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ORIGINAL ARTICLE

Stroke knowledge among various suburban communities in Khon Kaen Province, Thailand

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Abstract

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Stroke is a serious and increasing problem in Thailand. The aims of this study were to assess knowledge of stroke in a Thai population and to identify factors associated with lack of knowledge in two topics where this was weakest. The participants in this cross-sectional study were 781 residents of Northeastern Thailand over 18 years of age. Interview data were analysed using descriptive statistics and multiple logistic regression.

Although knowledge about stroke risk factors was generally high, only 57.9% knew that hypertension was a risk. Most (66%) could correctly recognise all the listed stroke symptoms, but only 31.4 % knew that the first reaction to stroke symptoms should be dialling the medical emergency number. In the multiple logistic regression analysis, the variables associated with unawareness that hypertension is a stroke risk factor were education to high school level or above, a history of hypercholesterolemia and no family history of stroke. The factors associated with disagreement that the immediate response to a stroke event should be to ring the medical emergency number were age and occupation.

Knowledge of stroke symptoms was surprisingly high, but this should be confirmed in other Thai populations. Systems for identifying hypertension need to be more widely used and accompanied by explicit information about stroke risk. Locally, further research is needed about the reasons for not immediately contacting the emergency service. The benefits of calling the service should be a major focus of any new public information campaign.

Keywords: knowledge, Khon Kaen, Thailand, stroke

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ความรู้เกี่ยวกับโรคหลอดเลือดสมองในชุมชนชนบท จังหวัดขอนแก่น ประเทศไทย

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ความรู้เกี่ยวกับโรคหลอดเลือดสมองในชุมชนชนบท จังหวัดขอนแก่น ประเทศไทย
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โรคหลอดเลือดสมองเป็นปัญหาที่สำคัญและมีแนวโน้มเพิ่มมากขึ้นในประเทศไทย วัตถุประสงค์เพื่อประเมินความรู้เกี่ยวกับโรคหลอดเลือดสมองในประชาชนไทยและเพื่อศึกษาปัจจัยที่มีความสัมพันธ์กับการขาดความรู้เกี่ยวกับโรคหลอดเลือดสมอง เป็นการศึกษาเชิงวิเคราะห์แบบภาคตัดขวาง กลุ่มตัวอย่าง 781 คน ที่อาศัยอยู่ในภาคตะวันออกเฉียงเหนือของไทย มีอายุ 18 ปีขึ้นไป เก็บข้อมูลโดยการสัมภาษณ์ ใช้สถิติเชิงพรรณนาและการวิเคราะห์ถดถอยโลจิสติกพหุคูณ

ถึงแม้ว่าประชาชนมีความรู้ดีเกี่ยวกับปัจจัยเสี่ยงของการเกิดโรคหลอดเลือดสมอง แต่มีเพียงร้อยละ 57.9 ที่รู้ว่าความดันโลหิตสูงเป็นปัจจัยเสี่ยงหนึ่งของการเกิดโรคหลอดเลือดสมอง ส่วนใหญ่จะมีความรู้เกี่ยวกับอาการของโรคหลอดเลือดสมองถูกต้องร้อยละ 66 แต่มีร้อยละ 31.4 ที่รู้ว่าหากมีอาการของโรคหลอดเลือดสมองควรจะโทรเรียกเบอร์ฉุกเฉินทางการแพทย์เป็นอันดับแรก การวิเคราะห์หาความสัมพันธ์แบบตัวแปรเชิงพหุพบว่ามีตัวแปรที่มีความสัมพันธ์กับการไม่ตระหนักว่าความดันโลหิตสูงเป็นปัจจัยเสี่ยงของการเกิดโรคหลอดเลือดสมอง คือ มีการศึกษาอยู่ในระดับมัธยมศึกษาหรือสูงกว่า การมีประวัติไขมันในเลือดสูง และการไม่มีประวัติคนในครอบครัวเป็นโรคหลอดเลือดสมอง ปัจจัยที่มีความสัมพันธ์กับการไม่เห็นด้วยว่าหากมีอาการของโรคหลอดเลือดสมองควรจะโทรเรียกเบอร์ฉุกเฉินทางการแพทย์ทันที คือ อายุ และอาชีพ

