

The Diagnostic Accuracy Study of Epilepsy Screening Test and Prevalence of Adult Epilepsy

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Objective: To validate the Srithanya screening test for epilepsy (SST) in the community setting and to study the point prevalence of active epilepsy in adult.

Material and Method: The cross-sectional study was done in the Klong Pra-u-dom Sub-district in the central part of Thailand. Three-step-approach was designed. The first step was a door-to-door surveyed by 15 community health volunteers (CHVs). People that were 15 years and older were interviewed using the SST and the Anand questionnaires. Secondly, possible cases were interviewed by the sub-head nurse of the health promoting hospital using the second questionnaire. Finally, suspected cases were examined neurologically. Sensitivity and specificity of the SST and the Anand's questionnaires were analyzed by receiving operating characteristic curve (ROC).

Results: Two thousand eighty one cases were interviewed by CHVs and 166 possible cases of epilepsy were identified. Of these, there were eight suspected cases, and five confirmed cases as true epilepsy. The point prevalence of active epilepsy was 2.4: 1,000. For the short form of SST, a cut-off score of 4 was selected, sensitivity was 100 (48 to 100), and specificity was 99.9 (99.6 to 100).

Conclusion: The short form of Srithanya screening test for epilepsy was validated in the community setting. This questionnaire was easy for health volunteers to screen people with suspected epilepsy after a half day training program. The point prevalence of active epilepsy was 2.4 per 1,000.

Keywords: Community, Epilepsy, Prevalence, Screening

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Epidemiology studies of epilepsy have been conducted in Asia providing different prevalence rates according to methods and definition⁽¹⁾. For population based epidemiological study of epilepsy, the operational definition of epilepsy proposed by Thurman et al (i.e.: "two or more unprovoked seizures occurring at least 24 hours apart") is still recommended⁽²⁾, though the definition of epilepsy has been recently reviewed by the International League Against Epilepsy (ILAE)⁽³⁾.

Epidemiology surveys of epilepsy in Thailand were carried out at local or hospital based^(4,5). Asawavichienjinda et al approach was by clinical assessment, but they did not use a screening questionnaire⁽⁴⁾. There was a rapid national survey by the Department of Mental Health in 1999, using a 26-item questionnaire and yielded a lifetime prevalence of epilepsy at 0.7%⁽⁶⁾. However, the study had been criticized on the study design, the invalid screening

tool, and the definition term of epilepsy.

The screening questionnaires in community surveys for epilepsy were validated in clinical settings and contained less than 10 items⁽⁷⁻¹⁰⁾. The 10-item Srithanya screening test was developed in 1994 and then, two short versions had been proposed and validated since 2012⁽¹¹⁾. However, the questionnaire has never been implemented in a community settings. The objectives of the present study were to validate the Srithanya screening test (SST) for epilepsy in the community setting and to survey an active epilepsy in a suburban area of the central region of Thailand, that the questionnaire may be beneficial for further epilepsy treatment gap study.

Material and Method

The cross-sectional study was carried out between April and September 2013 and had been approved by the Ethical Committee of Srithanya Hospital.

Study population

Klong Pra U-Dom Sub-district located in Pak

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Kred District, Nonthaburi Province was selected. It is located about 10 kilometers from Srithanya Hospital. This community had been chosen because of the successful collaboration between the Social Worker Department of Srithanya Hospital and the Health Promoting Hospital (HPH) resulting in the community receiving the best award of community rehabilitation care for psychiatric cases in 2011. Eligible cases were Thai native, speaking, and no migrants. Mentally ill cases were informed by family care givers. All were informed that the questionnaire was asking about epilepsy. People 15 years or older were enrolled into the present study.

This sub-district contained six villages. From the household registration data, the population was 6,299 persons. There were 5,294 people ages 15 years and older, classified into 2,558 males and 2,736 females. Of these, 850 (398 males and 452 females) persons had migrated to other areas without updating their registration.

Instruments

The South-East Asia Regional Office of WHO recommended member countries to use the questionnaire developed by Anand et al⁽¹²⁾. However, this questionnaire has never been tested in the community setting in Thailand. After content review, Anand's questionnaire contained six items, three items were similar to those of SST. The item-2 was separated into item-4 and item-5 as those of SST, therefore, total items of Anand's questionnaire in this study were seven. The 13 item-questionnaire consisting of SST and Anand's questionnaire was a screening instrument in the community by CHVs trained for data collection (see Appendix 1).

