Mild cognitive impairment and its associated factors amongst the older people attending government health clinics in Kuantan

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ABSTRACT

Introduction: Malaysia is undergoing a demographic transition towards an aging population, resulting in an anticipated rise in the number of older individuals at risk of developing dementia. Mild cognitive impairment (MCI) represents an intermediate clinical stage between normal cognition and dementia, characterized by cognitive decline that does not significantly impair daily functional activities. Early detection of MCI is critical, as early-stage interventions and modifications of risk factors can yield promising outcomes.

Materials and Methods: This cross-sectional study evaluated the prevalence of MCI and its associated factors among 327 older adults attending healthcare clinics. Data were collected using the Elderly Cognitive Assessment Questionnaire, Geriatric Depression Scale, and Barthel Index. Binary logistic regression analysis was performed to identify significant factors of MCI.

Results: The prevalence of MCI in the study population was 18.7%, with the majority demonstrating poor control of comorbid conditions. Significant factors of MCI included being a widower (OR 0.4; 95%CI: 0.18, 0.94), increasing age (OR 0.92; 95% CI: 0.88, 0.97), and having diabetes (OR 3.49; 95% CI: 1.81, 6.73).

Conclusion: The findings highlight that a significant proportion of older adults are at risk of progressing to dementia but remain underdiagnosed during the early stages. Optimizing blood sugar control emerges as a crucial strategy to mitigate the progression of MCI to irreversible dementia. Implementation of active cognitive screening programs is essential for early identification and timely intervention.

KEYWORDS:
Mild, cognitive dysfunction, aged, clinical, risk

INTRODUCTION

Cognition encompasses thinking, knowledge acquisition, and memory. Cognitive decline is commonly observed in older individuals due to aging or underlying physical and mental conditions. It is typically marked by memory disturbances and is prevalent among the elderly.[1] Dementia is a primary cause of cognitive deterioration, with Alzheimer's disease being its most common form.[2] Mild cognitive impairment (MCI) represents an intermediate phase between normal aging-related cognitive changes and dementia. Early detection of dementia, whether primary or secondary, is crucial, as timely intervention can lead to better outcomes.[1]

The global prevalence of MCI ranges from 14.71% to 38.6%, as reported in studies from Saudi Arabia, China, and India.[3-5] In Malaysia, prevalence rates in rural and urban settings vary between 22.4% and 64.7%.[6,7] Advancing age is a key determinant of MCI, with studies from Saudi Arabia and Malaysia reporting increased odds of MCI with age.[3,6] Additionally, research from New York, Malaysia, and Taiwan suggests that females may have a higher prevalence and faster progression of MCI compared to males (OR 2.95; 95% Confidence Interval 95%CI:1.82, 4.78).[2,8,9] Lower education levels and fewer years of schooling are associated with an increased risk of MCI.[7,9] Strong family support may reduce this risk, while low social support has been linked to higher susceptibility.[10] Smoking has also been associated with cognitive decline, including MCI.[11] Regular physical activity is consistently linked to a lower risk of MCI.[4,9] Additionally, non-communicable conditions such as being underweight or overweight, hypertension, diabetes, and dyslipidemia contribute to cognitive impairment.[3,12,13] Depression may further exacerbate cognitive decline and significantly increase the risk of dementia.[14,15]

As Malaysia's population ages, the proportion of individuals aged 65 and above is expected to rise from 5.0% in 2010 to 14.5% by 2040.[16] In Malaysia, research has primarily focused on dementia and its risk factors. However, significant gaps remain, particularly in the comprehensive diagnosis of MCI in the community, including the incorporation of daily function scores and the identification of associated risk factors. Therefore, this study aims to assess the prevalence of MCI accordingly and its related determinants among elderly patients receiving care at government health facilities in Kuantan.

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MATERIALS AND METHODS

Subjects

This cross-sectional study was conducted at government health clinics in Kuantan, Pahang, over six months beginning in January 2023. Participants were Malaysian citizens aged 60 years and older who attended these clinics. Individuals with known diagnoses of stroke, depression, dementia, or Alzheimer's disease were excluded from the study.

Sample Size

The sample size was determined using the single proportion formula, calculated with OpenEpi Version 3, an open-source calculator. Based on a prevalence rate of 14.6% reported by Hussin et al. in 2019, the minimum required sample size was 288.[17] To account for a 10% dropout rate, the final calculated minimum sample size was adjusted to 320.