ความรู้เกี่ยวกับอาการของโรคหลอดเลือดสมองค่อนข้างสูง ดังนั้นควรจะมีการศึกษายืนยันในประชาชนไทยกลุ่มอื่นๆ ด้วย ควรมีระบบการให้ข้อมูลกับประชาชนอย่างแพร่หลายในประเด็นความดันโลหิตสูงเป็นปัจจัยเสี่ยงของโรคหลอดเลือดสมอง ในการทำวิจัยครั้งต่อไปควรศึกษาเกี่ยวกับสาเหตุของการไม่โทรเรียกเบอร์ฉุกเฉินทางการแพทย์ทันทีหากมีอาการของโรคหลอดเลือดสมอง และควรจะมีการรณรงค์ให้ข้อมูลข่าวสารถึงประโยชน์ของการโทรเรียกเบอร์ฉุกเฉินทางการแพทย์

คำสำคัญ: ความรู้ ขอนแก่น ประเทศไทย โรคหลอดเลือดสมอง

Introduction

Stroke was the second most common cause of death worldwide in 2010 with an age-standardised mortality rate of 88.4 per 100,000[1]. However, death rates vary considerably across different countries for a variety of reasons including the lack of updated statistics and the diversity of ways in which deaths are recorded[2]. In Thailand stroke is now the leading cause of death in both males and females and disability in females, and the mortality rate has increased in recent years from 20.8 per 100,000 in 2008 to 30.7 in 2012[3]. This trend is likely to continue because stroke primarily affects the elderly, and Thailand is one of the most rapidly aging countries in the world. The proportion of older persons over 60 years of age in the Thai population is expected to reach 14% in 2015, 19.8% in 2025 and nearly 30% by 2050[4].

Stroke causes not only death, but also prolonged disability. Patients suffer both the physical and emotional effects of sensory and motor impairments, cognitive deficits, depression and sleep disorders. Stroke therefore has immense impacts in terms of its associated economic, social and psychological problems, and it contributes to career anxiety[5-6]. However, the control of risk factors can reduce the incidence of stroke[7], and good knowledge of the risk factors and how they can be avoided is the key to successful primary prevention. Once a stroke occurs, early diagnosis and treatment are crucial for reducing mortality and limiting disability[8-12] so that good knowledge of stroke warning signs and the need to minimize pre-hospital delay have important implications for secondary prevention.

In Thailand there has been little published research about stroke knowledge. One study surveyed the knowledge of stroke patients attending a hospital outpatient department[13], and another reported on the knowledge of inpatients or their responsible relatives following an ischemic stroke[14]. However, no studies have been found which explored stroke knowledge in the general population. The aim of the present study was to assess knowledge of stroke in a Thai general population and to identify the factors associated with lack of stroke knowledge.

Methods

Sampling

The participants in this cross-sectional study were the adult representatives of 781 households in Khon Kaen Province, Northeastern Thailand. A minimum required sample size of 600 subjects was obtained from the tables provided by Lwanga and Lemeshow[15]. The anticipated population proportion having correct stroke knowledge was set as 0.46 (adopted from a previous study[16]), the relative precision was 4%, and the confidence level was 95%.

The households were selected using a two-stage cluster random sampling process. Three districts were randomly selected from the list of all 26 provincial districts, and nine suburban communities were then randomly selected from these three districts. Systematic sampling was used to select households in each community so that the number of households selected in each community was proportional to the total number of households in all the nine communities. One adult over 18 years of age was selected by simple random sampling from each household, and agreed to participate. The selected households were visited by a team of interviewers who were health care providers working at the local health promoting

hospital. The selected household representatives were informed about the research project and the intended use of the information obtained, and agreement to participate was obtained by signed consent. Households were revisited at a later time if no eligible participant was at home on the first visit. Interview data were collected between November, 2012, and February, 2013.

Instrument

A structured interview questionnaire was developed for data collection. The questionnaire included items designed to elicit information from the participants about their demographic characteristics, body mass index (BMI), stroke related-behaviors (exercise and smoking), their own and their family history of stroke and heart disease, and their history of other medical complications/diseases/conditions associated with stroke. The assessment of stroke knowledge consisted of 18 items which were grouped into three sections: risk factors for stroke, stroke warning signs, and respondent's reaction to possible stroke symptoms. For each item, the participants were given two response options ('true' or 'false'), and, where they were unsure of their response, their answer was deemed to be 'false'. The responses were scored as correct according the author's knowledge of the literature and that for all the items the correct answer was 'true'.

