was conducted among public housing residents in the Bishan housing estate, a large centrally-located estate of public apartments in Singapore. This study was designed and implemented in February 2013 and March 2013 by medical students from Yong Loo Lin School of Medicine, National University of Singapore (NUS), under faculty supervision. Institutional Ethics Board approval was obtained prior to conducting this study.

A multi-stage random sampling process was used to select participants. In the first stage, public housing apartment blocks were enumerated, 30% of which were randomly selected. In the second stage, 40% of floors in each selected block were randomly chosen, and every unit on those floors was included in the sampling frame. Within each selected unit, all individuals who fulfilled the inclusion criteria were enumerated, and one individual from each participating household was randomly selected via a Kish table (Fig. 1). Up to 4 visits were performed before the household or individual was considered uncontactable.

The survey was administered in the 4 major languages of Singapore – English, Mandarin, Malay and Tamil. It was first drafted in English, then translated into the other 3 languages, with back-translation as a check for accuracy. The survey was administered by trained medical students via face-to-face interviews. Assessment of awareness of stroke symptoms and risk factors were performed through open-ended questions, which were then coded by the medical students. The questions used were obtained from the Stroke Awareness Questionnaire (SAQ)[9], and were phrased as follows: "What do you think are the symptoms and warning signs of a stroke? Try to tell me as many as you can." and "What do you believe are the risk factors associated with stroke? By risk factors, I mean anything that increases a person's chances of having a stroke. Try to tell me as many as you can." A pilot study was conducted prior to study implementation to assess the feasibility and to permit coding of common responses to the open-ended questions.

Overall awareness of stroke symptoms and risk factors were assessed. Cut-offs were used to divide respondents into "greater awareness" and "lesser awareness" groups in order to evaluate factors associated with stroke literacy. We defined "lesser awareness" of stroke symptoms as not knowing any of the symptoms of the FAST (Face, Arm, Speech and Time) stroke message,[10] which include facial droop, arm weakness, and speech difficulty and "greater awareness" as knowing at least 1 of the symptoms. We considered the following to be established stroke risk factors: high blood pressure, high cholesterol, cigarette smoking, diabetes mellitus, older age, previous heart attacks and stroke, based on existing literature on stroke literacy.[11-16] We defined "lesser awareness" of stroke risk factors as knowing less than 2 of the 7 risk factors and "greater awareness" as knowing 2 or more of the risk factors. Additional data collected included information about family history of diabetes mellitus, high blood pressure, high cholesterol, dementia, previous heart attacks, other heart problems, previous stroke, and cancer; being a caregiver of someone with a chronic illness or permanent disability; and having a family member who is a healthcare

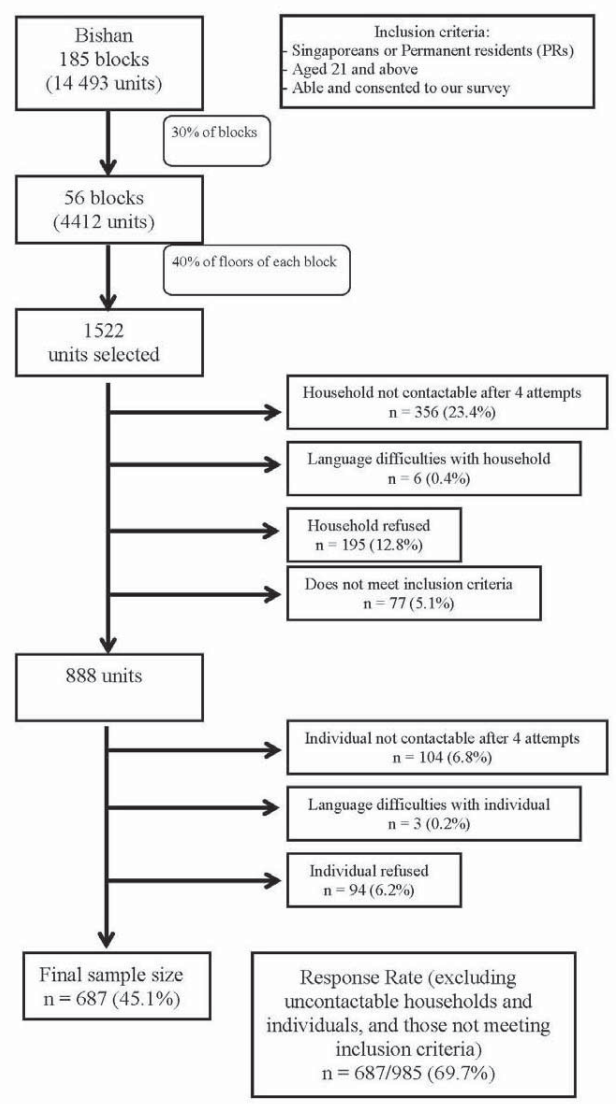

Fig. 1. Flow chart of the sampling procedure undertaken in the study, with corresponding numbers of participants and response rates at each stage.

