

## Research Article

# Prevalence of Mild Cognitive Impairment in Rural Thai Older People, Associated Risk Factors and their Cognitive Characteristics

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## Keywords

Aging and cognition · Mild cognitive impairment · Prevalence · Risk factors

## Abstract

**Introduction:** Mild cognitive impairment (MCI) is a transitional stage between normal cognition and dementia. A review showed that 10–15% of those with MCI annually progressed to Alzheimer's disease. **Objective:** This study aimed to investigate the prevalence and risk factors associated with MCI as well as the characteristics of cognitive deficits among older people in rural Thailand. **Methods:** A cross-sectional study in 482 people who were 60 years old and over was conducted in northern Thailand. The assessments were administered by trained occupational therapists using demographic and health characteristics, Mental Status Examination Thai 10, Activities of Daily Living – Thai Assessment Scale, 15-item Geriatric Depression Scale and the Montreal Cognitive Assessment-Basic (MoCA-B, Thai version). **Results:** The mean age of MCI was  $68.3 \pm 6.82$  years, and most had an education  $\leq 4$  years. The prevalence of MCI in older people was 71.4% (344 out of 482), and it increased with age. Low education and diabetes mellitus (DM) were the significant risk factors associated with cognitive decline. Older people with MCI were more likely to have an education  $\leq 4$  years (RR 1.74, 95% CI 1.21–2.51) and DM (RR 1.19, 95% CI 1.04–1.36) than those who did not. The 3 most common cognitive impairments according to MoCA-B were executive function (86%), alternating attention (33.1%) and delayed recall (31.1%). **Conclusion:** The prevalence of MCI in older Thai people in a rural area is high compared with that in other countries. The explanation might be due to low education and underlying disease associated with MCI. A suitable program that can reduce the prospects of MCI in rural Thailand is needed.

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## Introduction

A report from the World Alzheimer Organization in 2015 showed that the estimated number of individuals with dementia worldwide was 46.8 million. It was expected to rise to 131.5 million by 2050 and double every 20 years [1]. Mild cognitive impairment (MCI) is the transitional stage between normal cognition and dementia, and it is a prodromal condition which might be good predictive information for dementia such as Alzheimer disease (AD) [2]. Therefore, it is important to study the prevalence of MCI. Studies on the prevalence of MCI worldwide published in 2012 showed a range between 3 and 42% and a review in 2015 showed 5–36.7% [3, 4]. Thailand is one of the countries in Southeast Asia where older people who were 60 years old and over reached 16% from a total population of 65.1 million in 2015. With the proportion of those aged exceeding 10% of the total, Thailand has become an aging society [5, 6]. A few studies of the prevalence of MCI conducted in central Thailand reported ranges from 16.7 to 43.5%, and the prevalence of cognitive impairment was high at 64.3% in north east Thailand. These numbers were different depending on the method of study which included tools, age, education and the areas of study [7–9]. It has been reported that higher age, heart problems, blood pressure and diabetes were considered as risk factors of MCI [10, 11]. Studies on the prevalence, risk factors and characteristics of cognitive impairment in rural northern Thailand are rare, and publications using the tool that has been validated for a very low educated population with Montreal Cognitive Assessment – Basic (MoCA-B, Thai version) have not yet been published worldwide. This study aimed to investigate the prevalence and risk factors associated with MCI including the characteristics of cognitive deficits among older people in rural Thailand. These results would be new information on identifying MCI in a rural area and could help early detection, intervention and monitoring in people who had a problem with MCI in a rural community-based setting.

## Materials and Methods

A cross-sectional study was conducted with a total population of 1,096 older people among 11 villages in northern Thailand. The sample size estimate was based on 15% from a previous study [12], and the calculated number was 579 people. Stratified random sampling was used.

The participants who were aged 60 years and older were recruited. The inclusion and exclusion were based on Albert et al. [13] MCI diagnostic criteria combined with a comprehensive interview for past and concurrent underlying physical and mental illnesses in order to exclude cognitive impairment due to known medical conditions and medications or substances.

Albert et al. [13] diagnostic criteria for MCI are concerned with a change in cognition, impairment in one or more cognitive domains, preservation of independence in functional abilities and no dementia. The inclusion criteria were independent in activities of daily living and the MoCA-B, Thai version scores that were 24 and lower. The exclusion criteria were dementia, depression, a history of other psychiatric problems, cerebrovascular accident, Parkinson's disease, brain injury and physical disability. People who had thyroid disease, who were on sleeping and stress medicines and also people who had eye and hearing problems were also excluded. In total, 482 older people met the criteria of the study.