Statistical analysis

All analyses were performed with Stata version 10[17]. Statistics were used to summarise the characteristics and stroke knowledge of the participants. Differences in levels of knowledge between the younger (<45 years) and older (≥45 years) participants were analysed using a z test of the proportions providing the correct response on each of knowledge items.

The age of 45 years was chosen on a relatively arbitrary basis, but was intended to reflect evidence that the age of incidence of stroke is decreasing, especially, in those under 55 years of age in the USA[18], and that people in the lower age group need to consider that their risk of stroke will soon rapidly increase with the incidence of stroke doubling each decade after the age of 55 years[19]. For a logistic regression analysis to identify independent variables associated with a relative lack of stroke knowledge, two knowledge items were selected as the dependent binary variables. These items were those with the lowest percentages of correct responses: knowledge of hypertension is a risk factor of stroke, and knowledge that the first action to take when someone has stroke is to dial the medical emergency number. The Chi-square were performed to evaluate the association between factors, which influence the stroke knowledge. Fisher's exact test was used if the expected frequency was less than five for ≥ 20% of all cells.

To control for confounding factors, variables significant at the $p<0.25$ (two-sided) level were included as candidate variables in a multiple logistic regression using backward elimination. Statistical significance in the multiple logistic regression was set at $p<0.05$. For the first dependent variable, agreement that hypertension is a risk factor for stroke was the reference category while disagreement was the event of interest. For the second dependent variable, agreement that the first action to take when someone has a stroke was the reference category and disagreement was the event of interest.

Ethical approval

The research was approved by the Khon Kaen University Ethics Committee for Human Research (reference no. HE552164).

Results

The socio-demographic and medical histories of the 781 household representatives are summarised in Table 1 and Table 2. More than half (69%) were female, their ages ranged from 19 to 83 years (mean=50.9 years, SD=12.6 years), and the large majority (83.1%) were 40 years of age or older. A third (33.7%) were overweight or obese (BMI≥25). Most were not educated beyond primary school level (63.3%), worked in farming or some unskilled occupation (72.1%), and were receiving a low monthly income (62.6%). Only 0.6% had ever experienced a stroke, 82.7% had never smoked, and more than 90% reported no personal history of hypercholesterolemia or heart disease, but 23.9% did report a history of

Table 1 Distribution of respondents by socio-demographic factors

Socio-demographic factors		Number (n=781)	Percentage
Gender	- Male	241	30.9
	- Female	540	69.1
Age (years)	<40	132	16.9
	40-59	453	58.0
	≥60	196	25.1
Mean = 50.9, S.D. = 12.6, Min =19, Max = 83			
Body Mass Index (kg/m^2)	- Underweight <18.5	46	5.9
	- Normal 18.5-24.9	472	60.4
	- Over weight ≥25	263	33.7
Mean = 23.8, S.D. = 3.9, Min =14.4, Max = 46.6			
Education	- Primary school or less	494	63.3
	- High school or higher than high school	287	36.7
Income (Baht) per month	<7,000	489	62.6
	≥7,000	292	37.4
Median = 6,000, QD = 6,500, Min =300, Max = 50,000			
Occupation	- Worked in farming or some unskilled occupation	563	72.1
	- Government officer or Business man	218	27.9

hypertension. Family histories of stroke and heart diseases were reported by 5.8% and 9.0%, respectively. These results for the stroke knowledge items are summarised in Table 3. Except for three of the 18 knowledge items, the differences in frequencies of correct responses between those <45 and ≥45 years of age were not statistically significant at the $p<0.05$ level. The different frequencies between the lower and older age results for these 15 items were therefore ignored, and only the combined lower and older age groups frequencies are presented.

Table 2 Distribution of respondents by medical histories

Medical histories		Number (n=781)	Percentage
Stroke history	- Ever	5	0.6
	- Never	776	99.4
Heart disease history	- Ever	49	6.3
	- Never	732	93.7
Smoking	- Ever	135	17.3
	- Never	646	82.7
Regular exercise	- Yes	534	68.4
	- No	247	31.6
Hypertension history	- Ever	187	23.9
	- Never	594	76.1
Hypertension drug	- Ever	117	15.0
	- Never	664	85.0
Hyperglycemia	- Ever	87	11.1
	- Never	694	88.9
Hypercholesterolemia	- Ever	41	5.2
	- Never	740	94.8
History of family stroke	- Yes	45	5.8
	- No	736	94.2
History of family heart disease	- Yes	70	9.0
	- No	711	91.0

