



# DEVELOPMENT AND VALIDATION OF AN INSTRUMENT TO ASSESS GENERAL KNOWLEDGE OF STROKE

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## Abstract

Increasing knowledge and awareness of stroke is considered an important part in health educational programs for patients at high risk. Assessment of stroke knowledge requires an instrument with good content coverage and psychometric properties. The present study aims to construct a test to assess general knowledge of stroke among patients at high risk and to evaluate its psychometric properties. Four steps were employed to achieve the study objectives: perform formative research to develop and design test items; establish the content and face validity of test items; conduct a first pilot study to examine item characteristics in a cohort of 120 participants at risk for stroke; and reevaluate the final version of the test in another cohort of 60 participants. The final version of the test consisted of 14 items with acceptable reliability (Cronbach's coefficient alpha = 0.805) and good item characteristics. Thus, the developed instrument may provide a useful tool to identify knowledge gap and create educational programs for patients at high risk as well as to conduct future research related to stroke.

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**Keywords:** knowledge, stroke, test development, test validation

## Introduction

Stroke is a leading cause of death and disability worldwide. About 5.7 millions of deaths due to stroke occur annually (Strong et al. 2007). In Thailand, stroke was the first and third leading cause of death in females and males, respectively (Hanchaiphoolkul et al. 2011). A number of lifestyles and health conditions, such as hypertension, cigarette smoking, diabetes and obesity, are known to increase risk of stroke (Goldstein et al. 2011). Modification of these risk factors may successfully reduce stroke-related mortality and morbidity (Goldstein et al. 2011; Myint et al. 2009). Increasing knowledge and awareness of stroke is considered an important part in health educational programs for patients at high risk. To accomplish this, an instrument to assess general knowledge related to stroke is important in identifying knowledge gap and also determining the success of such educational programs. Therefore, the present study aims to develop a test to assess general knowledge of stroke among patients at high risk and to evaluate its psychometric properties.



## Methodology

### Generation of test items

A formative research was conducted to generate an initial list of test items. These included reviewing literature on stroke causes, signs and symptoms, risk factors and preventive strategies as well as conducting in-depth interviews with patients at high risk of stroke to determine commonly held beliefs about the disease. Initially, a 20-item test with the true-false format was generated based on information from literature review and patient interviews. The “I don't know” option was also included to improve the scale's reliability to reduce guessing associated with the true-false format. The items of the initial test addressed knowledge on causes, risk factors, symptoms, and preventive strategies of stroke. Thereafter, a panel of three health professional experts examined each item for its content validity. Item ratings provided by the panel members were used to calculate an index of item-objective congruence (IOC) for each item. The IOC score of more than 0.5 was considered to indicate good content validity. Panel members were also invited to comment on the wording of items and response format, and to suggest other items to be added to the test. Revisions were made to the test in accordance with suggestions from the experts. Further, face validity of the test items were also examined by administering the test to 10 patients to determine comprehension and wording of the contents.

### Examination of test item characteristics

To examine item characteristics, the 20-item test was administered to a cohort of 120 patients at high risk for stroke recruited from two tertiary-care hospitals in Phitsanulok Province. The question was scored as 1 if it was a correct response and 0 if it was incorrect. The “don't know” response was scored as incorrect. Each item was analyzed for its level of difficulty, discrimination index, alpha if item deleted and Cronbach's coefficient alpha of the whole test in order to select appropriate items. Lastly, further reevaluation of the test after the item revision was conducted in another cohort of 60 patients at high risk of stroke to determine final reliability and characteristics of the test items. All data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 16.

### Ethical issues

This study was approved by the Naresuan University Ethics Committees for Human Research. All patients provided written informed consent prior to the test administration. All data were kept in confidential with only JL and AJ having accessed to the data.

## Results

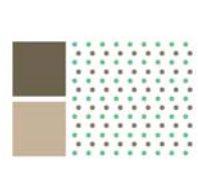
A literature review and patient interviews provided 20 potential items for the initial draft of the test instrument. These items addressed knowledge regarding stroke causes (3 items), symptoms (5 items), risk factors (8 items) and preventive strategies (4 items). Content validity of each item as judged by the expert panel was appropriate with the IOC index ranged from .67 to 1.00; thus, all 20 items were retained. To examine each item for its face validity, the test was administered to 10 patients with their comprehension and suggestion regarding the content and wordings recorded. This resulted in only slight modification of the wording, but no changes in the item content.

