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Mild cognitive impairment and its determinants in urban and rural areas among older adults: A Cross-Sectional Study

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Abstract

Background: Mild Cognitive Impairment (MCI) is a transitional stage between normal cognitive aging and dementia, often marked by noticeable cognitive decline without significant interference in daily activities. This study aimed to investigate the prevalence and determinants of MCI among older adults in urban and rural areas of Kermanshah City.

Methods: A cross-sectional study was conducted involving 506 older adults recruited from urban and rural areas using a cluster random sampling method. The participants completed assessments of cognitive function, social relationships, stress management, and socio-demographic factors. Logistic regression analyses and the Kruskal-Wallis and Mann-Whitney U tests were performed to examine the associations between these factors and MCI using SPSS version 25.

Results: The prevalence of MCI was 21.9% overall, with a higher prevalence in rural areas. In both areas, social relationships (urban: $p = 0.001$; rural: $p = 0.04$) and age (urban: $p = 0.001$; rural: $p = 0.013$) were significantly associated with MCI. In the rural elderly, education ($p = 0.02$) and economic situation ($p = 0.012$) were significant predictors, while in urban areas, gender ($p = 0.002$) and stress management ($p = 0.001$) were key determinants.

Conclusion: This study highlights the importance of considering psychosocial factors, such as social relationships and stress management, in understanding cognitive health among older adults. Targeted interventions are needed to address the higher prevalence of MCI in rural areas. Further research should explore strategies to improve cognitive health in aging rural and urban populations.

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Highlights

What is current knowledge?

MCI is a condition characterized by cognitive decline greater than expected for an individual's age and education level but not severe enough to interfere significantly with daily life or independent function. Factors such as age, genetic predisposition, cardiovascular health, and lifestyle choices are known to influence the prevalence and progression of MCI.

What is new here?

This study found that education and economic situation were significant predictors of MCI in rural areas, while gender and stress management were key determinants in urban areas.

Introduction

Due to medical advancements that have increased life expectancy, the proportion of people over 60 is expected to double by 2050, especially in developing countries like Iran (1,2).

Mild Cognitive Impairment (MCI) signifies a critical juncture between the cognitive changes associated with normal aging and the onset of more severe cognitive decline, such as dementia (3). In older adults, experiencing difficulties with information processing and memory retention can significantly impact their ability to carry out daily tasks, ultimately eroding their independence (4).

Cognitive function is influenced by various factors in urban and rural settings (5,6). Urban areas face challenges like pollution, noise, social isolation, and healthcare access that impact cognitive function (7). Conversely, rural areas contend with limited healthcare access, lower education levels, labor-driven activities, and tighter social networks (5).

This study aimed to investigate the MCI status in rural and urban areas while exploring the relationships between factors such as stress management, social and interpersonal relationships, socioeconomic status, and MCI in older adults residing in these diverse environments.

Methods

A cross-sectional study with a descriptive-analytic approach was conducted to meet the study objectives. The study included individuals aged 60 years and older with health records in Kermanshah City's healthcare centers. Inclusion criteria comprised age 60 or older, informed consent, no history of psychotic or cognitive disorders, and no hearing or speech impairments. Exclusion criteria included unwillingness to cooperate or incomplete examination/questionnaire.

The minimum required sample size was calculated to be 460 people based on Bae et al.'s study and the variance of the Mini-Mental State Examination (MMSE) score (8). A 10% sample loss was added to the target volume to ensure more accurate results. Consequently, the target sample size was 506 people.

Multi-stage cluster sampling was used, initially stratifying the sample into urban and rural areas. Kermanshah City was divided into eight clusters based on municipal divisions, including 24 urban areas and 77 health centers. Rural areas were divided into 12 comprehensive rural health service centers and 149 rural health centers, serving as clusters. Cluster selection was based on the population distribution of individuals aged 60 and older, with 17% in rural areas and 83% in urban areas. Twenty clusters were identified, with four from rural and 16 from urban health centers. Samples were randomly chosen within each center after obtaining written consent.

Data Collection

After obtaining the necessary approvals and permits in 2022, the researcher visited health centers in rural and urban Kermanshah armed with an introduction letter. Samples were randomly selected within each center. Eligible individuals were contacted by phone, briefed on the study, and invited to participate. After providing informed consent, the participants completed questionnaires via interviews. Data collection took place from March to September 2023, spanning six months.

Measures

Cognitive function was assessed using MMSE, and the education-specific cutoff points of total MMSE scores were used to identify MCI. The cutoff points for total MMSE scores were $\leqslant 19$ for illiterate individuals, $\leqslant 22$ for participants with high school education, and $\leqslant 26$ for those with a diploma or higher educational level (9). The reliability and validity of the MMSE questionnaire in Iran were established by Seydian et al., who reported a satisfactory Cronbach's alpha coefficient of 0.81 for internal reliability (10).