From clinical data, at the cut-off score two, the sensitivity (and specificity) of the short version (five items), expert version (six items), and full version (ten items) of SST were 92.7 (90.7), 92.7 (90.7), and 98.2% (84.8%) respectively⁽¹¹⁾. The sensitivity (specificity) of the cut score at and above 3 of those of Anand's questionnaire was 84.5% (87.0%)⁽¹²⁾.

Methods

Fifteen community health volunteers (CHVs) and the sub-head nurse of the health promoting hospital (HPH) were invited to a half day workshop held in April 2013 to learn how to use the screening questionnaire properly before data collection.

A three-stage design was used to identify person with epilepsy. First, door-to-door survey by

CHVs using the 13-item questionnaire to interview people ages 15 years and older between June and July 2013. Anyone who had one positive answer was considered a possible case and was further interviewed with the second questionnaire containing details of associated symptoms (i.e.: febrile seizure, alcohol withdrawal seizure, date of last attack, history of: diabetes mellitus, head injury, and epilepsy treatment) and general health assessment by the sub-head nurse of the HPH in August 2013. Then, the suspected cases, the known cases, and 10% of negative cases of epilepsy were randomly selected for further interview and neurological examination by a researcher in September and October 2013.

An active epilepsy was defined as two or more seizures during the preceding two years. People taking anti-epileptic drugs without any seizure during the preceding two years were considered as non-active epileptic cases.

Statistical analysis

The sensitivity and specificity of three versions of SST and those of Anand's questionnaire were analyzed by MedCalc freeware, which is available at http://www.medcalc.org/calc/diagnostic_test.php. The point prevalence was calculated. The optimal cut-off point by receiving operating characteristic curve (ROC) was calculated to compare area under curve (AUC) of each scale.

Results

Apart from 850 migrated persons, 43.1% of the residents were absent during the survey. Of these, there were 245 students and 1,670 factory workers. In addition, 10.3% (456 persons), classified into 219 males & 237 females, refused to be interviewed. Hence, the target population surveyed was at 46.8%. Two thousand eighty one completed questionnaires were collected by CHVs, classified into 963 males age between 15 and 90 years, and 1,114 females age between 15 and 96 years, (Fig. 1). An average age was 44.8±17.0 years. The ratios of age and gender of target population were comparable to those of the sub-district population (Table 1).

Door-to-door survey (Flow chart)

There were 166 cases (8.0%) considered possible cases having at least one positive score from the screening questionnaire. Of these, there were 61 males and 105 females, distributed to each village as shown in Table 2.

Suspected cases

One hundred sixty six possible cases were further interviewed for more details of epilepsy and general health condition by the sub-head nurse. Of these, 98 cases, age above 50 years had a history of fainting, and 80 of 98 cases were living in the village-5 (Table 2). Ten cases had diagnosis of diabetes mellitus and two had febrile seizures at childhood. The others (48 cases) did not have epilepsy according to the definition of epilepsy.

Among eight suspected cases, there were five known cases of epilepsy at age between 41 to 84 years and three were male. All were diagnosed as generalized seizure and accepted neurological assessment. The other three cases, one was schizophrenia and the others had history of epilepsy treatment but not an active epilepsy. Another 15 negative cases from possible cases (158 cases) were randomly selected for interview and neurological examination. All were confirmed as true negative cases. The positive rates among males

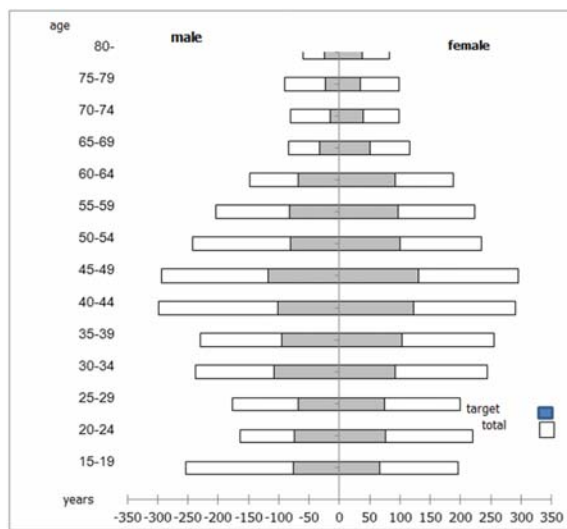


Fig. 1 Population distribution by 5-year age and gender (n = 5,294).