Sampling Method

A multistage random sampling technique was employed. Initially, five clinics were randomly selected from a total of 12 clinics using the Excel randomization function. These clinics were chosen based on their high geriatric attendance rates and represented the target sample size of 320. Systematic random sampling was then applied, whereby every third elderly patient listed for the day's geriatric appointments was approached until the required number of participants per clinic (approximately 50 to 70) was achieved. The distribution of participants was proportional to the annual geriatric attendance rates for each clinic.

Study Instruments

Study's questionnaire comprised three sections:

1. Sociodemographic Data: This section captured information on participants' weight, height, age, ethnicity, education level, occupation, and marital status.
2. Medical History and Lifestyle Factors: This section assessed participants past medical history and lifestyle. It included the Activities of Daily Living questionnaire and the Geriatric Depression Scale.
3. Cognitive Assessment: Cognitive impairment was screened using the validated Malay version of the Elderly Cognitive Assessment Questionnaire (ECAQ). This interview-based tool, designed for high sensitivity and specificity, consists of three subsections: memory, orientation and information, and memory recall. The ECAQ has a scoring range of 0–10, with a cut-off score of 7 or lower indicating MCI. The Malay version's validation showed 85.3% sensitivity, 91.5% specificity, and an 82.8% positive predictive value, outperforming other tools such as the Montreal Cognitive Assessment (MoCA) and Mini-Mental State Examination (MMSE).

Elderly patients at the five selected clinics were approached by investigators who provided a verbal explanation of the study and distributed a detailed patient information sheet. Eligible individuals who met the inclusion criteria were asked to sign informed consent forms before participation.

Statistical Analysis

Data analysis was conducted using IBM SPSS version 27.0. A $p < 0.05$ was considered statistically significant. Descriptive statistics, including frequencies and percentages, were used to summarize the respondents' baseline characteristics. MCI was defined as a score ≤ 7 on the Malay version of the ECAQ, alongside an intact Barthel Index score and no clinically identified alternate causes as assessed by the physician. Bivariate analyses were performed using the Chi-Square test and independent t-test to identify potential factors associated with MCI. Variables with significant bivariate results were then included in a multiple logistic regression analysis to determine adjusted odds ratios and 95% confidence intervals.

Ethical Considerations

Ethical approval was granted by the Department of Family Medicine and the Kulliyyah of Medicine at the International Islamic University Malaysia (IIUM) (IREC 2022-180), as well as by the Medical Research and Ethics Committee (MREC) (NMRR ID-21-02107-4AY), the Pahang State Health Department, and the Kuantan District Health Office.

RESULTS

A total of 327 individuals participated in this study, with a mean age of 67 years (SD 6.1), ranging from 60 to 92 years. The majority of participants were of Malay ethnicity (76.8%) and married (84.4%), while a significant proportion had attained a secondary school level of education (73.4%). Only a small percentage of respondents lived alone (9.8%).

In terms of smoking status, 61.5% of participants were non-smokers at the time of the study, excluding 21.4% who had ceased smoking. The prevalence of obesity, based on body mass index (BMI), was notably high at 72.4%. Hypertension was present in 83.5% of respondents, with 33.0% experiencing uncontrolled systolic blood pressure and 12.5% having uncontrolled diastolic blood pressure. Diabetes was reported in 70.3% of the population, with poor glycemic control, as reflected by HbA1c levels, observed in 42.2% of these cases. Hyperlipidemia was the most prevalent comorbidity, affecting 93.0% of respondents.

All participants underwent assessments for depression and limitations in activities of daily living; no cases were identified. A summary of the sociodemographic and clinical characteristics of the study population is presented in Table I.

The prevalence of MCI observed in this study (18.7%). A significant association between age, marital status, education level, hypertensive status and diabetic status with MCI was observed ($p < 0.001$) as showed in Table II. Table III highlights the adjusted associations between sociodemographic and clinical factors and MCI among elderly individuals in Kuantan. The main factors for MCI are marital and diabetic status.

