BMC Neurology

RESEARCH

Open Access

Factors associated with dementia risk reduction lifestyle in mild cognitive impairment: a cross-sectional study of individuals and their family caregivers

Hong Chen[1], Yongmei Deng[2], Xuan Li[2], Aicong Ding[1], Jiamei Wang[1], Ai Sun[3], Houmian Tu[4] and Yuchen Qiao[1*]

Abstract

Objective A healthy lifestyle has been shown to mitigate cognitive decline in patients with mild cognitive impairment, with family caregivers playing a pivotal role in the patients' lifestyle management. Exploring the level of dementia risk reduction lifestyle and the influencing factors at both the patient and caregiver levels in patients with mild cognitive impairment is crucial for identifying strategies to improve patients' lifestyles and delay disease progression.

Methods Using a convenience sampling method, 302 patients with mild cognitive impairment and their family caregivers admitted to the neurology departments of four tertiary care hospitals in China, from December 2024 to February 2025 were recruited and surveyed using a general information questionnaire, the Dementia Risk Reduction Lifestyle Scale (DRRLS), the Motivation to Change Lifestyle and Health Behaviors for Dementia Risk Reduction scale (MCLHB-DRR), the Perceived Social Support Scale (PSSS), and the Mutuality Scale (MS). Multiple linear regression was used to analyze the factors influencing the dementia risk reduction lifestyle of patients.

Results DRRLS score of 83.61 ± 16.13, multiple linear regression showed that the patient's monthly individual income, the presence of chronic disease, health beliefs, and social support were independent influences on their dementia risk reduction lifestyle. Furthermore, the lifestyle and mutuality of family caregivers were also independent influences on dementia risk reduction lifestyle in patients. The final model explained 75.5% of the variance in the lifestyle.

Conclusions Patients with mild cognitive impairment have a general level of dementia risk reduction lifestyle. The characteristics of both patients and caregivers collectively influence the patients' lifestyle. Healthcare providers should conduct early dyadic assessments and develop targeted dyadic intervention strategies based on influencing factors to improve patients' lifestyles and help them delay disease progression.

Keywords Alzheimer's disease, Mild cognitive impairment, Caregiver, Lifestyle, Influencing factors

*Correspondence:
Yuchen Qiao
qiaoyc2015@163.com
[1]Department of Neurology, Xuanwu Hospital Capital Medical University, Beijing 100053, China
[2]Department of Neurology, Tiantan Hospital Capital Medical University, Beijing 100071, China
[3]Department of Neurology, The First Hospital of Hebei Medical University, Shijiazhuang 050000, Hebei, China
[4]Department of Neurology, The First Hospital of Anhui Medical University, Hefei 230022, Anhui, China

Background

Alzheimer's disease (AD) continuum is estimated to affect 4.16 million individuals and has emerged as a major public health issue [1]. Mild cognitive impairment (MCI) due to AD is considered a prodromal stage of AD, characterized by cognitive decline exceeding that expected for an individual's age and education level, yet not severe enough to meet diagnostic criteria for dementia [2]. Early intervention at this stage holds the potential to prevent or delay the onset of dementia and sustain quality of life [3]. Lifestyle intervention provides a viable strategy for lowering dementia risks in patients with MCI.

Dementia risk reduction lifestyle incorporates various aspects such as a healthy diet, frequent exercise, cognitively stimulating activities, and social engagement [4]. The results of the Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER) trial demonstrate that multidomain lifestyle interventions are effective in preventing cognitive decline in at-risk older adults [5]. Therefore, dementia risk reduction lifestyle interventions constitute a critical component of preventive measures for dementia in high-risk individuals [4, 6]. However, adopting and maintaining dementia risk reduction lifestyle is challenging. The BRAIN BOOTCAMP, a multidomain lifestyle intervention program aimed at mitigating dementia risk, exhibited a substantial attrition rate of 58.3% [7]. Thus, investigating the factors influencing dementia risk reduction lifestyle levels in patients with MCI due to AD is crucial for developing precise intervention strategies.