Stress management and social relationships were evaluated using a scale developed by Ishaghi et al. The scale, originally comprising 46 questions across five domains, was adapted for this study. It assessed stress management with five questions and social relationships with seven questions. Responses ranged from 'very low' to 'very high' on a 5-point Likert scale. Internal correlational coefficients were 0.71 for stress management and 0.81 for social relationships, yielding a total Cronbach's alpha coefficient of 0.76 (11).

Data analyses

Data were analyzed using SPSS version 16, employing the Logistic Regression

test, Kruskal-Wallis test, and Mann-Whitney U test due to the non-normal distribution of the data. Univariate logistic regression analyses were conducted to examine the relationship between each independent variable and MCI. Variables were included in the analysis if they had a p-value of less than 0.01 to ensure a high level of statistical rigor. The variables included in the analysis were social relationships, stress management, age, and gender. The estimated indices for the logistic regression analysis included odds ratios and 95% confidence intervals. Statistical significance was set at $p < 0.05$ for all analyses.

Results

A total of 506 older adults participated, 419 from urban areas and 87 from rural areas in Kermanshah. Among them, 54% were men, and 70% were illiterate, with an 80% illiteracy rate among rural participants. Forty-five percent of the participants were aged between 60 and 65 years old. Details are summarized in Table 1. The overall prevalence of MCI was 21.9%. Urban areas showed a 15% prevalence, while rural areas had a higher prevalence rate of 55%.

Table 1. Demographic characteristics of the study participants (N = 506)

Variables		Total	Urban	Rural	P-value*
		N (%)	N (%)	N (%)	
Gender	Women	251 (49.6)	228 (90.8)	23 (9.2)	0.85
	Men	255 (50.4)	191 (74.9)	64 (25.1)	
Education	Illiterate	356 (70)	276 (77.5)	80 (22.5)	0.001
	High school	95 (19)	88 (92.6)	7 (7.4)	
	Diploma	20 (4)	20 (100)	_	
	College education	35 (7)	35 (100)	_	
Marital status	Married with partner	388 (77)	302 (77.8)	86 (22.2)	0.001
	Single	16 (3)	16 (100)	_	
	Divorced or Widow	102 (20)	101 (99)	1 (1)	
Economic status	Weak (Costs more than income)	234 (46)	210 (89.7)	24 (10.3)	0.01
	Average (Costs and income are equal)	217 (43)	166 (76.5)	51 (23.5)	
	Good (Income more than costs)	55 (11)	43 (78.2)	12 (21.8)	
Employment status	Employed	126 (25)	70 (55.6)	56 (44.4)	0.001
	Unemployed	117 (23)	105 (89.7)	12 (10.3)	
	Retired	85 (17)	85 (100)	_	
	Housewife	178 (35)	159 (89.3)	19 (10.7)	
Age	60-65	230 (45)	192 (83.5)	38 (16.5)	0.001
	65-70	132 (26)	95 (72)	37 (28)	
	70-75	94 (19)	86 (91.5)	8 (8.5)	
	> 75	50 (10)	46 (92)	4 (8)	
Residence		506 (100)	419 (82.8)	87 (17.2)	0.01

* Chi-squared test

Significant differences were found in social relationships between the MCI and healthy cognitive groups in both urban ($p = 0.001$) and rural ($p = 0.04$) areas, according to the Mann-Whitney U test. However, stress management significantly differed between the groups only in urban areas ($p = 0.001$). A significant difference was also observed in gender between the MCI and healthy cognitive groups in urban areas ($p = 0.002$). Additionally, based on the Kruskal-Wallis test, age showed significant differences between the MCI and healthy cognition groups in urban ($p = 0.001$) and rural ($p = 0.013$) areas. Contrary to the urban population, there was a significant association between education ($p = 0.02$) and economic status ($p = 0.012$) with MCI in the rural elderly (Table 2).

The logistic regression analysis (Table 3) examined the association between two factors and cognition in older adults. Results showed significant associations between cognition, social relationships, and stress management. Each one-unit increase in the social relationship score corresponded to a 1.12 increase in the odds of healthy cognition (95% CI: 1.06 - 1.19). Similarly, each one-unit increase in the stress management score corresponded to a 1.25 increase in the odds of healthy cognition (95% CI: 1.16 - 1.35).