professional. We obtained further information about the participant's personal medical history of diabetes mellitus, high blood pressure, high cholesterol, dementia, heart attacks, stroke, and heart rhythm problems. We obtained self-reported health behaviours of smoking, leisure-time exercise, fruit and vegetable consumption, adding salt or sauces to prepared food, health supplement consumption, and history of health screening. Hypothetical scenarios were also formulated to assess responses to medical emergencies. These scenarios probed the participant's reported actions to various scenarios such as having severe chest pain, sudden weakness on one side of the body, being unable to speak or understand speech, having cough or runny nose, and if someone they knew had symptoms or signs of stroke that rapidly improved or disappeared.

Associations between sociodemographics and health-related factors with awareness of stroke symptoms and risk factors were evaluated using logarithmic binomial regression. Prevalence rate ratios (PRR) and 95% confidence intervals (CI) were calculated for these associations. Age and ethnicity were adjusted for multivariate analyses. All analyses were performed on IBM Statistical Product and Service Solutions (SPSS) Statistics 20.

Results

From the 1522 households approached, the household response rate was 58.3% (888/1522). Among the eligible individuals in the households who agreed to participate, the individual response rate was 77.4% (687/888). The overall individual response rate was 69.7% (687/985) after excluding non-contactable and ineligible individuals and households (Fig. 1).

The majority of the 687 interviews were conducted in English (n, 77.6%), with 152 (22.2%) interviews conducted in Mandarin, 1 in Tamil and 1 in the Chinese dialect Hokkien. The mean age of the 687 respondents was 48.0 ±15.0 years, 393 (57.2%) were females, and the ethnic distribution was 584 (85.1%) Chinese, 26 (3.8%) Malays, and 64 (9.2%) Indians (Table 1). Among the respondents, 174 (25.3%) had a monthly household income of more than $7000 and 586 (85.3%) had received postprimary school education.

With regard to personal and family history of medical conditions, 257 (37.9%) respondents suffer from less than 1 of the following medical conditions which are predisposed to stroke: diabetes mellitus, high blood pressure, high cholesterol, previous acute myocardial infarction, previous stroke, and heart rhythm problems, and 547 (79.6%) respondents have a family member with less than 1 of these conditions.

Nearly all respondents (98.5%) had heard of stroke, with the majority able to identify stroke as preventable (89.7%),

Table 1. Sociodemographic Data of the Study Population (n = 687)

	n (%)
Age (in years) (n = 685)	
(Mean: 48.02 ± 14.99)	
21 – 34	144 (21.0)
35 – 44	134 (19.6)
45 – 54	171 (25.0)
55 – 64	135 (19.7)
65 and above	101 (14.7)
Gender (n = 687)	
Females	393 (57.2)
Males	294 (42.8)
Race (n = 686)	
Chinese	584 (85.1)
Malay	26 (3.8)
Indian	64 (9.3)
Others	12 (1.8)
Marital status (n = 687)	
Single	139 (20.2)
Married	516 (75.1)
Divorced/separated	12 (1.8)
Widowed	20 (2.9)
Highest level of educational qualification (n = 687)	
No formal education/primary education to PSLE	101 (14.7)
ITE certification, GCE 'N' levels, 'O' levels/'A' levels*	245 (35.6)
Polytechnic diploma†	116 (16.9)
University graduate/postgraduate degree holders†	225 (32.8)
Gross monthly household income (n = 687)	
Less than $3000	153 (22.3)
$3001 – $7000	221 (32.2)
More than $7000	174 (25.3)
Declined to answer	58 (8.4)
Do not know	81 (11.8)
Occupation (n = 684)	
Working‡	487 (71.2)
Homemaker	86 (12.6)
Retired/unemployed	111 (16.2)
Housing type (n = 685)	
HDB 1- & 2-room flat	0 (0.0)
HDB 3-room flat	28 (4.1)
HDB 4-room flat	383 (55.9)
HDB 5-room flat/executive flats/maisonette	274 (40.0)
Others	0 (0.0)
Language used for interview (n = 686)	
English	532 (77.6)
Mandarin Chinese	152 (22.2)
Malay	0 (0.0)
Tamil	1 (0.1)
Hokkien	1 (0.1)

*Considered as secondary and higher secondary education
†Considered as tertiary education
‡ Includes those working full time, part time, on contract work, self employed, National Servicemen and students

non-infectious (94.8%), and a life-threatening condition (92.9%). However, only 52.4% correctly localised stroke as a condition affecting the brain with 17.5% wrongly citing the heart as the source of pathology. About two-thirds of respondents (68.7%) knew that treatments were available for stroke. Many were aware that it was possible to lower the risk of subsequent strokes following an initial stroke (81.1%).