According to Social Cognitive Theory, individual psychological factors and social environmental factors drive changes in individual behavior [8]. Health beliefs are a key psychological factor and will determine how patients perceive the severity of their illnesses and the necessity of adopting to healthy behavior [9]. A previous study has indicated that stronger health beliefs are associated with better health behaviors in the context of dementia prevention among Chinese adults [10]. Social support, functioning as a positive social environmental factor, refers to the perceived understanding and assistance individuals receive from their personal relationships, such as family members, friends, and other significant individuals [11]. Patients who receive adequate social support tend to exhibit greater confidence in their self-management behaviors [12]. Research indicates that social support can facilitate the adoption and maintenance of healthy lifestyles among individuals with chronic diseases [13].

Furthermore, an individual's propensity to engage in healthy behaviors is significantly modulated by the cognitive appraisal of others [14]. Investigation reveals that approximately 77.2% of individuals diagnosed with AD in China receive care from family caregivers [15]. Family caregivers are typically the primary source of cognitive appraisal for patients with MCI due to AD [16]. According to the Dyadic Health Influence Model, caregivers can positively influence patients' healthy behaviors by modeling healthy behaviors and improving the mutuality [17]. Therefore, the family caregivers' dementia risk reduction lifestyle and mutuality may influence the dementia risk reduction lifestyle of patients with MCI due to AD.

In prior research, several factors associated with the adoption of dementia risk reduction lifestyle among cognitively normal elder adults have been identified, including individuals' gender, educational level, personal monthly income, and experience of receiving dementia-related health education [18, 19]. However, the applicability of these findings in patients with MCI remains unclear due to the differences in health conditions and healthcare experience. Furthermore, existing studies on dementia risk reduction lifestyle primarily focus on the perspectives of individuals, the relationship between family caregivers' characteristics and patients' dementia risk reduction lifestyle has not been explored. It is imperative to examine the factors that may influence the lifestyle of patients with MCI from the perspectives of family caregivers to inform intervention strategies.

Therefore, by including a diverse range of socio-demographic characteristics and behavior-related variables determined by Social Cognitive Theory and Dyadic Health Influence Model, the study aimed to (1) investigate the current state of dementia risk reduction lifestyle among patients with MCI due to AD; (2) examine the effects of patient characteristics, health beliefs, and social support on patients' dementia risk reduction lifestyle; and (3) explore the influence of caregiver characteristics, dementia risk reduction lifestyle, and mutuality on patients' dementia risk reduction lifestyle.

Methods

Study design

This study employed a cross-sectional survey design, which was conducted between December 2024 and February 2025 at the neurology departments of four tertiary care hospitals in China. This study was approved by the Ethics Committee of Xuanwu Hospital, Capital Medical University ([2024]319-001), and was performed in compliance with the principles outlined in the Declaration of Helsinki.

Participants and sample size

Participants were recruited using a convenience sampling method. The inclusion criteria for patients were as follows: (1) aged 50 years or older, (2) diagnosed with MCI due to AD, and (3) willingness to participate. The exclusion criteria for patients were as follows: (1) presence of drug addiction, traumatic brain injury, epilepsy, encephalitis, or other neurological diseases that may lead

to cognitive and motor disorders, and (2) severe impairments in vision, hearing, or speech. The inclusion criteria for family caregivers were as follows: (1) aged 18 years or older, (2) identified by the patient as the primary caregiver, (3) care duration ≥ 3 months and care time ≥ 4 h per day, and (4) willingness to participate. The exclusion criteria for family caregivers were as follows: (1) providing professional and compensated care, and (2) suffering from a mental illness that impairs normal communication and interaction.

The sample size was determined using the formula n = [$=u^2_{\alpha/2}\ \sigma^2\ /\ \delta^2$], in accordance with a previous relevant study [18], the standard deviation (σ) of the score associated with the Dementia Risk Reduction Lifestyle Scale was measured as 13.27, and allowable error $\delta = 2$. The initial calculation yielded a required sample size of 169. To account for a loss rate of 20%, for the final required sample size was adjusted to 211.

Data collection

Standardized anonymous questionnaires were administered to patients and their family caregivers by trained interviewers. Participants provided informed consent after being informed about the study's purpose and significance. Participants completed paper-based questionnaires independently. Those who were unable to complete the questionnaire independently were assisted by the interviewers, who read out the questions and recorded their answers without providing any prompts or suggestions. After completing the questionnaires, the interviewers immediately reviewed the quality and completeness of the responses on-site.