Table 1. Population by age range and gender (n = 5,294)

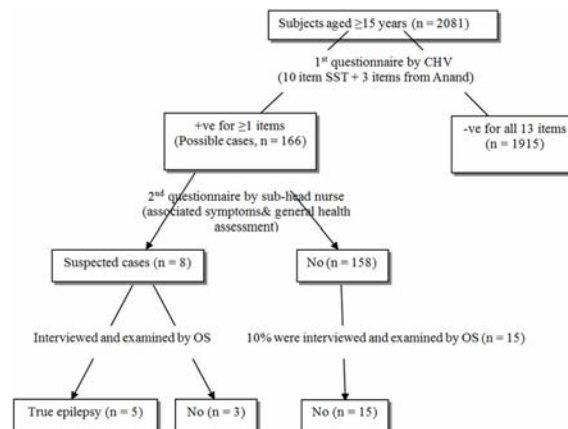
Age (years)	Male (n, %)		Female (n, %)	
	Population	Target	Population	Target
15 to 59	2,097 (39.6)	800 (38.4)	2,162 (40.8)	864 (41.5)
60 to 79	401 (7.6)	138 (6.6)	491 (9.3)	218 (10.5)
>80	60 (1.1)	25 (1.2)	83 (1.6)	36 (1.7)
Total	2,558 (48.3)	963 (46.2)	2,736 (51.7)	1,118 (53.7)

and females were 3.1 and 1.8: 1,000 respectively, and overall rate at 2.4: 1,000. The age-specific prevalence of 40 to 59 years for male, and female was 2.5 and 1.2: 1,000 respectively. For ages 60 years and above, the prevalence of epilepsy was 1.2: 1,000.

The cut-off scores of three versions of SST were listed in Table 3. The area under curve (AUC) of the short, expert, and full version of SST, and that of Anand's questionnaire were 0.94, 0.88, 0.83, and 0.79 respectively, (Fig. 2).

Discussion

The surveyed population had a low prevalence rate of epilepsy. This might be explained by people have more individual life style than those in rural area, and for their security reason, they would not open the door when a stranger knocked. The present study depended on relationship among the community health volunteers (CHVs) and the villagers. Nearly half of them did not attend the HPH, and refused to answer the questionnaires. Therefore, the prevalence may be underestimated. However, the ratios of age and gender of the surveyed population were comparable to those of the population. This figure could represent the



Flowchart. Procedures and results of the prevalence survey.

Table 2. Positive response of each item classified by villages (possible = 166 case)

Item	Village: number (%)					
	1 (n = 662)	2 (n = 314)	3 (n = 131)	4 (n = 227)	5 (n = 415)	6 (n = 332)
1	18 (2.7)	3 (1.0)	3 (2.3)	29 (12.8)	90 (21.7)	23 (6.9)
2	17 (2.6)	3 (1.0)	1 (0.8)	16 (7.0)	70 (16.9)	14 (4.2)
3	0	1 (0.3)	0	4 (1.8)	9 (2.2)	1 (0.3)
4	0	0	0	3 (1.3)	17 (4.1)	1 (0.3)
5	3 (0.4)	2 (0.1)	0	8 (3.5)	41 (9.9)	4 (1.2)
6	0	0	0	2 (0.9)	3 (0.7)	0
7	5 (0.8)	2 (0.1)	1 (0.8)	9 (4.0)	54 (13.0)	15 (4.5)
8	13 (2.0)	3 (1.0)	2 (1.5)	15 (6.6)	80 (19.2)	13 (3.9)
9	0	1 (0.3)	0	5 (2.2)	7 (1.7)	2 (0.6)
10	1 (0.2)	1 (0.3)	1 (0.8)	6 (2.6)	9 (2.2)	3 (0.9)
11	0	0	0	1 (0.4)	3 (0.7)	1 (0.3)
12	0	0	0	3 (1.3)	6 (1.4)	1 (0.3)
13	0	0	0	2 (0.9)	3 (0.7)	0
possible	18	3	3	29	90	23
%	10.8	1.8	1.8	17.5	54.2	13.8

