

The IQCODE : An Alternative Screening Test for Dementia for Low Educated Thai Elderly†

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Abstract

Objective : To explore an alternative method of screening for dementia in Thai elderly people who have a low educational level. The Informant Questionnaire on Cognitive Decline in the elderly (IQCODE) is used as the screening test.

Material and Method : A community based population of elderly subjects in Bangkok including 87 normal subjects and 73 demented elderly people were studied. Their ages ranged from 52 to 85 years old. The majority of the elderly people had had four years or less of primary-education. Dementia was diagnosed independently by DSM IV criteria. A short form of the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE), a short form, was administered to informants of the elderly by trained medical personnel. The Thai Mini Mental State Examination (TMSE) was also administered to these subjects and compared with the IQCODE. SPSS 9.0 was used for statistical analysis.

Results : The IQCODE showed a negative correlation with the TMSE ($n=160$, $r=-0.679$, $p<0.001$). The area under the receiver operating characteristic curve (ROC) of the IQCODE was larger than that of TMSE (0.928 vs 0.814). On logistic regression analysis, there were only three questions that contributed to the diagnosis that showed statistical significance. These questions are remembering what day and month it is, learning how to use a new gadget and handling other everyday arithmetic problems. Applying the new formula (z-score), these three questions showed a sensitivity of 84.90 per cent, and a specificity of 92 per cent for the diagnosis of dementia.

Conclusion : Informants' perceptions of cognitive impairment of the elderly can be reliably applied as a screening instrument for dementia in the Thai population with a variety of educational levels. A short form of the IQCODE using selected questions can be administered with good diagnostic sensitivity and specificity.

Key word : IQCODE, Screening Test for Dementia, Low Educated Thai Elderly

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Screening for dementia is important both clinically and epidemiologically. The main objective of screening is for secondary prevention of illness and incidents or for community surveillance of the disease. Dementia patients are at risk of falls, delirium, adverse drug reactions, and inability to perform self-care. The cost-effectiveness of the screening tool should be considered against the cost of caring for the co-morbidity. Screening a community to detect unrecognized demented individuals helps the community plan and provide services. Screening tests have floor and ceiling effects. A highly specific test will detect the severe cases and will miss the mild cases. A cognitive screening test has potential confounders⁽¹⁾ such as age, gender, education⁽²⁾, and culture. A brief mental state test, which is a global cognitive measure, can be administered in a busy geriatric clinic, on the ward or as a cross-sectional survey. Validation and norms for a particular population study need to be considered before application. Other methods for screening for dementia are measurements of functional disability and the informant's perceptions of cognitive impairment or decline. The former can be ascertained by observation of patient performance or by questioning the caregivers about the elderly person's daily functional ability. Instrumental activities of daily living (ADLs) are more useful as cognitive measures than basic ADLs. They are more related to cognitive function than to physical disability and tend to be impaired early in the course of dementia. The latter requires a caregiver or relatives who have known the elderly person long enough and well enough to recognize their impairment. This method of screening can overcome the need for the detection of dementia despite the possibilities of delirium or depression.

The IQCODE⁽³⁾ is a screening test for dementia which measures the informant's perception of the elderly person's cognitive decline (not just impairment). It requires informants who have known the elderly person for more than 10 years. The IQCODE has been applied in Australia, England⁽⁴⁾ and Taiwan⁽⁵⁾ with good results.

The Thai Mental State Examination (TMSE)⁽⁶⁾ is a global cognitive screening for dementia, which is widely used in Thailand. It consists of a brief assessment of orientation, registration, attention, calculation, language and recall. The total score is 30, whereas one who scores less than 24 is suspected of having dementia.

Objectives

We aimed to explore the informant's perception of cognitive impairment by using the IQCODE-short form⁽⁷⁾ as a screening tool for dementia in the Thai elderly who have a low educational level. The other purpose was to compare the overall performance of the IQCODE with the TMSE in a Thai population.

MATERIAL AND METHOD

Subjects

A community based population of elderly subjects who lived in the vicinity of Siriraj Hospital, Bangkok. These included 87 normal subjects, 73 demented elderly people, aged over 50 years. All these elderly people had relatives or long-term care givers who could give information about the elderly person's performance and their cognitive perception over the preceeding 10 years and at the present time.