Table 3 Percentage of correct answer of respondents by knowledge on stroke and age groups

Statement	All (n=781), (%)	Age <45 (n=214), (%)(95%CI)	Age ≥ 45 (n=567), (%)(95%CI)
Risk factors for stroke			
1. Smoking is a risk factor for stroke	90.8	92.1 (0.88-0.96)	90.3 (0.88-0.93)
2. Risk of stroke is reduced when quit smoking	85.9	85.5 (0.81-0.90)	86.1 (0.83-0.89)
3. Regularly drinking alcohol is a risk for stroke	89.4	86.5 (0.82-0.91)	90.5 (0.88-0.93)
4. Hypertension is a risk factor of stroke	57.9*	65.4 (0.59-0.72)	55.0 (0.51-0.59)
5. High fat food risks for stroke	94.7	92.5 (0.89-0.96)	95.6 (0.94-0.97)
6. The elderly has more opportunities for stroke	90.6	90.2 (0.83-0.92)	90.8 (0.84-0.89)
7. People with diabetes has more opportunities for stroke	90.0	89.3 (0.85-0.93)	90.3 (0.88-0.93)
8. People with hypercholesterolemia risk having stroke	96.4	95.3 (0.92-0.98)	96.8 (0.95-0.98)
9. People with heart disease or cardiac arrhythmia risk having stroke	91.3	88.8 (0.85-0.93)	92.2 (0.90-0.94)
10. People with obesity has more opportunities for stroke	94.2	90.2 (0.86-0.94)	95.8 (0.94-0.97)
Stroke warning signs			
11. Sudden trouble speaking	88.5	86.0 (0.81-0.91)	89.4 (0.87-0.92)
12. Sudden troubles in seeing	84.8	80.0 (0.75-0.85)	86.6 (0.84-0.89)
13. Severe headache with unknown cause	95.4	94.4 (0.91-0.97)	95.8 (0.94-0.97)
14. Dizziness, difficulty in walking, loss of balance	94.4	93.9 (0.91-0.97)	94.5 (0.93-0.96)
15. Sudden numbness or weakness of the face, arm or leg, especially on one side of the body	90.6	87.9 (0.83-0.92)	91.7 (0.89-0.94)
16. Sudden confusion or hard to understand speech	79.5	76.6 (0.71-0.82)	80.6 (0.77-0.84)
Respondent's reaction to stroke symptoms			
17. Delay in assisting patients with temporary ischemic attack can affect efficiency of treatment	93.0	90.2 (0.86-0.94)	94.0 (0.92-0.96)
18. The first reaction to take when someone has stroke is dialing 1669	31.4*	35.5 (0.29-0.42)	29.8 (0.26-0.34)

* Two items with the lowest percentages of correct answers

Risk factors for stroke

Over 90% correctly identified seven of the 10 listed risk factors, and 80-90% correctly identified three of the remainder. Ninety-six percent of the older age groups recognized that people with obesity have an increased chance of a stroke compared with 90% of lower age groups. The risk factor least well recognized was hypertension (57.9% correct), but it was better known by the lower age group (65%) than the older respondents (55%). This item was selected as one the two dependent variables for the logistic regression analysis.

Stroke warning signs

Knowledge of the six listed warning signs was also high with over 90% of respondents correctly recognizing half of the signs, and 66% of the respondents correctly recognized all signs. One sign (sudden troubles in seeing) was less well known by the younger age group (80% as opposed to 86.6% in the older group), and significantly ($p<0.05$) more of the older age group (69.3%) recognized all the signs than those in the younger group (56.1%).

Respondent's reaction to stroke symptoms

Although 93% knew that delay in obtaining treatment following a transient ischemic attack was unwise in terms of effective treatment, only 31.4% understood that the first action to take following a stroke was to ring the medical emergency contact number. The latter item was selected as the second dependent variable for the logistic regression analysis.