When respondents were asked to cite stroke symptoms, the common responses were speech disturbances or slurred speech (26.2%), one-sided limb weakness (23.9%), non-specific numbness (23.1%), one-sided facial weakness (21.8%), and non-specific weakness (20.4%) (Table 2). Less than half of the respondents (47.6%) were able to name 1 or more of the 3 stroke symptoms in the "FAST" message, with only 19.2% knowing more than 1 symptom. It is noteworthy that some relatively commonly cited responses by respondents when asked for stroke symptoms were those related to acute myocardial infarction rather than stroke, such as chest pain (12.4%), breathlessness (8.4%) and diaphoresis (6.1%).

Table 2. Awareness of Symptoms and Risk Factors of a Stroke (n = 687)

Warning Symptoms	**n (%)**	**Risk Factors**	**n (%)**
Slurred speech*	180 (26.2)	High blood pressure†	335 (48.8)
One-sided weakness in the arms/legs*	164 (23.9)	Poor diet	288 (41.9)
Numbness	159 (23.1)	High cholesterol†	268 (39.0)
Weakness of one side of the face/corner of mouth droops down*	150 (21.8)	Low level of physical activity	190 (27.7)
Weakness	140 (20.4)	Stress/insufficient rest	147 (21.4)
Dizziness	131 (19.1)	Cigarette smoking†	116 (16.9)
Chest pain	85 (12.4)	Diabetes mellitus†	92 (13.4)
Loss of consciousness	79 (11.5)	Overweight	92 (13.4)
Headache	69 (10.0)	Family history/genetics	87 (12.7)
Breathlessness	58 (8.4)	Excessive alcohol consumption	78 (11.4)
Numbness on one side of the body	54 (7.9)	Advanced age†	43 (6.3)
Hypertension	43 (6.3)	Previous heart attacks†	30 (4.4)
Sweating/cold sweats	42 (6.1)	Non-specific heart problems	22 (3.2)
Difficulty understanding/sudden confusion	32 (4.7)	Heart rhythm problems	21 (3.1)
Blurring of vision	31 (4.5)	Atherosclerosis/blocked vessels	15 (2.1)
Severe headache	19 (2.8)	Blood disorders	11 (1.6)
Nausea/vomiting	17 (2.5)	Previous strokes†	7 (1.0)
Pain in limbs	14 (2.0)	Drinking coffee	2 (0.3)
Other vision disturbances	7 (1.0)	Not able to identify any risk factors at all	62 (9.0)
Not able to identify any symptoms at all	64 (9.3)		
Levels of knowledge of established warning symptoms		Levels of knowledge of established risk factors	
Knows all 3 established symptoms	35 (5.1)	Knows 6 – 7 established risk factors	0 (0.0)
Knows 2 established symptoms	97 (14.1)	Knows 5 established risk factors	4 (0.6)
Knows 1 established symptoms	195 (28.4)	Knows 4 established risk factors	23 (3.3)
Do not know any established symptoms	360 (52.4)	Knows 3 established risk factors	77 (11.2)
		Knows 2 established risk factors	168 (24.5)
		Knows 1 established risk factor	212 (30.8)
		Do not know any established risk factors	203 (29.6)
Dichotomised groups for levels of knowledge for established symptoms		Dichotomised groups for levels of knowledge for established risk factors	
Greater awareness of established symptoms‡	327 (47.6)	Greater awareness of established risk factors‖	272 (39.6)
Lesser awareness of established symptoms§	360 (52.4)	Lesser awareness of established risk factors¶	415 (60.4)

*Established warning symptoms of a stroke, as defined by the FAST criteria, according to Singapore NNI
†Established risk factors of a stroke, as defined from various studies, review papers and guidelines from NINDS
‡Respondents who were able to identify >1 established warning symptoms of a stroke
§Respondents who were unable to identify any established warning symptom of a stroke
‖Respondents who were able to identify >2 established risk factors of a stroke
¶Respondents who were able to identify <2 established risk factors of a stroke