The instruments were demographic and health characteristics, Mental Status Examination Thai 10 [14], activity of daily living (ADL), Thai Assessment Scale [15], 15-item Geriatric Depression Scale [16, 17] and MoCA-B, Thai version. MoCA-B, Thai version was developed by collaboration between the MoCA Clinic and Institute in Canada and Prince Mahidol Award

Foundation and the Faculty of Medicine of Chulalongkorn University, Thailand. It is a standard test which already had been validated as a screening tool for detecting MCI. It had been designed and adjusted for older people with low education and varying literacy. One point was added to the total score for <4 years of education, and 2 points were added for an education of <4 years and illiterate, the maximum score was 30. The sensitivity was 81%, and the specificity was 86%. Test-retest reliability was 0.91 ( $p < 0.001$ ), and internal consistency was 0.82 [18]. The assessments were administered by trained occupational therapists.

After interviewing demographic and health characteristics, the Geriatric Depression Scale was done to exclude depression. The test for screening dementia, Mental Status Examination Thai 10 was used to ensure that the participants were not demented. The ADL Thai Assessment Scale was also used to assess their function. The MoCA-B, Thai version was then utilised to screen for MCI participants. Associated risk factors were defined as potential risk factors. These included demographic data (e.g., gender, age, education), memory problems and health conditions (history of hypertension, diabetes mellitus [DM], heart disease) [10, 11, 19, 20].

The study was approved by the Ethics Committee of the Faculty of Medicine, Chiang Mai University. Written informed consent was obtained. The investigators explained details of the study to the participants. After agreement to participate and getting informed consent, the research team started the interviews. The study was conducted in villages in a community-based setting.

#### *Statistical Analysis*

The data were analysed with SPSS software (version 26) and Epi info™ (version 7) [21]. Descriptive statistics; frequency, percentage, mean and SD were used to analyse demographic data. Univariate analysis included Pearson's chi-square, student *t* test, and relative risk (95% CI). A *p* value <0.05 was considered as statistically significant.

## **Results**

In total, 482 older people were included in the study. The prevalence of MCI was 71.4% ( $n = 344$ ). The mean age in the MCI group was higher than in the non-MCI group ( $68.33 \pm 6.82$  years;  $64.77 \pm 3.94$  years, respectively). The prevalence increased with age, 60–69 years was 65.1%, 70–79 years was 83.8% and over 80 years was 100% (Table 1).

Older people who were 70 years and older were more likely to have MCI than the younger group (60–69 years); RR 1.35, 95% CI 1.22–1.50). Older people with MCI were more likely to have a low education ( $\leq 4$  years; RR 1.74, 95% CI 1.21–2.51). Older people who had DM were more likely to have MCI than those who did not (RR 1.19, 95% CI 1.04–1.36) (Table 2).

The 3 most common cognitive impairments were executive function (EF; 86%), alternating attention (33.1%) and delayed recall (31.1%) (Fig. 1).

## **Discussion/Conclusion**

The prevalence of MCI in older Thai people in a rural area in this study using MoCA-B Thai version was high. Age, education and DM were the significant risk factors associated with MCI. The explanation might be because most older people in our study had a very low education, mostly only 4 years or less as shown in Table 1 (95.1%). In addition, most of them were farmers (65.1%) and had a very low income ( $\leq 270$  USD/month). The prevalence of MCI in our study was different from another study that had been conducted in central Thailand using

**Table 1.** Demographic and health characteristics of older people with MCI and non-MCI

Characteristics (total 482)	MCI (n = 344; 71.4%)		Non-MCI (n = 138; 28.6%)		p value
	frequency	percent	frequency	percent	
Gender					
Female	192	55.8	66	47.8	0.112 <sup>†</sup>
Male	152	44.2	72	52.2	
Age, years, range					
60–69	228	66.3	122	88.4	0.001 <sup>*,†</sup>
70–79	83	24.1	16	11.6	
80–89	33	9.6	–	–	
Age, years, mean ± SD		68.33±6.82		64.77±3.94	0.001 <sup>*,‡</sup>
Marital status					
Single	11	3.20	6	4.3	0.128 <sup>†</sup>
Married	244	70.9	108	78.3	
Widow/divorced	89	25.9	24	17.4	
Family type					
Single family	267	77.6	104	75.4	0.60 <sup>†</sup>
Extended family	77	22.4	34	24.6	
Education, years					
≤4	327	95.1	115	83.3	0.001 <sup>*,†</sup>
>4	17	4.9	23	16.7	
Occupation					
Farmers	224	65.1	81	58.7	0.006 <sup>*,†</sup>
Employees	108	31.4	42	30.4	
Others; merchant, government officer, not specified	12	3.5	15	10.9	
Income, USD/month					
≤270	327	95.1	122	88.4	0.009 <sup>*,†</sup>
>270	17	4.9	16	11.6	
Hypertension					
Yes	172	50	68	49.3	0.886 <sup>†</sup>
No	172	50	70	50.7	
DM					
Yes	49	14.2	10	7.2	0.034 <sup>*,†</sup>
No	295	85.8	128	92.8	
Heart disease					
Yes	15	4.4	7	5.1	0.735 <sup>†</sup>
No	329	95.6	131	94.9	
Memory problems					
Yes	200	58.1	71	51.4	0.181 <sup>†</sup>
No	144	41.9	67	48.6	