Factors associated with lack of knowledge on the two items with the lowest percentages of correct responses

Table 4 shows the independent variables associated with lack of knowledge that hypertension is a risk factor for stroke, and Table 5 shows the variables associated with disagreement about the first action to take when someone has stroke. The results of the multiple logistic regression indicated that the population who were unaware that hypertension is a risk factor tended to be those who were educated beyond primary school level (Adj OR=1.46, 95%CI=1.04-2.04), those who reported ever experiencing hypercholesterolemia (Adj OR=2.75, 95%CI=1.31-5.77), and those who reported no family history of stroke (Adj OR=1.95. 95%CI=1.04-3.66). The odds of disagreeing that the immediate response to a stroke event should be to ring the medical emergency number were less in those who were 45 years of age or older (Adj OR=0.63, 95%CI=0.44-0.89) and in those employed in the government sector or business-related occupations as opposed to farming or unskilled work (Adj OR=0.56, 95%CI=0.39-0.81).

Table 4 Factors associated with lack of knowledge that hypertension is a risk factor for stroke

Variables	Crude OR (95%CI)	p-value	Adjusted OR (95% CI)	p-value
Age (years)				
< 45	1.0		1.0	
≥ 45	**0.65 (0.47-0.89)**	**0.009**	**0.71 (0.50-1.03)**	**0.074**
Education				
- Primary school or less	1.0		1.0	
- Secondary school or higher	**1.65 (1.22-2.24)**	**0.001**	**1.46 (1.04-2.04)**	**0.026**
Occupation				
- Worked in farming or unskilled occupation	1.0		1.0	
- Government officer or business man	**1.30 (0.94-1.79)**	**0.110**	**1.13 (0.80-1.59)**	**0.466**
Hypercholesterolemia				
- Never	1.0		1.0	
- Ever	**2.35 (1.13-4.88)**	**0.020***	**2.75 (1.31-5.77)**	**0.007**
History of family stroke				
- Yes	1.0		1.0	
- No	**1.61 (0.88-2.96)**	**0.110**	**1.95 (1.04-3.66)**	**0.037**

* The p value was obtained using Fisher's exact test

Table 5 Factors associated with disagreement that the first reaction to take when someone has stroke is dialing 1669

Variables	Crude OR (95%CI)	p-value	Adjusted OR (95% CI)	p-value
Age (years)				
< 45	1.0		1.0	
≥ 45	**0.77 (0.55-1.08)**	**0.120**	**0.63 (0.44-0.89)**	**0.010**
Occupation				
- Worked in farming or unskilled occupation	1.0		1.0	
- Government officer or business man	**0.64 (0.45-0.91)**	**0.010**	**0.56 (0.39-0.81)**	**0.002**
Heart disease history				
- Never	1.0		1.0	
- Ever	**1.86 (1.03-3.34)**	**0.040***	**1.70 (0.91-3.17)**	**0.090**
Hypertension history				
- Ever	1.0		1.0	
- Never	**0.74 (0.53-1.05)**	**0.090**	**0.71 (0.49-1.03)**	**0.070**
History of family heart disease				
- Yes	1.0		1.0	
- No	**0.62 (0.37-1.02)**	**0.060***	**0.65 (0.39-1.11)**	**0.110**

* The p value was obtained using Fisher's exact test

Discussion

The main finding of this study was that, with exception of the two items selected as dependent variables, stroke knowledge was not only high but generally higher in the older age group whose risk vulnerability for stroke was greater. This was so even though the socioeconomic status of many of the respondents was apparently low with a clear majority reporting low levels of formal education and monthly income and employment in agriculture and unskilled occupations.

The ability to recognise all the major individual warning signs of a stroke is important because the symptoms vary from one stroke victim to another, and people cannot chose which symptom or group of symptoms they will experience when having a stroke[20]. Perhaps the most surprising finding of the present study was that such a large proportion (66%) was able to recognise correctly all the six signs of a stroke. This finding was in marked contrast to the results of various previous studies performed in other countries. For example, a study in Ireland found that only 41.6% were unable to correctly recognise

any warning signs for stroke[21], and an Italian study reported that 51.1 % of their sample could recognize only one correct stroke warning sign and that only 43.5 % of the sample could correctly identify two correct warning signs: the authors suggested that this was due to a confusion in distinguishing between signs and symptoms of heart attack and stroke[22].