In unadjusted analyses, the proportion of people with greater awareness of stroke symptoms was higher in the middle-aged groups of 35 to 44 years old (PRR 1.32, 95% CI, 1.11 to 1.71) and 45 to 54 years old (PRR 1.34, 95% CI, 1.05 to 1.72) as compared to the youngest age group of 21 to 34 years old (Table 3). Compared to Chinese respondents, those of other ethnicities had greater awareness of stroke symptoms (PRR 1.27, 95% CI, 1.05 to 1.53). There was no association with gender or language of interview. After adjusting for age and ethnicity, a family history of stroke-predisposing conditions was associated with greater awareness of stroke symptoms (PRR 1.39, 95% CI, 1.10 to 1.76), although this was not observed for personal history of stroke risk factors (PRR 0.94, 95% CI, 0.78 to 1.13). Caregivers of patients with chronic illnesses also had greater awareness of stroke symptoms (PRR 1.34, 95% CI, 1.07 to 1.69).

Commonly cited stroke risk factors by respondents included high blood pressure (48.8%), poor diet (41.9%), high cholesterol (39.0%), physical inactivity (27.7%), stress/insufficient rest (21.4%), smoking (16.9%), diabetes mellitus (13.4%) and being overweight (13.4%). Among respondents, 29.6% were unable to name any of the 7 established risk factors and 39.6% had greater awareness of stroke risk factors using our threshold of knowing at least 2 risk factors.

In unadjusted analyses, age, gender, ethnicity and interview language were not associated with awareness of risk factors. After adjusting for age and ethnicity, a family history of stroke-predisposing conditions was independently associated with greater awareness of stroke risk factors (PRR 1.62, 95% CI, 1.21 to 2.17), but a personal history of risk factors was not (PRR 1.19, 95% CI, 0.96 to 1.49). Caregivers of patients with chronic illnesses also had greater awareness of stroke risk factors (PRR 1.41, 95% CI, 1.08 to 1.85).

The majority of respondents reported that they would seek medical care immediately if they experienced stroke symptoms of unilateral weakness (81.8%) or an inability to speak clearly or understand speech (90.0%) (Table 4). Only 408 (59.4%) participants knew the number for an emergency ambulance in Singapore. When presented with the scenario of what they would do if someone they knew presented with symptoms of stroke, 546 (79.5%) respondents said that they would either call an ambulance (67.1%) or bring the person by taxi/car (12.4%) to an accident and emergency (A&E) department. However, if the symptoms of stroke had resolved spontaneously, only 473 (68.9%) respondents would advise the person to see a doctor immediately or on the same day.

Discussion

This study found that stroke literacy in this study population of Singapore residents was poor. There was a general lack of awareness of stroke symptoms and risk factors which was not limited to any particular sociodemographic subgroup. Less than half of respondents knew of at least 1 established stroke symptom, and less than half knew of at least 2 risk factors. Of note, subgroups at higher risk of stroke such as the elderly and respondents with stroke-predisposing conditions also had poor awareness of both symptoms and risk factors of stroke. Our findings suggest that there is a need to improve public education on stroke, particularly among those at higher risk of stroke.

A previous study[8] of stroke literacy in Singapore (which used telephone survey methods) reported higher rates of stroke literacy than our study (77% of respondents correctly citing at least one stroke symptom, compared with 47.6% in our study). However, in contrast to our study which used FAST criteria, this study used broader criteria for "acceptable" symptoms including any numbness, weakness or dizziness. The numbers of respondents who could cite at least 1 stroke risk factor was similar (75% versus 70.4% in our study).

Studies conducted in other countries suggest that the level of awareness of stroke symptoms and risk factors worldwide is poor.[11-17] Direct comparisons between studies can be misleading when different question formats have been used, and where different criteria have been applied for defining high stroke literacy. We found 2 studies in the literature that used an open-ended design similar to our study, where participants were asked to respond to open-ended questions without any prompts. In a study conducted in Ireland, 30.7% of respondents were able to cite at least 2 out of 8 stroke symptoms, and 71.1% were able to cite at least 2 out of 5 stroke risk factors.[9] Another in Korea[17] found that 61.5% of respondents were able to cite at least 1 out of 5 stroke symptoms, and 56.1% were able to cite at least 1 out of 8 stroke risk factors. In comparison, our study population also had low literacy levels, with 47.6% able to cite at least 1 out of 3 stroke symptoms, and 39.6% able to cite at least 2 out of 7 stroke risk factors.