Data Collection and Instruments

The Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE)^(3,7) The short form of the IQCODE consists of 10 items. It assesses the caregivers's perception of the cognitive decline of the elderly person. Caregivers are required to compare the elderly person's performance today with their performance 10 years previously. In this population study, the caregivers were relatives or long-term paid caregivers or neighbors who had been providing some care. Informants were asked to indicate the change on a 10 items scale from 1 (much improved) to 5 (much worse). The score is the average of these sixteen items. The IQCODE was translated into Thai and translated back into English. Then some adaptation for Thai culture was made. The translation and adaptation were reviewed by a member of the Royal Institute (Rajabunditsatharn).

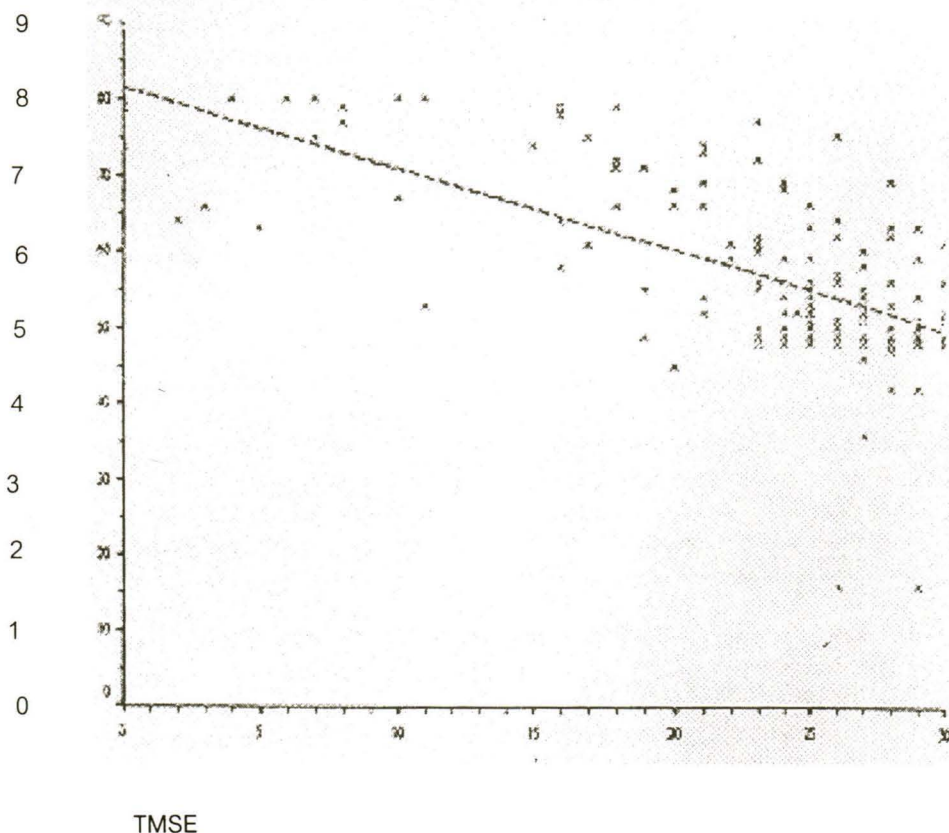
Thai Mental State Examination (TMSE)⁽⁶⁾ The TMSE is a brief cognitive screening test for dementia which is widely used in Thailand. It is adopted from the MMSE to suit Thai society and culture. Scores less than or equal to 24 out of 30 are considered as suspected dementia.

Historical data including educational attainment were obtained from caregivers or non demented elderly people directly. The IQCODE and TMSE were conducted by trained research assistants and trained nurses. Neurologists were involved

Table 1. Characteristics of normal and demented subjects.

	Normal (n=87)		Demented (n=73)		p value
Age					
Male (yrs) mean \pm sd (min, max)	65.81 \pm 4.33 (57, 75)		70.71 \pm 7.64 (57, 83)		0.625
Female	65.53 \pm 5.35 (52, 79)		70.67 \pm 9.0 (52, 85)		
Total	65.67 \pm 4.94 (52, 79)		70.68 \pm 8.58 (52, 85)		
Sex					
	%		%		
Male	37	42.5	21	28.8	0.098
Female	50	57.5	52	71.2	
Education					
None, illiterate	3	3.4	9	12.3	0.71
None, literate	2	2.3	5	6.8	
1-4 yrs	55	63.2	30	41.1	
6-7 yrs	3	3.4	5	6.8	
8-10 yrs	9	10.3	9	12.3	
11-12 yrs	6	6.9	4	5.5	
> 12 yrs	9	10.3	11	15.1	
TMSE (mean \pm SD)	26.07 \pm 2.45		18.25 \pm 8.75		< 0.001
IQCODE score (mean \pm SD)	3.14 \pm 0.44		4.14 \pm 0.59		< 0.001