DISCUSSION

Prevalence of Mild Cognitive Impairment amongst the elderly

The MCI prevalence in this study (18.7%) aligns with previous Malaysian studies.[18,19] Rashid reported 11%, while Lee et al. and Sherina et al. found rates of 21.1% and 22.4%, respectively.6,18,19 Razali et al. reported a higher prevalence of 63.7%, likely due to differences in study settings.[7]

Table I Sociodemographic and clinical characteristics of the respondents (N=327)

Variables	n	%
Age(years) [a]	67.3	6.48
Gender		
Male	156	47.7
Female	171	52.3
Ethnicity		
Malay	251	76.8
Chinese	41	12.5
Indian	28	8.6
Others[b]	7	2.1
Marital Status		
Single	7	2.1
Married	276	84.4
Divorced / widowed	44	13.5
Education Level		
Primary school	61	18.7
Secondary school	240	73.4
Tertiary education	26	8.0
Living Alone		
Yes	32	9.8
No	295	90.2
Smoking History		
Smoker	56	17.1
Ex-smoker	70	21.4
Non-smoker	201	61.5
Weight Class (kg)		
30-49	18	5.5
50-69	140	42.8
70-89	139	42.5
90-109	25	7.6
110-129	5	1.5
BMI Classification		
Normal	47	14.4
Overweight	43	13.1
Obese type 1	128	39.1
Obese type 2	109	33.3
Hypertension		
Yes	273	83.5
No	54	16.5
Systolic Blood Pressure (mmHg)		
Normal	219	67.0
Uncontrolled	108	33.0
Diastolic Blood Pressure (mmHg)		
Normal	286	87.5
Uncontrolled	51	12.5
Diabetes		
Yes	230	70.3
No	97	29.7
HbA1C		
Not available	98	30.0
Normal	91	27.8
Uncontrolled	138	42.2
Hyperlipidaemia		
Yes	304	93.0
No	23	7.0
GDS[c] Class		
Normal	327	100.0
ADL[d] Class		
Normal	327	100.0

Note: Data were expressed as n (%) unless otherwise indicated
[a] Mean (SD)
[b] Others include Orang asli and other minority groups
[c] GDS – Geriatric depression scale
[d] ADL – Activity of daily living

Table II: Association between sociodemographic, clinical factors and MCI (N=327)

Variables	MCI		χ^2 Statistics (df = 1)	p-value
	Yes n (%)	No n (%)		
Age(years) [a]	71.85 (6.96)	66.26 (5.90)	4.930b	0.027[c]
Gender				
Male	29 (47.5)	127 (47.7)	0.001	0.977
Female	32 (52.5)	139 (52.3)		
Ethnicity				
Malay	48 (78.7)	203 (76.3)	2.821	0.420
Chinese	6 (9.8)	35 (13.2)		
Indian	7 (11.5)	21 (7.9)		
Others	0 (0.0)	7 (2.6)		
Marital Status				
Single	2 (3.3)	5 (1.9)	25.002	<0.001[c]
Married	39 (63.9)	237 (89.1)		
Widowed	20 (32.8)	24 (9.0)		
Living alone				
Yes	9 (14.8)	23 (8.6)	2.097	0.148
No	52 (85.2)	243 (91.4)		
Education level				
Primary school	23 (37.7)	38 (14.3)	18.760	<0.001[c]
Secondary school	36 (59.0)	204 (76.7)		
Tertiary education	2 (3.3)	24 (9.0)		
Smoking History				
Smoker	11 (18.0)	45 (16.9)	4.743	0.093
Ex-smoker	19 (31.1)	51 (19.2)		
Non-smoker	31 (50.8)	170 (63.9)		
Hypertension				
Yes	60 (98.4)	213 (80.1)	12.034	<0.001c
No	1 (1.6)	53 (19.9)		
Systolic Blood Pressure(mmHg)				
Normal	32 (52.5)	187 (70.3)	7.141	0.008[c]
Uncontrolled	29 (47.5)	79 (29.7)		
Diastolic Blood Pressure (mmHg)				
Normal	47 (77.0)	239 (89.8)	7.414	0.006[c]
Uncontrolled	14 (23.0)	27 (10.2)		
Hyperlipidaemia				
Yes	54 (88.5)	250 (94.0)	2.263	0.133
No	7 (11.5)	16 (6.0)		
Weight(kg)				
30-49	5 (8.2)	13 (4.9)	9.150	0.057
50-69	23 (37.7)	117 (44.0)		
70-89	28 (45.9)	111 (41.7)		
90-109	2 (3.3)	23 (8.6)		
110-129	3 (4.9)	2 (0.8)		
130-149	0 (0.0)	0 (0.0)		
Body Mass Index				
Underweight	0 (0.0)	0 (0.0)	2.362	0.501
Normal	6 (9.8)	41 (15.4)		
Overweight	6 (9.8)	37 (13.9)		
Obese1	26 (42.6)	102 (38.3)		
Obese 2	23 (37.7)	86 (32.3)		
Diabetes Mellitus				
Yes	28 (45.9)	202 (75.9)	21.459	<0.001[c]
No	33 (54.1)	64 (24.1)		