Table 3. Cut-off scores of 3 version of Srithanya screening scale

Item	Cut-off score	True+	False+	Sensitivity (95% CI)	Specificity 95% CI	Positive predictive	Negative predictive
SST							
-Total	1	5	161	100 (48.0,100)	92.2 (91.0,93.3)	3.0 (1.0,6.9)	100 (99.8,100)
(10 items)	2	5	149	100 (48.0,100)	92.8 (91.6,93.9)	3.2 (1.7,7.4)	100 (99.8,100)
1-9,13	3	5	124	100 (48.0,100)	94.0 (92.9,95.0)	3.9 (1.3,8.8)	100 (99.8,100)
	4	5	88	100 (48.0,100)	95.8 (94.8,96.6)	5.4 (1.8,12.1)	100 (99.8,100)
	5	4	46	80 (28.8,96.7)	97.8 (97.1,98.4)	8.0 (2.3,19.2)	100 (99.7,100)
-Short	1	5	161	100 (48.0,100)	92.2 (91.0,93.3)	3.0 (1.0,6.9)	100 (99.8,100)
1,2,6,8,13	2	5	140	100 (48.0,100)	93.2 (92.1,94.3)	3.4 (1.1,7.9)	100 (99.8,100)
	3	5	98	100 (48.0,100)	95.3 (94.3,96.1)	4.9 (1.6,11.2)	100 (99.8,100)
	4	5	2	100 (48.0,100)	99.9 (99.6,100)	71.4 (29.3,95.5)	100 (99.8,100)
	5	3	0	60 (15.4,93.5)	100 (99.8,100)	100 (30.5,100)	99.9 (99.6,100)
-Expert	1	5	161	100 (48.0,100)	92.2 (91.0,93.3)	3.0 (1.0,6.9)	100 (99.8,100)
1,2,5,6,8,13	2	5	143	100 (48.0,100)	93.1 (91.9,94.2)	3.4 (1.1,7.7)	100 (99.8,100)
	3	5	106	100 (48.0,100)	94.9 (93.8,95.8)	4.5 (1.5,10.2)	100 (99.8,100)
	4	5	44	100 (48.0,100)	97.9 (97.2,98.4)	10.2 (3.4,22.2)	100 (99.8,100)
	5	4	1	80 (28.1,96.7)	99.9 (99.7,100)	80.0 (28.1,96.7)	100 (99.7,100)
Anand et al ^(1,4-6,10-12)	1	5	160	100 (48.0,100)	92.3 (91.0,93.4)	3.0 (1.0,6.9)	100 (99.8,100)
	2	3	73	60 (15.4,93.5)	96.5 (95.6,97.2)	4.0 (0.9,11.1)	100 (99.8,100)
	3	3	25	60 (15.4,93.5)	98.8 (98.2,99.2)	10.7 (2.4,28.2)	99.0 (99.7,100)
	4	3	4	60 (15.4,93.5)	99.8 (99.5,100)	42.9 (10.4,81.2)	99.0 (99.7,100)
	5	3	1	60 (15.4,93.5)	100 (99.7,100)	75.0 (20.3,95.9)	100 (99.7,100)

prevalence rate of this community. Comparing the national household census surveys in 2010⁽¹³⁾, the ratios of people aged 15 to 59, 60 to 79, and 80 years

and older, were 84, 13.9, and 2.0% respectively. Therefore, the age distribution in the present study and the community did not differ from those of the

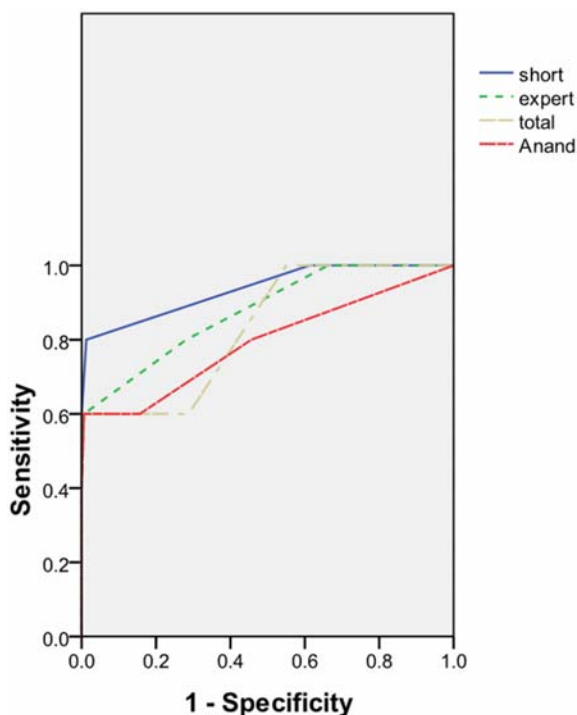


Fig. 2 ROC curves of 3 versions of Srithanya screening test and Anand's questionnaire.

country.