IQCODE
SCORE

**Fig. 1. Negative correlation between TMSE and IQCODE (N=160, $r=-0.679$, $P<0.001$).**

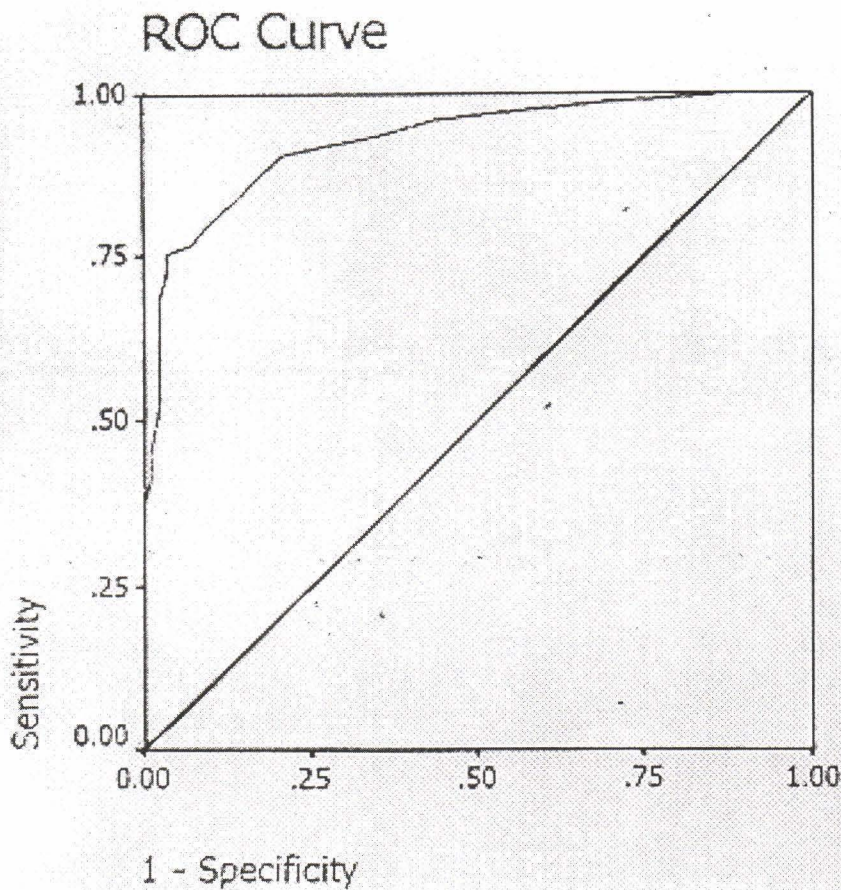


Fig. 2. ROC curve of the IQCODE score demonstrates an area under the curve of 0.928 (SE = 0.021). At a score ≥ 3.47 , its' sensitivity is 83.6% and its' specificity is 86.2%.

in the history taking, physical and neurological examinations of all the elderly people enrolled in this study, and gave a diagnosis of dementia based on DSM IV criteria. Relatives or caregivers were also interviewed by neurologists concerning daily activities and social function of the elderly person. Neurologists were not aware of either the IQCODE or TMSE scores at the time of their assessment.

Data Analysis

Descriptive analysis, two-tailed *t*-test, logistic regression analysis, and the Pearson's correlation coefficient, and receiver operating characteristic (ROC) analysis, were performed using an SPSS 9.0 computer program. Sensitivity, specificity, positive predictive value and negative predic-

tive value were calculated from EPI-info version 6. A *p* value of <0.05 was accepted as statistically significant.