Measures

General sociodemographic and clinical information

Based on a preliminary literature review and expert panel discussions, we developed a questionnaire to collect general sociodemographic and clinical information (supplementary 1). This study investigated both patients' and caregivers' age, gender, marital status, education level, monthly individual income, current work status, and primary dwelling place. Additionally, patients supplied disease duration, presence of chronic disease, family history of dementia, and residence patterns, as well as caregivers supplied relationship type with the patient, daily caregiving hours, self-perceived health status, and co-caregivers.

Dementia risk reduction lifestyle

The Dementia Risk Reduction Lifestyle Scale (DRRLS) is a self-reported tool designed to evaluate lifestyles associated with the prevention or mitigation of dementia risk. The DRRLS was developed by Zhang [20]. The DRRLS is comprised of 32 items that assess 8 dimensions: health responsibility, brain-healthy exercise, brain-healthy diet, mental activity, smoking cessation behavior, interpersonal relationship, stress management, and spiritual growth. Each item employs a Likert-type scoring system. Responses are quantified on a four-point scale ranging from 0 ("Never") to 3 ("Always"), with higher aggregate scores reflecting a healthier lifestyle. Reliability analysis demonstrated strong internal consistency, with Cronbach's α coefficients of 0.931 for patients and 0.938 for caregivers.

Health belief

The Motivation to Change Lifestyle and Health Behaviors for Dementia Risk Reduction scale (MCLHB-DRR) is a self-reported tool designed to evaluate health beliefs regarding dementia prevention. The MCLHB-DRR was originally developed by Kim [21]and subsequently translated into Chinese by Wang [21]. The Chinese version of the MCLHB-DRR is comprised of 27 items that assess 7 dimensions: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, health motivation, and self-efficacy. Each item employs a Likert-type scoring system. Responses are quantified on a five-point scale ranging from 0 ("Strongly disagree") to 4 ("Strongly agree"), with higher aggregate scores reflecting greater health beliefs. Reliability analysis demonstrated strong internal consistency, with Cronbach's α coefficients of 0.899 for patients.

Social support

The Perceived Social Support Scale (PSSS) is a self-reported tool designed to evaluate social support. The PSSS was originally developed by Zimet [22] and subsequently translated into Chinese by Jiang [23]. The PSSS is comprised of 12 items that assess 3 dimensions: family support, friend support, and other support. Each item employs a Likert-type scoring system. Responses are quantified on a seven-point scale ranging from 0 ("Strongly disagree") to 6 ("Strongly agree"), with higher aggregate scores reflecting greater social support. Reliability analysis demonstrated strong internal consistency, with Cronbach's α coefficients of 0.936 for patients.

Mutuality

The Mutuality Scale (MS) is a self-reported tool designed to evaluate mutuality. The MS was originally developed by Archbold [24] and subsequently translated into Chinese by Shyu [25]. The MS is comprised of 15 items that assess 4 dimensions: love and emotions, reciprocity, sharing happiness, and sharing values. Each item employs a Likert-type scoring system. Responses are quantified on a five-point scale ranging from 0 ("Not at all") to 4 ("A lot"), with higher aggregate scores reflecting higher mutuality. Reliability analysis demonstrated strong internal

consistency, with Cronbach's α coefficients of 0.960 for caregivers.

Data analysis

This study employed SPSS 26.0 software for statistical analysis. Quantitative data that conformed to a normal distribution were described using the mean and standard deviation, while qualitative data were described using frequency and percentage. Single-factor analysis was conducted using independent samples *t*-tests or one-way analysis of variance (ANOVA). The correlation between variables was analyzed using Pearson correlation analysis. Multivariate analysis was performed using multiple linear regression. A P-value of less than 0.05 was considered statistically significant.

Results

Among the 318 invited patient-caregiver dyads, 10 dyads declined to participate, and 6 dyads submitted invalid questionnaires. Ultimately, 302 dyads were included in the data analysis. The average age of the patients was (67.67 ± 8.18) years. Approximately one-third of the patients had an educational level of junior high school or below; the majority of patients resided in urban areas. The average age of the family caregivers was (62.26 ± 12.64) years. Most caregivers were spouses of the patients, and about two-thirds of the caregivers reported good self-perceived health. The sociodemographic and clinical characteristics of the participants are presented in Table 1.