Note: Data were expressed based on Chi Square test otherwise indicated
[a] Mean (SD)
[b] F independent sample T test
[c] P < 0.05

Community-based studies, including ours, tend to report lower prevalence than hospital-based studies, where participants often have chronic illnesses requiring specialized care.[6,7,18]

Regionally, Xue et al. reported a pooled MCI prevalence of 14.7% in China, with slight variations based on methodology.[5] In Singapore, Lim et al. found a prevalence of 7.7% using the Elderly Cognitive Assessment Questionnaire (ECAQ), though its predominantly Chinese sample limits generalizability.[18] Studies using the Montreal Cognitive Assessment (MoCA) report MCI prevalence ranging from 6.7% to 25.2%, consistent with our findings.[5,18]

Table III Logistic regression analysis of factors associated with MCI

Variables	Odd ratio	Wald	Adjusted Odds Ratio	95%CI		p-value
				Lower	Upper	
Age(years)	-0.094	14.972	0.910	0.868	0.955	< 0.001[a]
Marital Status						
Married	Reference					
Single	-0.235	0.053	0.790	0.107	5.812	0.817
Widowed	-0.963	5.411	0.382	0.170	0.859	0.020[a]
Education level						
Primary school	-0.966	1.275	0.381	0.071	2.035	0.259
Secondary school	-0.385	0.255	0.681	0.139	3.331	0.635
Tertiary education	Reference					
Hypertension						
No	Reference		1			
Yes	1.856	6.398	0.158	0.805	50.829	0.079
Systolic Blood Pressure(mmHg)						
Normal	Reference		1			
Uncontrolled	0.597	2.612	1.897	0.881	3.749	0.106
Diastolic Blood Pressure (mmHg)						
Normal	Reference		1			
Uncontrolled	0.736	2.625	2.088	0.857	5.090	0.105
Diabetes Mellitus						
No	Reference		1			
Yes	1.250	13.918	3.490	1.810	6.729	<.001[a]
Constant	5.594	10.721	385.298			0.001[a]

Notes: Estimates of odds ratio from a binary logistic regression adjusted; aStatistically significant at P < 0.05; OR = odds ratio; CI = confidence interval

Associated Factors For Mild Cognitive Impairment (Univariate analysis)

A significant association between age and MCI was observed (p < 0.001), with the prevalence of MCI increasing in older age groups (Table II). For instance, the proportion of individuals with MCI rose from 16.4% in those aged 60–64 to 27.9% in the 70–74 age group and remained high in those aged 75–84. This aligns with existing evidence that advancing age is one of the strongest risk factors for cognitive decline, attributed to neurodegenerative changes, reduced brain plasticity, and vascular factors.19 Interestingly, the prevalence of MCI was slightly lower in the oldest age group (85+), possibly reflecting survivor bias, where the healthiest individuals tend to live longer, or under-detection due to reduced health-seeking behavior in this subgroup.

Marital status was significantly associated with MCI (p < 0.001), with divorced or widowed individuals showing a much higher prevalence of MCI (32.8%) compared to married individuals (9.0%). This highlights the potential protective role of marriage, which may provide emotional support, companionship, and assistance in managing health-related issues. In contrast, divorced or widowed individuals may experience loneliness and reduced social interaction, which are known risk factors for cognitive decline.[20]

Education level also showed a strong association with MCI (p < 0.001). Those with primary education exhibited the highest prevalence of MCI (37.7%), compared to 59.0% for secondary and 3.3% for tertiary education. This finding supports the cognitive reserve hypothesis, which posits that higher education provides a buffer against neurodegeneration by enhancing the brain's ability to cope with pathological changes.[21] Furthermore, lower education may be linked to poorer brain development, reduced synaptic density, and diminished neuroplasticity, contributing to the brain's decreased ability to compensate for age-related changes and neurodegeneration, thus increasing susceptibility to MCI.[22] The low prevalence of MCI among tertiary-educated individuals underscores the importance of lifelong learning and mental stimulation in promoting cognitive health.