The lack of association of awareness of stroke symptoms and risk factors with older individuals, despite their higher risk of stroke, is consistent with previous studies.[15] Further, we observed that those with a personal history of stroke-predisposing medical conditions did not have better stroke literacy. Unusually, stroke literacy was better in individuals with a family history of a stroke-predisposing condition or who were caregivers of family members with medical conditions. A possible reason for this could be the strong role the family plays in an individual's medical care in Singapore,[18] which may result in more interaction and education opportunities with healthcare professionals.

Table 3. Factors Associated with Awareness of Stroke Symptoms and Risk Factors

		Greater Awareness of Symptoms† (Unadjusted)		Greater Awareness of Symptoms† (Adjusted)*		Greater Awareness of Risk Factors‡ (Unadjusted)		Greater Awareness of Risk Factors‡ (Adjusted)*	
		Prevalence Rate Ratio	95% Confidence Interval	Prevalence Rate Ratio	95% Confidence Interval	Prevalence Rate Ratio	95% Confidence Interval	Prevalence Rate Ratio	95% Confidence Interval
Age (years)	21 – 34	1				1			
	35 – 44	1.32	1.11 – 1.71			1.13	0.86 – 1.48		
	45 – 54	1.34	1.05 – 1.72			0.96	0.73 –1.26		
	55 – 64	1.22	0.93 – 1.59			0.98	0.73 – 1.30		
	65 and above	1.08	0.79 – 1.46			0.84	0.60 – 1.17		
Gender	Female	1		1		1		1	
	Male	0.95	0.81 – 1.12	0.96	0.82 – 1.12	0.91	0.75 – 1.10	0.90	0.75 – 1.09
Ethnicity	Chinese	1				1			
	Malay	1.43	1.07 – 1.92			0.77	0.43 – 1.38		
	Indian	1.23	0.97 – 1.55			0.98	0.71 – 1.35		
	Others	1.09	0.62 – 1.94			1.04	0.53 – 2.05		
	Chinese	1				1			
	Non-Chinese	1.27	1.05 – 1.53			0.93	0.71 – 1.22		
Education	No education/PSLE	0.80	0.61 – 1.07	0.75	0.53 – 1.05	0.83	0.61 – 1.13	0.91	0.63 – 1.32
	GCE ‘N’ level, ‘O’ level, ‘A’ level, ITE	1.11	0.93 – 1.33	1.04	0.83 – 1.30	0.96	0.77 – 1.19	1.01	0.79 – 1.29
	Polytechnic Diploma	0.88	0.68 – 1.13	0.87	0.67 – 1.12	0.93	0.71 – 1.22	0.95	0.73 – 1.25
	University graduate/postgraduate	1		1		1		1	
Income	Less than $3000	1		1		1		1	
	$3001 – $7000	1.24	0.99 –1.56	1.28	1.01 – 1.62	1.20	0.90 – 1.60	1.18	0.87 – 1.60
	More than $7000	1.23	0.97 – 1.56	1.33	1.04 – 1.71	1.41	1.06 – 1.88	1.39	1.03 – 1.89
Occupation	Working/national service/student	1		1		1		1	
	Homemaker	1.20	0.98 – 1.47	1.16	0.94 – 1.43	1.00	0.76 – 1.32	1.02	0.77 – 1.35
	Retired/unemployed	0.74	0.57 – 0.97	0.70	0.52 – 0.93	0.82	0.62 – 1.09	0.86	0.63 – 1.17

*Adjusted for age and ethnicity
†Respondents who were able to identify >1 established warning symptoms of a stroke
‡Respondents who were able to identify >2 established risk factors of a stroke
§Includes diabetes mellitus, high blood pressure, high cholesterol, previous acute myocardial infarction (AMI), previous stroke, and heart rhythm problems
||Includes diabetes mellitus, high blood pressure, high cholesterol, previous acute myocardial infarction (AMI), previous stroke and other heart problems

Table 3. Factors Associated with Awareness of Stroke Symptoms and Risk Factors (Con't)