The descriptive analyses and univariate analysis of dementia risk reduction lifestyle in patients with MCI due to AD

The total average score of dementia risk reduction lifestyle for patients with MCI due to AD was 83.61 ± 16.13. Table 2 displays the total score and the scores for each dimension. Univariate analysis results indicate that the dementia risk reduction lifestyle of patients differs significantly across various patients' levels of education, primary dwelling place, monthly individual income, and presence of chronic disease. Furthermore, the dementia risk reduction lifestyle exhibits statistically significant variations in relation to the family caregivers' educational level, primary dwelling place, monthly individual income, daily caregiving hours, self-perceived health status, and co-caregivers. (Table 1)

Correlation analysis of the study variables

Correlation analysis revealed that patients' health beliefs ($r = 0.727$, $P<0.001$) and social support ($r = 0.773$, $P<0.001$), as well as family caregivers' dementia risk reduction lifestyle ($r = 0.532$, $P<0.001$) and mutuality ($r = 0.526$, $P<0.001$), were all positively associated with the dementia risk reduction lifestyle of patients with MCI due to AD. (Table 3)

Multivariate analysis of dementia risk reduction lifestyle in patients with MCI due to AD

In a multiple linear regression analysis, we used dementia risk reduction lifestyle scores in patients with MCI due to AD as the dependent variable and the 13 statistically significant variables identified through univariate and correlation analyses as independent variables. The results revealed that a patient's monthly individual income, the presence of chronic disease, health beliefs, and social support were significant predictors of their dementia risk reduction lifestyle. Furthermore, the lifestyle and mutuality of family caregivers were also identified as significant predictors of patients' dementia risk reduction lifestyle. These variables can explain 75.5% of the variance in dementia risk reduction lifestyle ($F = 67.37$, $P<0.001$, Adjusted $R^2 = 0.755$).(Table 4).

Discussion

This study aimed to investigate the level of dementia risk reduction lifestyle among patients with MCI due to AD, as well as the associated factors influencing these lifestyles, from both patient and caregiver perspectives. The study found that patients with higher monthly individual income, without chronic disease, better health beliefs and social support, elevated levels of caregivers' dementia risk reduction lifestyle and increased caregivers' mutuality, are more inclined to adopt the dementia risk reduction lifestyle. However, our study did not find any significant association between caregivers' socio-demographic characteristics and patients' lifestyle.

According to the study's findings, the average score of dementia risk reduction lifestyle of patients with MCI due to AD was 83.61 ± 16.13, and the average score of items was 2.61 ± 0.50. The score indicates a general level of lifestyle, which is lower than the results of Zhang et al. [18]. This may be attributed to differences in the study populations. Research indicates that a positive correlation between the severity of cognitive impairment and the adoption of unhealthy lifestyle [26]. MCI is characterized by noticeable changes in memory and executive function, which may impair instrumental activities of daily living, thereby making it more challenging for patients to adhere to healthy lifestyle, such as regular exercise, healthy diets and cognitive training [27, 28]. Furthermore, patients with MCI often experience elevated levels of depression, anxiety, and social isolation, which may reduce their motivation to adopt a healthy lifestyle [29, 30]. This finding highlights the need to focus on the level of dementia risk reduction lifestyle in patients with MCI due to AD. Healthy lifestyle are associated with the prevention or deceleration of cognitive decline in older adults, whereas

Table 1 Sample descriptives and univariate analyses of dementia risk reduction lifestyle in patients with MCI due to AD ($n=302$)