Table 2. A comparison of MCI among older adults based on stress management, social relationships, and demographic variables within the rural and urban samples

Variable		MCI N (%)		P-value*	
		Urban N (%)	Rural N (%)	Urban (P-value)	Rural (P-value)
Stress management		63 (15)	48 (55)	0.001**	0.896**
Social relationship		63 (15)	48 (55)	0.001**	0.04**
Gender	Man	40 (63.5)	38 (80)	0.002**	0.191**
	Woman	23 (36.5)	10 (20)		
Education	Illiterate	49 (77.8)	48 (100)	0.057*	_***
	High school	6 (9.5)	_		
	Diploma	4 (6.3)	_		
	College education	4 (6.3)	_		
Marital status	Married	47 (74.6)	47 (97.9)	0.788*	0.367*
	Single	1 (1.6)	-		
	Divorced	15 (23.8)	1 (2.1)		
Employment status	Employed	9 (14.3)	35 (72.9)	0.194*	0.102*
	Housewife	19 (30.2)	9 (18.8)		
	Retired	11 (17.5)	_		
	Unemployed	24 (38.1)	4 (8.3)		
Economic situation	Weak (Costs more than income)	27 (42.9)	10 (20.8)	0.45*	0.012*
	Average (Costs and income are equal)	32 (50.8)	27 (56.3)		
	Good (Income more than costs)	4 (6.3)	11 (22.9)		
Age	60-65	16 (25.4)	15 (31.3)	0.001*	0.013*
	65-70	10 (15.9)	25 (52.1)		
	70-75	27 (42.9)	4 (8.3)		
	> 75	10 (15.9)	4 (8.3)		

* Kruskal-Wallis test, **Mann-Whitney U test, ***All participants with MCI in the rural region were illiterate

Table 3. Logistic regression analysis of factors associated with cognition

Variable	B	S.E	OR	95% Confidence interval
Social relationship	0.12	0.02	1.12	1.06 - 1.19
Stress management	0.22	0.04	1.25	1.16 - 1.35
Age	- 0.38	0.10	0.68	0.55 - 0.83
Gender	1.06	0.23	2.91	1.85 - 4.57

Discussion

This study aimed to investigate MCI and its determinants in urban and rural areas among older adults. The findings revealed that the MCI prevalence in the total population was 21.9%, which is consistent with findings from a study in 2022 reporting an MCI prevalence of 27% (12). Similarly, another study in America reported an MCI prevalence of 20% (13). Based on the present study's findings, this prevalence was higher in rural areas, possibly due to limited access to healthcare services and educational resources (14).

Another finding of this study was that social relationships were associated with MCI in older adults. Social relationships are crucial in maintaining cognitive function through cognitive stimulation, emotional support, and engagement in stimulating social activities (15,16). Individuals with stronger social networks often have more opportunities for cognitive engagement, such as meaningful conversations and social interactions, which can help preserve cognitive function (17). Additionally, social relationships may buffer against the adverse effects of loneliness (18), a known risk factor for cognitive decline (19).

The findings also indicated an association between stress management and mild cognitive function. Chronic stress has been implicated in cognitive decline through its impact on physiological pathways, including the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system (20). Prolonged activation of these stress-response systems can lead to dysregulation of cortisol levels, neuroinflammation, and oxidative stress, all detrimental to cognitive health (21). Additionally, stress may indirectly affect cognitive function by promoting unhealthy coping behaviors such as smoking, excessive alcohol consumption, and poor dietary habits, which are known risk factors for cognitive impairment (22).

Furthermore, the findings indicated a relationship between MCI and the age of older adults. This association may be explained by various underlying mechanisms inherent to the aging process. Age-related changes in the brain, such as neuronal loss, synaptic dysfunction, and the accumulation of amyloid-beta plaques and tau tangles, contribute to cognitive decline and increase the risk of developing MCI (23). Moreover, aging is often accompanied by other health conditions, such as cardiovascular disease, diabetes, and hypertension, which can further exacerbate cognitive decline (24,25).

Despite the valuable insights provided by this study, several limitations warrant consideration. Firstly, the study's cross-sectional design precludes the establishment of causality between the identified factors and MCI. Additionally, the study relied on self-reported measures for variables such as social relationships and stress management, which may be subject to recall and social desirability biases. Future studies should aim to replicate these findings in diverse populations, including older adults in both marginal and non-marginal areas of cities, to enhance the external validity of the results.

Conclusion

This study elucidates the prevalence and determinants of MCI among older adults in both urban and rural areas of Kermanshah City. Psychosocial factors, such as social relationships and stress management, emerge as crucial in understanding cognitive health in later life. The higher prevalence of MCI in rural areas signals the necessity for targeted interventions addressing the unique challenges in these communities. Additionally, the study highlights that education and economic situation are particularly associated with MCI in older adults residing in rural areas, suggesting that targeted strategies to improve educational and economic conditions could significantly enhance cognitive health in these populations.

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Ethical statement

The study was carried out after obtaining ethical approval from the Research Committee of Kermanshah University of Medical Sciences with code IR.KUMS.REC.1401.565. Prior to participation, all participants were informed about the study objectives and their right to withdraw at any point during the study.

Conflicts of interest

The authors declare no conflicts of interest.

Author contributions

ZR: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Writing - Original draft. LR: Conceptualization, Methodology, Writing - Review and Editing. MR: Conceptualization, Data Curation, Investigation, Methodology, Writing - Review and Editing. NS: Formal Analysis, Writing - Review and Editing.

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