RESULTS

Characteristics of the subjects: Eighty seven were normal (54.38%) and seventy three were demented (45.62%). The majority of both groups were female (57.5%, 71.2% respectively). The average age of the normal subjects was 65.67 (± 4.94) years old (range 52 to 79 years). There was a variation in educational attainment in both groups. 68.9 per cent of normal subjects had had no education or four or less years of education, 60.2 per cent of the demented subjects had had no education or four or less years of education. However

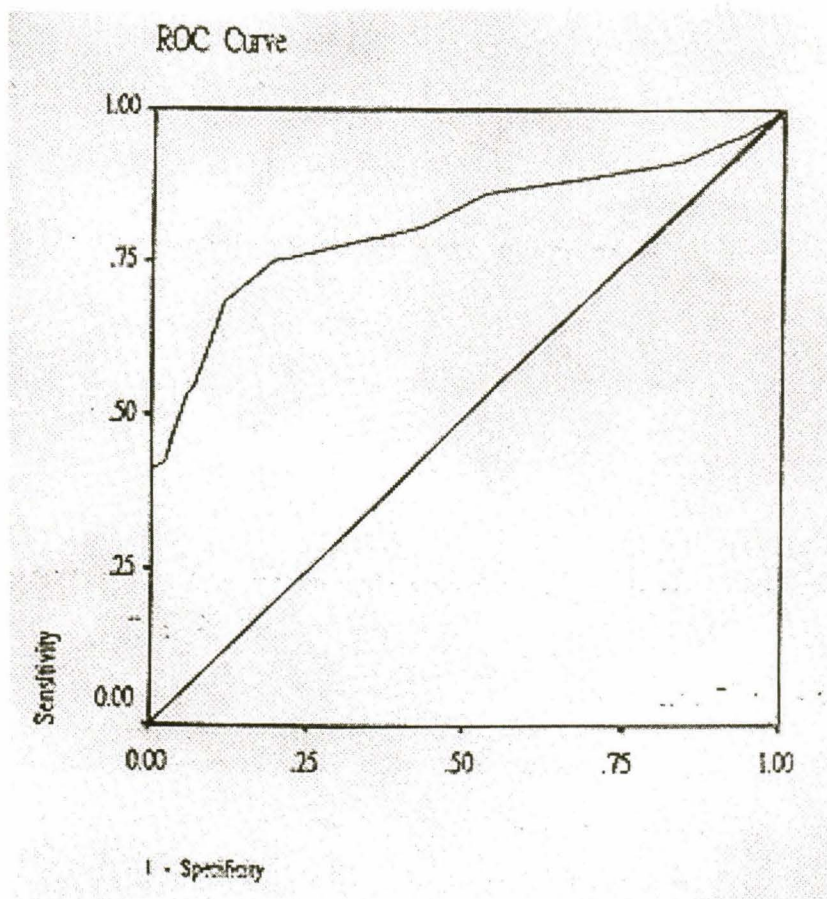


Fig. 3. ROC curve of the TMSE score demonstrated an area under the curve of 0.814 (SE = 0.037).

there was no statistically significant differences in terms of age, sex and educational attainment. (Table 1).

The majority of caregivers in the control group were either relatives or neighbours who had known the elderly person for ten years. Among the caregivers of the 73 demented elderly, 54 (74%) lived under the same roof as the elderly and 19 (26%) did not live under the same roof but saw or contacted the demented elderly several times a week. The caregivers of all 73 demented elders had been living with them for ten years. Fifty eight of them (79.5%) were women, and 15 of them (20.5%) were men. Twelve were a spouse, 43 were their children, 3 were daughters-in-law or sons-in-law, 5 were their grand children and 10 were neighbours. Their mean age was 44.45 (SD=14.14) years old.

There was no correlation between the IQCODE score and age ($n=160$, $r=0.328$, $p<0.001$), no correlation between the IQCODE score and education ($n=160$, $r=-0.08$, $p=0.315$) and there was no statistically significant difference in the IQCODE score between the sexes (male= 3.50 ± 0.59 , female= 3.65 ± 0.78 , $n=160$, $p=0.214$). The Pearson's correlation coefficient between the IQCODE score and TMSE score was -0.679 ($n=160$, $p<0.001$). Our study demonstrates that there is no "education" effect on the IQCODE score as a score that reflects level of dementia unrelated to previous education attainment.

Receiver operating characteristic (ROC) analysis was used to compare the performance of the IQCODE with the TMSE (Fig. 2, 3). The area under the ROC curve indicates the overall perfor-

Table 2. The IQCODE (short form) : items 5, 9, 15.

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5. Remembering what day and month it is
 9. Learning how to use a new gadget or machine around the house.
 15. Handling other everyday arithmetic problems, e.g. knowing how much food to buy, knowing how long between visits from family or friends.
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Table 3. Probability of diagnosing dementia with the IQCODE items 5, 9 and 15.