		Greater Awareness of Symptoms† (Unadjusted)		Greater Awareness of Symptoms† (Adjusted)*		Greater Awareness of Risk Factors‡ (Unadjusted)		Greater Awareness of Risk Factors‡ (Adjusted)*	
		Prevalence Rate Ratio	**95% Confidence Interval**	**Prevalence Rate Ratio**	**95% Confidence Interval**	**Prevalence Rate Ratio**	**95% Confidence Interval**	**Prevalence Rate Ratio**	**95% Confidence Interval**
Marital status	Single	1		1		1		1	
	Married	1.14	0.92 – 1.41	1.20	0.95 – 1.53	1.09	0.85 – 1.39	1.19	0.91 – 1.55
	Divorced/separated	1.18	0.65 – 2.14	1.30	0.70 – 2.43	2.04	1.38 – 3.03	2.17	1.50 – 3.24
	Widowed	1.41	0.94 – 2.12	1.58	1.00 – 2.49	0.82	0.40 – 1.65	0.98	0.46 – 2.08
Language used for interview	English	1		1				1	
	Other languages	0.83	0.67 – 1.02	0.82	0.65 – 1.04	0.98	0.79 – 1.23	1.03	0.81 – 1.32
Being a caregiver	Yes	1.32	1.05 – 1.67	1.34	1.07 – 1.69	1.40	1.07 – 1.83	1.41	1.08 – 1.85
	No	1		1		1		1	
Significant past medical history§	Yes (>1 significant personal past medical condition(s))	0.98	0.83 – 1.15	0.94	0.78 – 1.13	1.08	0.90 – 1.31	1.19	0.96 – 1.49
	No	1		1		1		1	
Significant family history‖	Yes (≥1 significant family history of medical condition(s))	1.42	1.12 – 1.80	1.39	1.10 – 1.76	1.63	1.21 – 2.18	1.62	1.21– 2.17
	No	1		1		1		1	

* Adjusted for age and ethnicity
†Respondents who were able to identify >1 established warning symptoms of a stroke
‡Respondents who were able to identify >2 established risk factors of a stroke
§Includes diabetes mellitus, high blood pressure, high cholesterol, previous acute myocardial infarction (AMI), previous stroke, and heart rhythm problems
||Includes diabetes mellitus, high blood pressure, high cholesterol, previous acute myocardial infarction (AMI), previous stroke and other heart problems

Table 4. Reported Actions by Respondents to Hypothetical Scenarios of Suspected Stroke and other Medical Emergencies and Their Knowledge of Emergency Medical Services (n = 687)

	n (%)
Immediate action if they suspected that a colleague/friend was having warning symptoms of a stroke	
Call an ambulance*	461 (67.1)
Send to A&E department by car/taxi*	85 (12.4)
Bring the person to a general practitioner (GP)	54 (7.9)
Call a family member or friends for help	6 (0.9)
Prick finger and let the blood drain	6 (0.9)
Encourage person to exercise/change diet	5 (0.7)
Wait and see if the symptoms resolve on their own	2 (0.3)
Bring the person to the A&E department by Mass Rapid Transit (MRT)/bus	2 (0.3)
Bring the person to a traditional physician	2 (0.3)
Bring the person to a specialist	2 (0.3)
Initiate cardiopulmonary resuscitation	2 (0.3)
Send the patient for acupuncture	2 (0.3)
Apply medicated oil	2 (0.3)
Do not know what to do/will not do anything	2 (0.3)
Give the person medications	1 (0.1)
Immediate action if they suspected that somebody had signs of stroke which subsequently resolved	
Go to the doctor immediately/on the same day*	473 (68.9)
Lifestyle advice (change diet, encourage exercise, take medications/control illnesses)	65 (9.5)
No further action; wait to see if symptoms come back	64 (9.3)
Go to the doctor in a few days' time	40 (5.8)
Tell the doctor the next time he/she sees him for another medical problem	11 (1.6)
Self-medicate/take vitamins	10 (1.5)
Go to a traditional physician	3 (0.4)
Go for health screening/full body check	3 (0.4)
Action when there is sudden weakness on one side of the body (n = 681)	
Immediately*	557 (81.8)
Wait for a few hours to see if symptoms resolve	82 (12.0)
Wait till the next day to see if symptoms resolve	30 (4.4)
Would not seek medical care	12 (1.8)
Action when suddenly unable to speak clearly or understand speech (n = 681)	
Immediately*	613 (90.0)
Wait for a few hours to see if symptoms resolve	36 (5.3)
Wait till the next day to see if symptoms resolve	23 (3.4)
Would not seek medical care	9 (1.3)
Number to call for an ambulance in Singapore (n = 687)	
995*	408 (59.4)
999†	98 (14.3)
911	45 (6.6)
1777†	3 (0.4)
Others/did not know	133 (19.3)

*Correct answers for the condition- and symptom-specific scenarios
†In Singapore, the police hotline is 999 and the private ambulance hotline is 1777

Although majority of respondents reported that they would seek medical help immediately if someone they knew had symptoms of a stroke, local studies have found substantial delays in hospital presentation.[19,20] In a 2009 study of Singapore stroke patients, the mean time of hospital arrival from stroke onset was over 20 hours, with only 15% presenting within the time window for consideration for thrombolysis.[20] This inconsistency between reported intentions and actual behaviour is striking. One possible explanation is social desirability bias, as medical students had been the ones who administered the survey, and thus respondents may have overestimated their willingness to seek medical assistance. Alternatively, the inconsistency may be due to the difficulty in recognising stroke symptoms when they occur, and assessing whether these symptoms are serious or severe enough to warrant medical attention, an issue that has been highlighted in other studies.[9,16] Further research with in-depth qualitative interviews of stroke patients and their family members is needed to better understand the reasons for this inconsistency.