In the USA, a CDC analysis of 2001 data from the Behavioral Risk Factor Surveillance System (BRFSS) in 17 states and the U.S. Virgin Islands revealed that 19.6% of about 60,000 respondents were able to correctly identify all of five stroke warning signs when one decoy item was used[23]. Similarly, in a large, population-based household telephone survey in Spain, 19% succeeded in correctly identifying all of the six warning signs listed[24]. In Asia, a Chinese survey of patients who had experienced a stroke or TIA found that only 3.3% were able to correctly identify all the warning signs[25]. A Japanese study reported that 23.2% correctly recognised all of five warning signs, and knowledge of all warning signs was lower in those aged 60 years or more[20]. A survey of university students and academic/non-academic staff and in Nigeria found that even among this mainly highly educated sample as few as 12.6% could identify all seven signs of stroke, and awareness of warning signs was better in those aged less than 40 years[26]. In Kuwait a survey of 900 randomly selected respondents found that only 10.4% were able to recognize all five listed stroke symptoms[27]. Recognition of warning signs can be poor even in those preparing for a career in rehabilitation which is likely to involve with stroke patients. In a USA survey of a relevant group of allied health students, only 25% were able to recognize the top five warning signs from a list of 20 items after attending stroke-related courses[28]. Compared with the data from these studies in many different parts of the world, the outcome of present study is encouraging.

One of the two least well known knowledge items in the present study was that hypertension is risk factor for stroke. In previous studies when respondents are asked questions about risk factors for stroke there was a wide variation in awareness of the role of hypertension (32-98%), but more than 80% recognize high blood pressure when close-ended questions are used[29]. Our finding that only 57.9% correctly identified hypertension as a risk factor was surprising since the great majority were able to correctly identify each of the other nine listed risk factors. Whereas they were able to identify a high fat diet, alcohol consumption and obesity as risk issues, the perhaps more basic issue of hypertension seemed to be largely overlooked, especially by the better educated respondents. The relative lack of understanding that hypertension is a risk factor is disappointing because it is easy to treat, and generic medications need not be expensive[30]. Furthermore, the effective control of hypertension is seen as a crucial component of stroke management[31]. However, in a large cross-sectional study of over 140,000 adults in 17 countries[32] while as many as 40.8% were found to have hypertension, only 46.5% were aware of the diagnosis, and although a large majority who were aware reported receiving treatment with anti-hypertensive medication, in only about a third was the hypertension controlled. This suggests that, by itself, knowledge of a risk factor such as hypertension is unhelpful unless people are diagnosed and receive effective treatment. Similar problems of under-diagnosis and lack of control

appear to exist in Thailand. In a retrospective cross-sectional study conducted across 24 selected stroke clinics in the urban and rural areas in of six regions across Thailand[31] only 49.1% had control over their hypertension, and the authors concluded that continuing medical education programmes and national-level policies were necessary to improve the risks posed by uncontrolled hypertension in stroke patients.

While recognition of stroke symptoms was high and the vast majority of respondents apparently understood the importance of early medical treatment, less than a third agreed that the first action should be to contact the emergency medical service. This finding almost identical to the result of a Korean National Survey[7], but very different from those of many other studies which reported much higher rates of identifying the most appropriate immediate response[20, 22, 24, 29, 33]. Our finding that older respondents were less likely to indicate that calling an emergency medical service should be the first reaction was in line with other studies[33-34], but perhaps the most important correlate is stroke knowledge. In the past, it was often assumed that failure to seek proper medical care was due to lack of knowledge about stroke symptoms[8, 35]. The findings of the present study showed no relationship, and this is consistent with those of another recent study[22]. A major research issue is why this is the case and what other barriers exist to seeking urgent diagnosis and treatment via emergency medical services. The perceived obstacles are likely to vary considerably from one part of the world to another. In Thailand, there is no financial barrier to involving the ambulance service. It is free to Thai people. In the study area, the service is also committed to responding and conveying possible stroke victims to a tertiary hospital within the 4.5 hour 'window' for diagnosis and effective treatment of ischemic strokes. Furthermore, the ambulance staff advise the staff of the tertiary hospital of the impending arrival of potential stroke victim so that fast-track procedures for diagnosis and, if needed, the administration of a thrombolytic can be arranged in advance. In terms of future stroke awareness campaigns, further research is needed to determine the probable principle reasons for the apparently common lack of understanding that calling the medical emergency number is important. How far the advantages of calling an ambulance are known is a matter for future study: one potential barrier may well be a belief that emergency services are intended for 'more deserving cases' such as traffic accident victims. Notably in the present study, people in the lower socioeconomic occupational group were less likely to see calling the emergency number as the first response, and this raises the question about, for example, whether they thought that there was a cost associated with calling an ambulance and were worried about affording the fee. At a local level, further information about these sorts of issues is crucial for optimising the effectiveness of public information campaigns about stroke.