To determine psychometric properties of the test items, a cohort of 120 participants at high risk of stroke was recruited and administered the initial test. The test took 10-15 minutes to complete. Demographic characteristics of participants of the first cohort are shown in Table 1. Analysis of the initial test included a level of difficulty, a discrimination index, an alpha if item deleted of each test item and also an internal consistency for the whole test (Table 2). Results revealed that the 20-item test had moderate reliability with Cronbach's coefficient alpha of 0.632. After reviewing item characteristics, the decision was made to delete 6 items based on their difficulty levels (items 15 and 20), discrimination index (items 2, 8, 11, 13, 15 and 20) and increased internal consistency if an item was deleted (items 8, 11 and 20). However, none of the items demonstrated poor characteristics on all three of parameters examined. The decision was made to retain the items number 3, 14 and 18 although they demonstrated low levels of difficulty due to their significances in testing knowledge on causes, prevention and symptoms of stroke, respectively. Thus, the final instrument consisted of 14 items, including 2 items on causes, 4 items on symptoms, 6 items on risk factors and 2 items on preventive strategies of stroke; thus maintaining coverage on all areas of stroke knowledge addressed by the initial test.

**Table 1 Participants' demographic characteristics**

Characteristics	The first cohort (N = 120)	The second cohort (N = 60)
Gender		
Female (%)	56 (46.7)	21 (35.0)
Mean age $\pm$ SD [range] (years)	63.07 $\pm$ 7.792 [48-82]	64.15 $\pm$ 9.027 [46-82]
Marital status		
Single	1 (0.8)	2 (3.3)
Married	82 (68.3)	47 (78.3)
Divorce/ separated	37 (30.9)	11 (18.3)
Highest formal education		
No formal education	4 (3.3)	5 (8.3)
Primary school	72 (60.0)	30 (50.0)
Secondary school	22 (18.4)	2 (21.7)
Bachelor degree or above	22 (18.3)	12 (20.0)
Personal history of diseases*		
Hypertension	108 (90)	57 (95.0)
Diabetes	78 (65.0)	41 (68.3)
Heart disease	50 (41.7)	17 (28.3)
Dyslipidemia	104 (86.7)	51 (85.0)
Atrial fibrillation	1 (0.8)	1 (1.7)
Others	14 (11.6)	9 (15.0)
Current smoker		
Yes	14 (11.7)	3 (5.0)
Current alcohol drinker		
Yes	5 (4.2)	6 (10.0)

\* One participant may have more than one personal history of diseases.



The final 14-item test was further reevaluated in another cohort of 60 participants considered at high risk of stroke to determine its final reliability and item characteristics. Demographic characteristics of participants in the second cohort are shown in Table 1. Analysis of the 14-item test demonstrated acceptable reliability (Cronbach's coefficient alpha = 0.805) with good item characteristics as shown in Table 3.

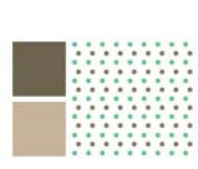
## Discussion and Conclusion

Previous studies have assessed knowledge of stroke by identifying stroke risk factors or stroke symptoms from the check-list, or by patients' recall (Al Shafae et al. 2006; Gongora-Rivera et al. 2005; Neau et al. 2009; Yoon et al. 2001). However, individuals need not only be able to identify their risk factors or stroke symptoms, but also to understand them in the context of overall stroke knowledge. Thus, the purpose of this study is to develop a psychometrically reliable and valid test, covering all aspects of stroke knowledge, which could be used to reflect more general knowledge in future studies. The final version of the test includes 14 items that cover the major dimensions of stroke knowledge, including causes, symptoms, risk factors and preventive strategies. These knowledge areas have been proposed as necessary in creating educational programs for patients at high risk but with low risk perception as reported by previous studies (Nicol and Thrift 2005; Yoon et al. 2001).

An interesting finding from Table 2 and 3 includes the misunderstanding of participants that taking energy drinks decrease risk of stroke. About half of participants gave wrong answers on this specific item. This finding was discovered initially during the in-depth interview of the item generation phase and further confirmed in both initial and final validation studies. The significance of this finding may be twofold. First, patients at high risk may choose energy drinks as preventive strategies to decrease risk of stroke, leading to overconsumption of sugar and salt provided in most of the energy drinks. Second, a misconception that energy drinks provide a boost of energy and reduction of stroke symptoms may hinder patients from seeking appropriate care when needed. Thus, an educational program should be also addressing this issue to correct any inappropriate behaviors leading to health problems among this patient group.

The psychometric properties of each instrument item are considered very important in measurement of the construct of interest. Reckase suggested that in selecting items for test construction, the difficulty level of an item should be close to 0.5 (Rackase 1996). In general, a difficulty level of 0.1-0.9 was considered acceptable. From Table 3, the levels of difficulty of test items in the final instrument ranged from 0.47 to 0.88, thus all 14 items possess optimal levels of difficulty. Only the difficulty levels of items 2 and 13 were close to 0.9; however, both item were considered necessary to address the content assessed by this test and should be retained for future studies.