Hypertension was significantly associated with MCI (p < 0.001), with 98.4% of individuals with MCI reporting a history of hypertension compared to 80.1% of those without MCI. Additionally, uncontrolled systolic (p = 0.008) and diastolic (p = 0.006) blood pressure were significantly linked to the presence of MCI. These findings align with evidence highlighting the role of hypertension in vascular damage and reduced cerebral blood flow, which contribute to the development of vascular cognitive impairment.[23] Previous studies have emphasized that effective management of blood pressure may mitigate the risk of cognitive impairment in aging populations.[23,24] These findings underscore the importance of routine screening for MCI in hypertensive individuals to facilitate early diagnosis and implement targeted interventions aimed at preventing cognitive decline.

Diabetes mellitus emerged as a significant factor of MCI (p < 0.001), with a much higher prevalence among individuals with MCI (45.9%) compared to those without MCI (24.1%). This association can be attributed to several mechanisms, including chronic hyperglycemia, insulin resistance, and vascular complications, which negatively affect brain health and increase the risk of cognitive impairment.[25] These findings emphasize the need for stringent glycemic control and regular cognitive screening among diabetic patients.

Significant Factors for Mild Cognitive Impairment
Marital Status
A significant association was observed between marital status and MCI, with divorced or widowed individuals showing higher odds of developing MCI compared to their married counterparts (AOR :0.418; 95% CI: 0.181, 0.962). These findings align with existing literature indicating that marital status serves as a proxy for social support, which may safeguard against cognitive decline. The absence of a spouse is often associated with increased loneliness, reduced social interaction, and diminished emotional support—factors linked to accelerated cognitive deterioration.[20]

Previous studies have reported that divorced or widowed individuals, particularly older adults, are more likely to experience MCI than married individuals.[26] Contributing factors may include the psychological stress of divorce, reduced social support, fewer social interactions, and limited mental stimulation, all of which are protective against MCI. Moreover, the financial and emotional hardships often associated with divorce or widowhood can exacerbate cognitive decline. These findings underscore the importance of community-based social interventions aimed at supporting divorced or widowed elderly individuals to mitigate their risk of cognitive impairment.

Diabetes Mellitus
Diabetes mellitus emerged as the strongest predictor of MCI in this study, with diabetic patients showing over three times the odds of having MCI compared to non-diabetic individuals (AOR:3.434; 95% CI: 1.775, 6.643). This finding is consistent with global evidence linking diabetes to cognitive impairment through mechanisms such as chronic hyperglycemia, insulin resistance, microvascular damage, and increased oxidative stress.[27,28] These processes contribute to both vascular dementia and Alzheimer's disease, explaining the high prevalence of cognitive decline among diabetic populations.

Chronic hyperglycemia and insulin resistance in diabetes lead to neuroinflammation, oxidative stress, and vascular damage, which impair synaptic plasticity and neuronal health, ultimately affecting memory and cognitive function. Additionally, diabetes accelerates amyloid-beta deposition and tau phosphorylation, both of which are hallmark pathological processes in Alzheimer's disease.[29] Given these mechanisms, integrating cognitive screening into diabetes management protocols and prioritizing interventions for optimal glycemic control is essential.

LIMITATIONS
This study was conducted exclusively in government primary healthcare clinics in Kuantan, thereby excluding patients who receive follow-up care in private practices or hospitals. While these clinics serve a demographically diverse population, the findings may not reflect the prevalence of MCI across the entire Kuantan district. Furthermore, the study's scope was confined to Kuantan, the principal district of Pahang State. Expanding future research to include other districts in Pahang and a wider range of medical facilities could provide more comprehensive insights into the prevalence and determinants of MCI.

CONCLUSION
Our findings revealed that 18.7% of the elderly population in Kuantan is affected by MCI. Key factors of MCI identified in this study were marital status and diabetes mellitus. Notably, Malaysia's national screening guidelines and algorithms do not currently incorporate routine screening for MCI in community healthcare settings. With the nation's aging population, the combination of modifiable and non-modifiable risk factors is expected to result in a marked increase in dementia cases. These findings underscore the need to revise targeted screening protocols for the elderly, with an emphasis on cardiovascular and dementia risk factors. Specifically, the results justify implementing routine MCI screening for elderly individuals, particularly those with diabetes, within community healthcare settings. To optimize healthcare delivery, we propose incorporating MCI screening into the existing diabetic foot screening schedule. Such an approach would streamline preventive efforts and facilitate early detection, enabling timely interventions to mitigate cognitive decline in at-risk populations.

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