As far as we know, the present study is the only published general population survey of knowledge of about stroke in Thailand where stroke is a major public health issue and is likely to become even more serious because of the ageing population. However, the study has a number of limitations. Firstly, the stroke knowledge items were all close-ended questions required only a true/false response, and the absence of decoy items meant that a 'true' response was always correct. This allowed the data to be affected

by guessing and the possibility of response biases such as acquiescence bias, even though the interviewers were instructed to record a response as incorrect of the respondent indicated doubt. The end result was likely to be an overestimation of knowledge levels. Another potential weakness due to the use of only close-ended items was that the subjects' knowledge necessarily relied on recognition rather than recall which is unlikely to be optimally effective in 'real-life' circumstances involving, for example, the need to recall risk factors for stroke, and the inclusion of decoy items does not avoid this. On the other hand, recognition is the more importance process for recognizing warning signs since these vary from stroke victim to another and, as Miyamatsu et al. (2013)[20] observed, people cannot choose their stroke symptom when a stroke occurs. Thirdly, caution is needed in generalising the findings to other regions of Thailand, especially rural village communities. However, the majority of the present sample (which provided good coverage of the ages associated with high stroke incidence) were poorly educated, worked in agriculture and unskilled occupations and reported low monthly incomes.

Conclusions and Recommendations

Knowledge of stroke symptoms appeared high in the study area, but this needs to be confirmed in other Thai populations. Systems for identifying hypertension need to be improved and accompanied by more explicit information about the stroke risk. In the study area, there is a need for further research into the reasons for not immediately contacting the medical emergency service, and the benefits of calling the service should be a major focus of future information campaigns.

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References

1. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012; 380(9859): 2095-128.
2. Thrift AG, Cadilhac DA, Thayabaranathan T, Howard G, Howard VJ, Rothwell PM , et al. Global stroke statistics. Int J Stroke. 2014; 9: 6-18.
3. Suwanwela NC. Stroke Epidemiology in Thailand. J Stroke. 2014; 16(1): 1-7.
4. World Health Organization. The health-care challenges posed by population ageing. Bull World Health Organ. 2012; 90: 82-3.
5. National Heart Foundation of Australia. Heart, Stroke and Vascular Disease-Australian Facts 1999 Report. Canberra: Australian Institute of Health and Welfare, 1999.
6. Wu X, Zhu B, Fu L, Wang H, Zhou B, Zou S, et al. Prevalence, Incidence, and Mortality of Stroke in the Chinese Island Populations: A Systematic Review. PLoS One. [Online] 2013 Nov; 8(11): e78629. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3826735/pdf/

pone.0078629.pdf [Accessed 2014 April 20]

7. 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: 1146-49.
8. Evenson KR, Rosamond WD, Morris DL. Prehospital and in-hospital delays in acute stroke care. Neuroepidemiology. 2001; 20(2): 65-76.
9. Ingall TJ, O'Fallon WM, Asplund K, Goldfrank LR, Hertzberg VS, Louis TA, et al. Findings from the reanalysis of the NINDS tissue plasminogen activator for acute ischemic stroke treatment trial. Stroke. 2004; 35(10): 2418-24.
10. Moser DK, Kimble LP, Alberts MJ, Alonzo A, Croft JB, Dracup K, et al. Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association Council on cardiovascular nursing and stroke council. Circulation. 2006; 114: 168-182.
11. Lecouturier J, Murtagh MJ, Thomson RG, Ford GA, White M, Eccles M, et al. Response to symptoms of stroke in the UK: a systematic review. BMC Health Serv Res. 2010; 10: 157-165.
12. Quah JL, Yap S, Cheah SO, Ng YY, Goh ES, Doctor N, et al. Knowledge of signs and symptoms of heart attack and stroke among Singapore residents. Biomed Res Int. [Online] 2014 Apr; 2014: 572425. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4000924/pdf/BMRI2014-572425.pdf [Accessed 2014 August 22]
13. Limwattananon P, Sirichativapee W, Ruangpratyakul T, lukkhet P, Sasitorn Duangprom S, Sirataranon P, et al. Stroke Knowledge of OPD Patients in Srinagarind Hospital. Srinagarind Med J. 2013; 28: 185(abstr).
14. Muengtaweepongsa S, Hunghok W, Harnirattisai T. Poor recognition of prompted treatment seeking even with good knowledge of stroke warning signs contribute to delayed arrival of acute ischemic stroke patients in Thailand. J Stroke Cerebrovasc Dis. 2014; 23(5): 948-952.
15. Lwanga SK and Lemeshow S. Sample size estimation in health studies: a practical manual. Geneva: World Health Organization, 1991.
16. Becker KJ, Fruin MS, Gooding TD, Tirschwell DL, Love PJ, Mankowski TM. Community-Based Education Improves Stroke Knowledge. Cerebrovasc Dis 2001; 11: 34-43.
17. StataCorp LP. Stata Release 10: User's Guide. College Station TX: Stata Press, 2007.
18. Kissela BM, Khoury JC, Alwell K, Moomaw CJ, Woo D, Adeoye O, Flaherty ML, Khatri P, Ferioli S, De Los Rios La Rosa F, Broderick JP, Kleindorfer DO. Age at stroke: temporal trends in stroke incidence in a large, biracial population. Neurology. 2012; 79(17): 1781-7.
19. Ovbiagele B, Nguyen-Huynh MN. Stroke Epidemiology: Advancing Our Understanding of Disease Mechanism and Therapy. Neurotherapeutics, 2011, 8: 319–29.
20. 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: 241-9.
21. 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(4): 298-306.