The item discrimination index was considered appropriate when the index was more than 0.3 (Rackase 1996). Only item number 6 in the final instrument demonstrated discrimination index of lower than 0.3 and also higher alpha if item was deleted. Thus, in further refinement of the test in the future, this item could be deleted to increase reliability of the whole test. However, overall the final 14-item test demonstrated good reliability (coefficient alpha = 0.805) and item characteristics.



Some limitation of the present study merits discussion. First, the instrument was only validated in patients at high risk of stroke. Whether the test will demonstrate similarly psychometric properties when administered to different groups of subjects remains uncertain and needs further validation. Second, although the instrument demonstrated good reliability and was evaluated for face and content validity, assessment of its construct and criterion-related validity is still needed to further provide evidence of the instrument utility.

In conclusion, a test to measure general knowledge of stroke was successfully developed in the present study. The developed instrument demonstrated good reliability and item characteristics. The instrument may provide a useful tool to identify knowledge gap and create educational programs for patients at high risk as well as to conduct future research related to stroke. Future research may involve investigation of construct and criterion-related validity of the instrument.

**Table 2. Analysis of the item characteristics on the initial test**

Questions	Mean #	Corrected Item-Total Correlation <sup>##</sup>	Alpha if item deleted	Decision to retain or discard an item
<b>Cronbach's coefficient alpha = 0.632</b>				
1. Stroke is caused by narrowing of blood vessels in the brain.	0.79	0.349	0.604	Retained
2. Stroke is caused by vitamin deficiency.	0.28	0.182	0.625	Discarded
3. The rupture of blood vessel in the brain causes stroke.	0.93	0.324	0.613	Retained
4. Patients with the disease caused by narrowing of coronary blood vessels are at increased risk of getting a stroke.	0.72	0.376	0.598	Retained
5. Diabetes increases risk of getting a stroke.	0.63	0.259	0.615	Retained
6. Smoking increases risk of getting a stroke.	0.60	0.441	0.586	Retained
7. Lean persons have a higher chance of getting a stroke than overweight persons.*	0.53	0.293	0.609	Retained
8. Stroke can be caused by heredity.	0.48	0.032	0.648	Discarded
9. Walk unsteadily is one of the stroke symptoms.	0.66	0.355	0.600	Retained
10. Stroke may cause temporary loss of vision.	0.51	0.351	0.600	Retained
11. Stroke can causes deafness*	0.34	0.097	0.638	Discarded
12. Stroke causes severe headache	0.57	0.201	0.623	Retained
13. Exercise regularly prevent stroke	0.98	0.066	0.632	Discarded
14. Keeping blood pressure under control decreases risk of having a stroke	0.94	0.323	0.615	Retained
15. Drinking plenty of water prevent stroke*	0.13	0.019	0.640	Discarded
16. Eating high fat meal increases risk of having a stroke	0.89	0.270	0.616	Retained
17. Excess alcohol intake increases risk of having a stroke	0.87	0.367	0.605	Retained
18. Weakness of the arm or leg could be a first sign of stroke	0.94	0.144	0.628	Retained
19. Energy drinks decrease risk of stroke*	0.56	0.152	0.631	Retained
20. Stroke can cause respiratory discomfort*	0.13	-0.093	0.651	Discarded

\* refers to the questions which are false; # indicates item level of difficulty; ## indicates item discrimination index

**Table 3. Psychometric properties of the finalized 14 test-items**

Questions	Mean #	Corrected Item-Total Correlation ##	Alpha if item deleted
<b>Cronbach's coefficient alpha = 0.805</b>			
1. Stroke is caused by narrowing of blood vessels in the brain	0.77	0.454	0.791
2. The rupture of blood vessel in the brain causes stroke	0.87	0.520	0.789
3. Patients with the disease caused by narrowing of coronary blood vessels are at increased risk of getting a stroke	0.77	0.440	0.792
4. Diabetes increases risk of getting a stroke	0.58	0.385	0.797
5. Smoking increases risk of getting a stroke	0.57	0.515	0.786
6. Lean persons have a higher chance of getting a stroke than overweight persons*	0.53	0.191	0.814
7. Walk unsteadily is one of the stroke symptoms	0.58	0.432	0.793
8. Stroke may cause temporary loss of vision	0.53	0.543	0.783
9. Stroke causes severe headache	0.48	0.415	0.795
10. Keeping blood pressure under control decreases risk of having a stroke	0.83	0.541	0.786
11. Eating high fat meal increases risk of having a stroke	0.83	0.511	0.788
12. Excess alcohol intake increases risk of having a stroke	0.70	0.466	0.790
13. Weakness of the arm or leg could be a first sign of stroke	0.88	0.317	0.801
14. Energy drinks decrease risk of stroke*	0.47	0.352	0.800

\* refers to the questions which are false; # indicates item level of difficulty; ## indicates item discrimination index.

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