The overall low level of stroke awareness in Singapore highlights the need for systematic and comprehensive population-based education efforts, as well as opportunistic education by healthcare providers of older patients and patients with stroke-predisposing medical conditions. There is published evidence that such education efforts can improve public stroke literacy.[21-23] Higher stroke literacy is associated with earlier hospital presentation of stroke patients,[24] which will allow for greater utilisation of proven acute stroke management strategies such as thrombolysis. This is particularly important in Singapore where the burden of stroke is expected to rise, given its rapidly ageing population[25] and relatively high prevalence of stroke-predisposing conditions such as diabetes.[26] In planning an education programme, it is necessary to consider carefully the target audience, the specific message being communicated, and the media through which communication will take place, in order to maximise the impact of the programme. It is well-known that a gap exists between information and behaviour change, so any programme developed must attempt to bridge this gap. Finally, a robust evaluation programme should be set up; it should assess the effectiveness of the education programme implemented, using appropriate and objective measures that focus on actual behaviour change. Well-designed stroke awareness programmes have been shown to be able to successfully improve stroke literacy, both in terms of knowledge, and in terms of actual observed behaviour, although the success of these programmes depend on choosing the right message and the right medium for any target group.[27] Although most stroke programmes have focused on adults and at-risk individuals, some programmes have successfully targeted children who then transfer this knowledge to their

adult relatives.[27] Opportunistic promotional efforts can be conducted during routine medical appointments for patients with stroke-predisposing conditions like hypertension and diabetes. These efforts can focus both on improving literacy, and on controlling risk factors for stroke.

There are 2 main sets of limitations in this study – one with regard to the questionnaire used, and the other with regard to the population surveyed. The use of open-ended questions tends to result in lower reported stroke literacy rates[15,16] compared to close-ended questions, but it is not certain how this relates to actual literacy. There is no widely accepted standardised questionnaire to measure awareness of stroke. Comparisons between studies are difficult in view of differing question formats. We modified the SAQ questionnaire that has been validated in other countries, but not in Singapore. Furthermore, although language translations included back-translation and piloting, the translated versions of the questionnaire were also not formally evaluated for validity. Further, our dichotomisation of the study population into "lesser awareness" and "greater awareness" was arbitrary, although we believed that the cut-offs used were reasonable and adequately discriminated between people based on their level of stroke literacy. The survey population used may limit the generalisability of our findings. A single public housing estate was sampled and respondents living in private housing (which represents about 18% of all dwellings in Singapore)[28] were not included. Our study was small, and included few respondents belonging to ethnic minorities or to very low socio-economic groups.

Conclusion

In this study of residents living in a public housing estate in Singapore, the level of awareness of stroke symptoms and risk factors was low, highlighting the need for public education efforts to improve stroke literacy in Singapore.