The first step, door- to- door screening using the questionnaire, was administered by CMHs. They had been trained during a half-day workshop to ensure that they clearly understood and strictly followed the questionnaire. Basically, they had been assigned to collect other personal health data such as hypertension, tobacco used, and vaccination, etc. The positive rate (8%) of possible cases in the first step by CMHs was comparable to that of Tran et al in the rural area of Lao (6.4%)⁽⁹⁾. This might be explained by the similar item concerning major symptom of epilepsy, which is 'loss of consciousness'.

The point prevalence of active epilepsy in this community was comparable to those of Hong Kong⁽¹⁴⁾ (1.5: 1,000 of people ages 15 years or older) and west of China (females 1.7: 1,000)⁽¹⁵⁾, which also used the door-to-door survey. However, it was lower than that of the rural area of Thailand (7.2: 1,000) and that of Laos (7.7: 1,000)^(4,9), which were the lifetime prevalence and included children population. The ratio of epilepsy case was higher in males than females in concordance with west China⁽¹⁵⁾. The prevalence in males was high in Asian countries such as China, India, and Turkey, etc., but the absolute difference in gender was

minimal⁽¹⁶⁾. For age-specific prevalence, the present study did not show that the prevalence of epilepsy increased with age^(4,17). False positive rate was high among people ages above 50 years. Therefore, the diagnostic of epilepsy should be done with the completed clinical assessments.

The Srithanya screening test for epilepsy used by CHVs revealed that item-6 yielded the highest accuracy. The short version, comparing with other versions of SST and Anand's questionnaire, yielded the highest accuracy by area under curve (AUC). At the cut-off score 2, the false positive rate was found in syncope. Therefore, a higher cut-off score such as 4 would be more appropriate in a community setting. Comparing with Anand et al's report, at the cut-off score 3, it yielded a lower sensitivity that might be explained by the item response as shown in Table 2. Originally, Anand's questionnaire was aimed to assess generalized tonic clonic seizures but the SST included other type of epilepsy⁽¹¹⁾. However, there were only a few cases of epilepsy in this community. For the community survey, users should be aware that there is a trade-off between sensitivity and specificity. People with ageing or diabetes mellitus or hypertension should be reconfirmed by the other specific questionnaire. The short version of SST would be beneficial to further study in the prevalence and treatment gap of epilepsy in Thailand.

Conclusion

At the cut-off score 4, the SST had high sensitivity and specificity in a suburb area setting. This questionnaire was easy for health volunteers to screen people with suspected epilepsy in a community setting with a half-day training program. The point prevalence of active epilepsy in Klong Pra-u-dom Sub district area was 2.4 per 1,000.

What is already known on this topic?

Epidemiology studies of epilepsy have been conducted in Asia providing different prevalence rates according to methods and definition. The Srithanya screening test had been validated in 2012 at clinical based.

What this study adds?

The Srithanya screening test used by community health workers was validated at the community level and yielded the prevalence of active epilepsy at 2.4: 1,000 in people ages 15 years and older in suburb area of the central part of Thailand.

Limitation

This study has limitation because of the low response rate and the few cases of epilepsy identified in the community. The setting is specialized to suburb area of Nonthaburi, which may not represent the national data.

Acknowledgements

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Potential conflicts of interest

None.