\* Statistically significant ( $p < 0.05$ ).

<sup>†</sup> Pearson's chi-square.

<sup>‡</sup> Student *t* test.

MCI, mild cognitive impairment; DM, diabetes mellitus.

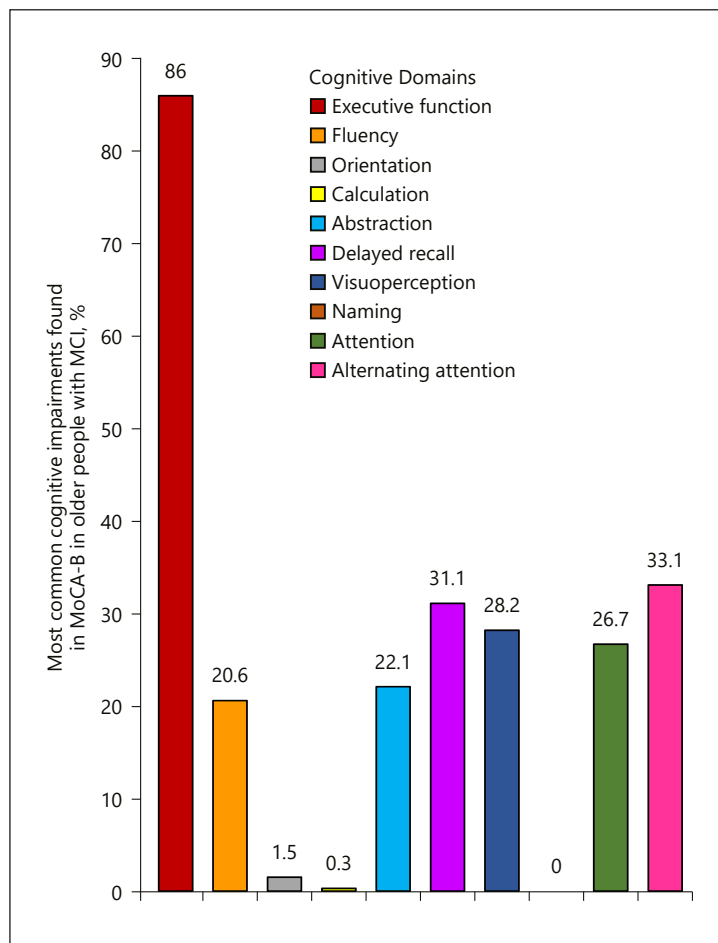
MoCA Thai version that showed lower prevalences (43.5%) in a younger group that had a mean age of MCI at  $57.12 \pm 7.48$  years and had higher income and a better education [8]. Compared to other countries, the results were consistent with the study in Saudi Arabia using MoCA Saudi Arabian version where the assessment was also done in a community-based setting. Their overall prevalence of cognitive impairment was 72.5%, and the mean age of the sample group was  $67 \pm 6$  years. However, after adjustment of the education-cutoff scores, their prevalence of MCI was reduced to 38.6%. The Saudi Arabian study also showed that

**Table 2.** Risk factors associated with MCI

Factors		RR	95% CI	p value
Gender	Female/male	1.10	0.98–1.23	0.112
Age	70 up/60–69 years	1.35	1.22–1.50	0.001*
Education	≤4/>4 years	1.74	1.21–2.51	0.001*
Hypertension	Yes/no	1.01	0.90–1.13	0.886
DM	Yes/no	1.19	1.04–1.36	0.034*
Heart disease	Yes/no	0.95	0.71–1.28	0.735
Memory problems	Yes/no	1.08	0.96–1.22	0.181

\* Statistically significant ( $p < 0.05$ ).

MCI, mild cognitive impairment; DM, diabetes mellitus.



**Fig. 1.** Percentage of most common cognitive impairments found in MoCA-B in older people with MCI. MoCA-B, Montreal Cognitive Assessment-Basic; MCI, mild cognitive impairment.