REFERENCES

1. Mathers CD, Lopez AD, Murray CJL. The burden of disease and mortality by condition: data, methods, and results for 2001. In: Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL, editors. Global burden of disease and risk factors. Washington DC: The International Bank for Reconstruction and Development/The World Bank Group, 2006.
2. Phua HP, Chua AV, Ma S, Heng D, Chew SK. Singapore's burden of disease and injury 2004. Singapore Med J 2009;50:468-78.
3. Adams HP, Jr., del Zoppo G, Alberts MJ, Bhatt DL, Brass L, Furlan A, et al. Guidelines for the early management of adults with ischemic stroke: a guideline from the American Heart Association/American Stroke Association Stroke Council, Clinical Cardiology Council, Cardiovascular Radiology and Intervention Council, and the Atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research Interdisciplinary Working Groups: The American Academy of Neurology affirms the value of this guideline as an educational tool for neurologists. Circulation 2007;115:e478-534.
4. Hacke W, Kaste M, Bluhmki E, Brozman M, Davalos A, Guidetti D, et al. Thrombolysis with alteplase 3 to 4.5 hours after acute ischemic stroke. N Engl J Med 2008;359:1317-29.
5. Durai Pandian J, Padma V, Vijaya P, Sylaja PN, Murthy JM. Stroke and thrombolysis in developing countries. Int J Stroke 2007;2:17-26.
6. Evenson KR, Foraker RE, Morris DL, Rosamond WD. A comprehensive review of prehospital and in-hospital delay times in acute stroke care.Int J Stroke 2009;4:187-99.
7. Venketasubramanian N, Pwee KH, Chen CP. Singapore ministry of health clinical practice guidelines on stroke and transient ischemic attacks. Int J Stroke 2011;6:251-8.
8. Phua J, Lim HF, Tay CK, Aung NW. Public awareness of sepsis and stroke in Singapore: a population-based survey. Ann Acad Med Singapore 2013; 42:269-77.
9. Hickey A, Holly D, McGee H, Conroy R, Shelley E. Knowledge of stroke risk factors and warning signs in Ireland: development and application of the Stroke Awareness Questionnaire (SAQ).Int J Stroke 2012;7:298-306.
10. Harbison J, Hossain O, Jenkinson D, Davis J, Louw SJ, Ford GA. Diagnostic accuracy of stroke referrals from primary care, emergency room physicians, and ambulance staff using the face arm speech test. Stroke 2003;34:71-6.
11. 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;14:12-6.
12. Nedeltchev K, Fischer U, Arnold M, Kappeler L, Mattle HP. Low awareness of transient ischemic attacks and risk factors of stroke in a Swiss urban community. J Neurol 2007;254:179-84.
13. 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;279:1288-92.
14. 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;289:343-6.
15. Nicol MB, Thrift AG. Knowledge of risk factors and warning signs of stroke. Vasc Health Risk Manag 2005;1:137-47.
16. Jones SP, Jenkinson AJ, Leathley MJ, Watkins CL. Stroke knowledge and awareness: an integrative review of the evidence. Age and ageing 2010;39:11-22.
17. Kim YS, Park SS, Bae HJ, Heo JH, Kwon SU, Lee BC, et al. Public awareness of stroke in Korea: a population-based national survey. Stroke 2012;43:1146-9.

18. Tan JOA, Chin JJL. What doctors say about care of the dying. The Lien Foundation, Singapore 2011.
19. De Silva DA, Ong SH, Elumbra D, Wong MC, Chen CL, Chang HM. Timing of hospital presentation after acute cerebral infarction and patients' acceptance of intravenous thrombolysis. Ann Acad Med Singapore 2007;36:244-6.
20. De Silva DA, Yassin N, Toh AJ, Lim DJ, Wong WX, Woon FP, et al. Timing of arrival to a tertiary hospital after acute ischaemic stroke – A follow-up survey 5 years later. Ann Acad Med Singapore 2010;39:513-5.
21. Morimoto A, Miyamatsu N, Okamura T, Nakayama H, Toyoda K, Suzuki K, et al. Effects of intensive and moderate public education on knowledge of early stroke symptoms among a Japanese population: the Acquisition of Stroke Knowledge study. Stroke 2013;44:2829-34.
22. Fogle CC, Oser CS, McNamara MJ, Helgerson SD, Gohdes D, Harwell TS. Impact of media on community awareness of stroke warning signs: a comparison study. J Stroke Cerebrovasc Dis 2010;19:370-5.
23. Silver FL, Rubini F, Black D, Hodgson CS. Advertising strategies to increase public knowledge of the warning signs of stroke. Stroke 2003;34:1965-8.
24. Teuschl Y, Brainin M. Stroke education: discrepancies among factors influencing prehospital delay and stroke knowledge. Int J Stroke 2010; 5:187-208.
25. National Population & Talent Division Prime Minister's Office, Department of Statistics, Ministry of Home Affairs, Immigration & Checkpoints Authority, Singapore. Population in Brief 2013. Singapore 2013. Available at: http://www.singstat.gov.sg/statistics/browse_by_theme/population/statistical_tables/popinbrief2013.pdf. Accessed 30 September 2013.
26. Epidemiology & Disease Control. National Health Survey 2010. Ministry of Health Singapore 2012. Available at: http://www.moh.gov.sg/content/moh_web/home/Publications/Reports/2011/national_health_survey2010.html. Accessed 30 September 2013.
27. Rasura M, Baldereschi M, Di Carlo A, Di Lisi F, Patella R, Piccardi B, et al. Effectiveness of public stroke educational interventions: a review. Eur J Neurol 2014;21:11-20.
28. Department of Statistics, Singapore. Singapore census of population 2010: statistical release 2: households and housing. Ministry of Trade and Industry, Republic of Singapore 2011. Available at: http://www.singstat.gov.sg/publications/publications_and_papers/cop2010/census10_stat_release2.html. Accessed 30 September 2013.