References

1. Mac TL, Tran DS, Quet F, Odermatt P, Preux PM, Tan CT. Epidemiology, aetiology, and clinical management of epilepsy in Asia: a systematic review. *Lancet Neurol* 2007; 6: 533-43.
2. Thurman DJ, Beghi E, Begley CE, Berg AT, Buchhalter JR, Ding D, et al. Standards for epidemiologic studies and surveillance of epilepsy. *Epilepsia* 2011; 52 (Suppl 7): 2-26.
3. Fisher RS, Acevedo C, Arzimanoglou A, Bogacz A, Cross JH, Elger CE, et al. ILAE official report: a practical clinical definition of epilepsy. *Epilepsia* 2014; 55: 475-82.
4. Asawavichienjinda T, Sitthi-Amorn C, Tanyanont W. Prevalence of epilepsy in rural Thailand: a population-based study. *J Med Assoc Thai* 2002; 85: 1066-73.
5. Kasemtrup K. The 10 years retrospective study of epilepsy in adults of Institute of Neurology. *Bull Dep Med Serv* 2002; 23: 172-82.
6. Bunditchate A, Saosarn P, Kitiruksanon P, Chutha W. Epidemiology of mental disorders among Thai people. *J Psychiat Assoc Thai* 2001; 46: 335-43.
7. Chen CC, Chen TF, Hwang YC, Wen YR, Chiu YH, Wu CY, et al. Population-based survey on prevalence of adult patients with epilepsy in Taiwan (Keelung community-based integrated screening No. 12). *Epilepsy Res* 2006; 72: 67-74.
8. Placencia M, Sander JW, Shorvon SD, Ellison RH, Cascante SM. Validation of a screening questionnaire for the detection of epileptic seizures in epidemiological studies. *Brain* 1992; 115 (Pt 3): 783-94.
9. Tran DS, Odermatt P, Le TO, Huc P, Druet-Cabanac M, Barennes H, et al. Prevalence of epilepsy in a rural district of central Lao PDR. *Neuroepidemiology* 2006; 26: 199-206.
10. Wang WZ, Wu JZ, Wang DS, Dai XY, Yang B, Wang TP, et al. The prevalence and treatment gap in epilepsy in China: an ILAE/IBE/WHO study. *Neurology* 2003; 60: 1544-5.
11. Silpakit, O. Srithanya screening test for epilepsy: a short version. *Siriraj Med J* 2012; 64: 149-52.
12. Anand K, Jain S, Paul E, Srivastava A, Sahariah SA, Kapoor SK. Development of a validated clinical case definition of generalized tonic-clonic seizures for use by community-based health care providers. *Epilepsia* 2005; 46: 743-50.
13. National Statistical Office, Thailand. Table 2 Population by single year of age, sex and area [Internet]. 2010 [cited 2015 May 12]. Available from: http://popcensus.nso.go.th/table_stat.php?yr=2553
14. Fong GC, Mak W, Cheng TS, Chan KH, Fong JK, Ho SL. A prevalence study of epilepsy in Hong Kong. *Hong Kong Med J* 2003; 9: 252-7.
15. Hu J, Si Y, Zhou D, Mu J, Li J, Liu L, et al. Prevalence and treatment gap of active convulsive epilepsy: a large community-based survey in rural West China. *Seizure* 2014; 23: 333-7.
16. Shakir S, Ali N, Khan A, Nabi M. The prevalence, incidence, and etiology of epilepsy. *Int J Clin Exp Neurol* 2014; 2: 29-39.
17. Neligan A, Hauser WA, Sander JW. The epidemiology of the epilepsies. In: Stefan H, Theodore WH, editors. *Epilepsy, Part I: Basic principles and diagnosis*. Amsterdam: Elsevier; 2012: 113-34.

ความตรงของแบบคัดกรองโรคลมชักและความชุกของโรคลมชักในผู้ใหญ่

อรวรรณ ศิลปกิจ

วัตถุประสงค์: เพื่อศึกษาแบบคัดกรองโรคลมชักศรัทธูญาและความชุกโรคลมชักในผู้ใหญ่ในชุมชน

วัสดุและวิธีการ: เป็นการศึกษา 3 ขั้นตอน ขั้นตอนแรกอาสาสมัครสาธารณสุข (อสม.) จำนวน 15 คนสำรวจรายบ้านและสัมภาษณ์กลุ่มตัวอย่างอายุ 15 ปีขึ้นไปด้วยแบบสอบถามประยุกต์จากแบบคัดกรองโรคลมชักศรัทธูญาและของอนันต์และคณะ ในขั้นตอนที่ 2 ผู้ที่อาจจะเป็นโรคลมชักจะได้รับการซักถามเพิ่มเติมด้วยพยาบาล และจากนั้นผู้สงสัยว่าเป็นโรคลมชักได้รับการสัมภาษณ์และตรวจระบบประสาทวิเคราะห์ค่าความไวและความจำเพาะของ SST และของอนันต์ด้วย receiving operating characteristic curve (ROC)

ผลการศึกษา: อสม. สัมภาษณ์กลุ่มตัวอย่างจำนวน 2,081 ราย และมีผู้จะเป็นโรคลมชัก 166 ราย ในจำนวนนี้มีผู้สงสัยว่าเป็น 8 ราย และยืนยันว่าเป็นโรคลมชักจริง 5 ราย แบบ SST ที่จุดตัดคะแนน 4, มีความไวและความจำเพาะดังนี้ 100 (48 ถึง 100), 99.9 (99.6 ถึง 100)

สรุป: แบบคัดกรองโรคลมชักศรัทธูญาฉบับนี้มีความตรงในระดับชุมชนได้ง่ายโดย อสม. ที่ผ่านการอบรมครั้งวัน ความชุกของโรคลมชักระยะมีอาการอัตรา 2.4 ต่อพันประชากร