Predicted	Observed	
	Demented	Normal
Demented	62	7
Normal	11	80
Sensitivity	= 84.9% (74.2, 91.9)	
Specificity	= 92% (83.6, 96.4)	
Positive predictive value	= 89.9% (79.6, 95.5)	
Negative predictive value	= 87.9% (79.0, 93.5)	

mance of the test. An area of 0.5 suggests that this performance could have been obtained by chance, and an area of 1.0 suggests excellent performance of the test. In this study, the ROC analysis demonstrated that the overall performance of the IQCODE is better than that of the TMSE. The area under the curve of the ROC of the IQCODE score was 0.928 (SE=0.021) while that of the TMSE score was 0.814 (SE=0.037). This study showed that an IQCODE score ≥ 3.47 had a sensitivity of 83.6 per cent, and a specificity of 86.2 per cent, while a TMSE score ≤ 23.5 had a sensitivity of 68.5 per cent and a specificity of 88 per cent. However, if we used a TMSE score of ≤ 25.5 in order to obtain a higher sensitivity, it demonstrated a sensitivity of 80.8 per cent and a specificity of 57.5 per cent.

We then analyzed the data of those elderly people who had ≤ 4 years of education. In this group, there were 44 demented elders and 60 normal subjects. The mean IQCODE scores of these two groups showed a statistically significant difference (3.15 ± 0.401 vs 4.21 ± 0.586 , $p < 0.001$). The ROC curve of IQCODE score of those who had ≤ 4 years of education demonstrated an area under the curve of 0.941 (SE=0.025). At a score less than 3.56 it showed a sensitivity of 81.8 per cent and a specificity of 90.0 per cent. Stepwise logistic regression analysis demonstrated that questions 5,

9 and 15 were as good as the total test (16 questions) at screening for dementia. (Table 2 and 3) With the corrected formula (z-score), it showed a sensitivity of 84.9 per cent (74.2, 91.9), a specificity of 92 per cent (83.6, 96.4), a positive predictive value of 89.9 per cent (79.6, 95.5) and a negative predictive value of 87.9 per cent (79.0, 93.5). This demonstrated that even a smaller number of questions from the IQCODE could contribute to the diagnosis of dementia in the Thai elderly. This finding confirms the clinical significance of functional assessment from caregivers.

DISCUSSION

The IQCODE was first used in Australia and was then translated and applied in many countries^(4,5). The test has been shown to have little correlation with the subject's educational level, gender or age⁽⁸⁾. In an Asian community, it is acceptable for an elderly person to have fewer outdoor and indoor functions. Their relatives often look after them and do nearly all daily living tasks for an elderly person. It is not uncommon for the family informant to fail to recognize a memory problem that occurs in an elderly person with dementia, and to regard this problem as part of aging. Ross GW et al found that unrecognized dementia was common in the Honolulu-Japanese population, especially mild cases⁽⁹⁾. He suggested the use of cognitive screening programs for the elderly and public education policies to increase the awareness of dementia. We have demonstrated that ascertaining the functional abilities of elderly people and comparing these abilities with when they were younger by using the IQCODE could aid the diagnosis of dementia in a Thai population with only a few years of education. In our study, the IQCODE was better than the TMSE as a screening instrument for dementia. Uhlmann RF and Larson EB conducted a study on the effect of education on the Mini Mental State Examination, which is similar to the TMSE, as a screening test for dementia⁽²⁾. They concluded that education-specific norms opti-

mize the performance of the MMSE as a screening test for Alzheimer's dementia in the elderly on an out patient basis. The TMSE is widely used in Thailand. Thai physicians are now familiar with this simple neuropsychological test as a screening tool. We suggest that a combined neuropsychological test and informant perception of the elderly person's activities of daily living be developed as a screening test for dementia to achieve a higher sensitivity.

In summary, informant perception of cognitive impairment of the elderly can be reliably applied as a screening instrument for dementia in a population with a variety of educational backgrounds and levels. Short selected questions of the IQCODE can be administered with good diagnostic sensitivity. A new tool that combines a functional and neuropsychological assessment is needed as a dementia screening test in the Thai populations.