57.6% of people with MCI had an education of >7 years [19]. However, the MoCA-B (Thai version) was already developed for screening MCI in illiterate and low education populations [18]. A study in China found that the prevalence of MCI was 20%, and it was significantly higher in people who did not exercise [10]. The study worldwide of the prevalence of MCI in diverse geographical and ethnocultural regions which analyzed data from 11 international cohort studies which included USA, Europe, Asia and Australia found that the estimation of

MCI prevalence was 5.0–36.7%. The prevalence increased with age and not completing high school increased the likelihood of MCI significantly; however, sex was not a factor. These risk factors were consistent with our study [4]. Another systematic review in 2012 on the disparity of prevalence estimates in MCI across countries showed 3–42%, the highest prevalence was found in a French study with 42% and a mean age  $\geq 65$  years. The second highest prevalence was in a Finland study with 38.4% with mean age of 68.8 years. A low prevalence was found in a US study at 3.2% with mean age of 74.6 years. However, they reported that one reason for the differences in prevalence varied with the operational criteria of MCI and research methods. Petersen et al. [22] criteria were frequently cited in their review. It was also found that subjective memory complaints were not always included in the criteria, and no instruments were specified in the criteria [3]. In our study, 58.1% accepted that they had memory problems.

In addition, DM and hypertension were risk factors associated with MCI, but only DM was a related significant risk factor. Heart disease was not a significant factor. The study in China demonstrated that stroke and DM but not hypertension and coronary heart disease were related risk factors of MCI [10]. Another Chinese study found that DM was shown to be a risk factor of MCI progressing to AD. There was evidence suggesting that having type 2 DM might be a potential risk in the progress from MCI to AD because DM is associated with factors such as obesity, hypertension, inflammation and dyslipidemia which were shown to have a negative impact on the brain [20]. Memory problems in older people in our study were not a significant risk factor associated with MCI. Likewise, the results in Saudi Arabia reported only 37.4% had memory complaints and were not shown as a risk factor in their results [19].

Considering the cognitive domains in our study assessed by MoCA-B Thai version, EF, alternating attention and delayed recall were most common cognitive impairments. This result was consistent with the concept of MCI by Petersen et al. [22] which revealed that the impairment of cognitive domains such as alteration in attention abilities, dysexecutive syndrome were found in MCI and an impairment of memory including delayed recall were found in early AD. Also other study indicated that decline in EF including attention may be indicative of several neurodegenerative conditions [23]. Another study also suggested that using working memory and EF could be used to assess or track the behavioural change to distinguish between normal aging, MCI and AD [24]. EF was associated with functional impairment or instrumental ADL in older people [25, 26].

The strength of our study was that we could include a large number of participants in the study in a rural northern Thailand community-based setting. However, the limitation was that there were a limited number of cognitive assessment tools that have been validated in a large sample size in Thailand to be used.

In conclusion, the results in this study provided early detection of MCI which needs to be done in community-based setting because the opportunity to access a specialist cognitive assessments in rural is likely to be less than a big town. This information of such early detection could be used to support health professionals to prepare a suitable program for MCI. It is suggested that education is a significant risk factor associated with MCI. Conventional education may not be suitable for their age and experience. Therefore, the support should be an interaction with them using easy literacy activities that they can use in their daily life, outside a conventional classroom education that follows their interests and enjoyment. There is also a need to control DM, increase exercise and other physical activities in order to decrease related risk factors on MCI. In addition, older people should receive multifaceted cognitive training that may improve their cognition to reduce the prospect of MCI.

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## Statement of Ethics

The research study has been approved by Ethics Committee from the Faculty of Medicine, Chiang Mai University, Thailand, which used international guidelines accordance with the World Medicine Association Declaration of Helsinki; study code COM-2561-05259. All the participants were given an overview of the research study and were informed that they could withdraw from the study if they did not feel comfortable. All of them were willing to participate in the study and have given their written informed consent.

## Disclosure Statement

The authors declare that they have no competing financial interests.

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## Author Contributions

J.G.: first or main author performed the research including writing the proposal and the manuscript, designed research and planned the implementation of the research, collected data, prepared data, analysed data, wrote the results and discussed the results. L.T.: second author and corresponding author: main supervisor in the research proposal, supervised research design methods and helped with the data analysis; supported in applying for the funding and helped revising the manuscript. N.W.: third author: co-supervised the research proposal, discussed the design, supervised measurement utilisation, scoping MCI theory, data interpretation and helped revising manuscript. P.M.: fourth author: co-supervised the research proposal, discussed the research design, supervised in the preparation of the research staff in collecting data and helped revising the manuscript.

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