22. Baldereschi M, Di Carlo A, Vaccaro C, Polizzi B, Inzitari D. Stroke knowledge in Italy. Neurol Sci. 2015; 36(3): 415-421.
23. Centers for Disease Control and Prevention (CDC). Awareness of stroke warning signs-17 states and the US Virgin Islands, 2001. Morbidity and Mortality Weekly Report. 2004; 53(17): 359-362.
24. Lundelin K, Graciani A, Garc´a-Puig J, Guallar-Castillón P, Taboada JM, Rodr´guez-Artalejo F, et al. Knowledge of stroke warning symptoms and intended action in response to stroke in Spain: a nationwide population-based study. Cerebrovasc Dis. 2012; 34(2): 161-8.
25. Zeng Y, He GP, Yi GH, Huang YJ, Zhang QH, He LL. Knowledge of stroke warning signs and risk factors among patients with previous stroke or TIA in China. J ClinNurs. 2012; 21: 2886-95.
26. Obembe AO, Olaogun MO, Bamikole AA, Komolafe MA, Odetunde MO. Awareness of risk factors and warning signs of stroke in a Nigeria university. J Stroke Cerebrovasc Dis. 2014; 23(4): 749-758.
27. Awad A, Al-Nafisi H. Public knowledge of cardiovascular disease and its risk factors in Kuwait: a cross-sectional survey. BMC Public Health. 2014; 14: 1131-41.
28. Milner A, Lewis WJ, Ellis C. Knowledge of stroke risk factors and early warning signs of stroke among students enrolled in allied health programs: a pilot study. J Allied Health. 2008; 37(4): e296-315.
29. 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.
30. Angell SY, De Cock KM, Frieden TR.A public health approach to global management of Hypertension. Lancet. 2015; 385: 825-7.
31. Nidhinandana S,Ratanakorn D,Charnnarong N, Muengtaweepongsa S, Towanabut S. Blood pressure control among stroke patients in Thailand—the i-STROKE study. J Stroke Cerebrovas Dis. 2014; 23(3): 476-483.
32. Chow CK, Teo KK, Rangarajan S, Islam S, Gupta R, Avezum A, et al. Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in high-, middle-, and low-income countries. JAMA. 2013; 310(9): 959-968.
33. Nordanstig A, Jood K, Rosengren L. Public stroke awareness and intent to call 112 in Sweden. Acta Neurol Scand. 2014; 130(6): 400-4.
34. Yang J, Zheng M, Cheng S, Ou S, Zhang J, Wang N, et al. Knowledge of Stroke Symptoms and Treatment among Community Residents in Western Urban China. J Stroke Cerebrovasc Dis. [Online]. 2014 May-Jun; 23(5): 1216-24. Available from: http://www.strokejournal.org/article/S1052-3057(13)00429-1/fulltext [Accessed 2014 April 20].
35. Yoon SS, 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: 1926-30.