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REFERENCES

1. Chandra V, Ganguli M, Ratcliff G, et al. Studies of the epidemiology of dementia: comparisons between developed and developing countries. General conceptual and methodological issues. *Aging: Clin Exp Res* 1994; 6: 307-21.
 2. Uhlmann RF, Larson EB. Effect of Education on the Mini-Mental State Examination as a Screening Test for Dementia. *JAGS* 1991; 39: 876-80.
 3. Jorm AF, Scott R, Cullen JS, Mac Kinnon AJ. Performance of the Informant Questionnaire on Cognitive Decline in the elderly (IQCODE) as a screening test for dementia. *Psychol Med* 1991; 21: 785-90.
 4. Harwood DMJ, Hope T, Jacoby R. Cognitive Impairment in medical in patients. I: Screening for dementia-is history better than mental state? *Age and Aging* 1997; 26: 31-5.
 5. Fuh JL, Teng EL, Lin KN, et al. The Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) as a screening tool for dementia for a predominantly illiterate Chinese population. *Neurology* 1995; 45: 92-6.
 6. Train the Brain Forum Committee (Thailand) Thai Mental State Examination (TMSE). *Siriraj Hosp Gaz* 1993; 45: 359-74.
 7. Jorm AE. A short form of the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE): development and cross-validation. *Psychol Med* 1994; 24: 145-53.
 8. Jorm AE, Jacomb PA. The Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) : socio-demographic correlates, reliability, validity and some norms. *Psychol Med* 1989; 19: 1015-22.
 9. Ross GW, Abbott RD, Petrovitch H, et al. Frequency and Characteristics of Silent Dementia Among Elderly Japanese-American Men. The Honolulu-Asia Aging Study. *JAMA* 1997; 277: 800-5.
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IQCODE : แบบทดสอบคัดกรองของภาวะสมองเสื่อมในผู้สูงอายุไทยที่มีการศึกษาน้อย†

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วัตถุประสงค์ : เพื่อศึกษาการวินิจฉัยภาวะสมองเสื่อมโดยใช้แบบทดสอบคัดกรองในผู้สูงอายุไทยที่มีระดับการศึกษาน้อย โดยอาศัยการประเมินความสามารถของสมรรถภาพการทำงานของสมองจากข้อมูลจากญาติหรือผู้ดูแล ในการศึกษานี้ใช้แบบทดสอบคัดกรอง Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE)

วัสดุและวิธีการ : ผู้วิจัยก็ได้ทำการศึกษานักเรียนผู้สูงอายุซึ่งอาศัยอยู่ในชุมชนรอบวิทยาเขตศิริราช ที่มีภาวะสมองเสื่อม 73 ราย และไม่มีภาวะสมองเสื่อม 87 ราย และอายุตั้งแต่ 52 - 85 ปี ส่วนใหญ่ผู้สูงอายุกลุ่มนี้จบประถมศึกษา 4 หรือต่ำกว่า พยาบาลและผู้ช่วยวิจัยก็ได้ทดสอบแบบสอบถาม Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) จากญาติหรือผู้ดูแล และ Thai Mini Mental State Examination (TMSE) จากผู้ป่วย ตามลำดับ แพทย์วินิจฉัยภาวะสมองโดยใช้เกณฑ์ DSM IV โดยแพทย์ไม่ทราบถึงผลของ IQCODE และ TMSE

ผลการทดลอง : IQCODE มีความสัมพันธ์ผกผันกับ TMSE ($n=160$, $r=-0.679$, $p<0.001$) โดยที่ค่า Receiver operating characteristic (ROC) ของ IQCODE มีมากกว่า ROC ของ TMSE (0.928 vs 0.814) จากการคำนวณโดยวิธี Logistic regression analysis พบว่ามี 3 คำถาม จาก 16 คำถามของ IQCODE ที่มีความสำคัญอย่างมีนัยสำคัญทางสถิติต่อการวินิจฉัยภาวะสมองเสื่อม และจากค่า z score พบว่า 3 คำถามนี้ มีความไว 84.3% และความจำเพาะ 92% ในการวินิจฉัยภาวะสมองเสื่อม

สรุป : การวินิจฉัยภาวะสมองเสื่อม โดยแบบทดสอบคัดกรองที่ประเมินสมรรถภาพการทำงานของสมองจากญาติหรือผู้ดูแล สามารถใช้ได้ดีในประชากรสูงอายุที่มีการศึกษาน้อย จากการศึกษาพบว่าหากลดคำถามของแบบทดสอบ IQCODE ลงก็ยังใช้เป็นแบบทดสอบคัดกรองของภาวะสมองเสื่อมได้ดี

คำสำคัญ : IQCODE, แบบทดสอบคัดกรอง, ผู้สูงอายุไทยการศึกษาน้อย

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