	Variables	*N* (%)	DRRLS M(SD)	t/F	*P*
Patients					
Age				1.157	0.316
	<60	56 (18.5)	80.95 ± 15.49		
	60 ~ 74	184 (60.9)	83.82 ± 16.16		
	≥ 75	62 (20.5)	85.39 ± 16.55		
Gender				-1.397	0.164
	Male	88 (29.1)	81.59 ± 14.91		
	Female	214 (70.9)	84.44 ± 16.57		
Education level				39.299	<0.001
	Junior high school or lower	111 (36.8)	75.92 ± 14.30		
	High school/vocational high school	97 (32.1)	82.60 ± 15.84		
	University and above	94 (31.1)	93.73 ± 12.88		
Current work status				0.027	0.978
	Unemployed	272 (90.1)	83.62 ± 16.15		
	Employed	30 (9.9)	83.53 ± 16.25		
Marital status				0.716	0.474
	Married	267 (88.4)	83.85 ± 16.12		
	Single/divorced/widowed	35 (11.6)	81.77 ± 16.34		
Primary dwelling place				5.267	<0.001
	City	251 (83.1)	85.72 ± 15.97		
	Village	51 (16.9)	73.22 ± 12.58		
Monthly individual income[a]				24.204	<0.001
	0-4999	153 (50.7)	77.97 ± 14.88		
	5000–9999	114 (37.7)	87.94 ± 15.87		
	>10,000	35 (11.6)	94.17 ± 12.46		
Disease duration				0.304	0.738
	<1 year	96 (31.8)	83.80 ± 16.48		
	1–3 years	149 (49.3)	84.05 ± 15.96		
	>3 years	57 (18.9)	82.12 ± 16.17		
Presence of chronic disease				4.067	<0.001
	No	157 (52.0)	87.15 ± 15.67		
	Yes	145 (48.0)	79.78 ± 15.79		
Family history of dementia				-0.542	0.589
	No	210 (69.5)	83.28 ± 15.68		
	Yes	92 (30.5)	84.37 ± 17.17		
Residence pattern				1.112	0.330
	Live with spouse	182 (60.3)	84.73 ± 16.34		
	Live with children	40 (13.2)	81.72 ± 15.64		
	Live with spouse and children	80 (26.5)	82.00 ± 15.86		
Caregivers					
Age				2.355	0.097
	<60	105 (34.8)	80.91 ± 16.19		
	60 ~ 74	154 (51.0)	84.79 ± 15.77		
	≥ 75	43 (14.2)	85.95 ± 16.78		
Gender				1.240	0.216
	Male	180 (59.6)	84.56 ± 15.68		
	Female	122 (40.4)	82.21 ± 16.74		
Education level				24.034	<0.001
	Junior high school or lower	74 (24.5)	74.65 ± 12.68		
	High school/vocational high school	99 (32.8)	82.39 ± 15.33		
	University and above	129 (42.7)	89.68 ± 15.94		
Current work status				-0.023	0.982
	Unemployed	210 (69.5)	83.60 ± 15.91		

Table 1 (continued)

	Variables	*N* (%)	DRRLS M(SD)	t/F	*P*
	Employed	92 (30.5)	83.64 ± 16.71		
Primary dwelling place				4.889	<0.001
	City	264 (87.4)	85.27 ± 15.98		
	Village	38 (12.6)	72.08 ± 12.03		
Marital status				-0.329	0.742
	Married	299 (99.0)	83.58 ± 16.12		
	Single/divorced/widowed	3 (1.0)	86.67 ± 20.40		
Monthly individual income[a]				23.628	<0.001
	0-4999	113 (37.4)	76.51 ± 13.81		
	5000–9999	123 (40.7)	85.72 ± 15.38		
	>10,000	66 (21.9)	91.82 ± 16.36		
Relationship type with the patient				1.549	0.123
	Spouse	239 (79.2)	84.44 ± 15.83		
	Child	63 (20.8)	80.90 ± 16.75		
Daily caregiving hours[b]				5.665	0.004
	4–8	113 (37.4)	79.66 ± 15.19		
	8–12	84 (27.8)	85.40 ± 15.79		
	>12	105 (34.8)	86.42 ± 16.68		
Self-perceived health status				10.007	<0.001
	Good	212 (70.2)	86.17 ± 16.50		
	Fair	67 (22.2)	78.55 ± 13.27		
	Poor	23 (7.6)	74.74 ± 14.07		
Co-caregivers				-4.649	<0.001
	No	156 (51.7)	79.57 ± 14.99		
	Yes	146 (48.3)	87.92 ± 16.23		

Abbreviations: M, mean; SD, standard deviation; DRRLS, Dementia Risk Reduction Lifestyle Scale; *t*, independent *t* test; F, one-way ANOVA

[a]: The monetary unit of the monthly individual income is RMB yuan;

[b]: The daily caregiving hours refers to the duration of daily caregiving;

Table 2 Score of patients with MCI due to AD on dementia risk reduction lifestyle ($n = 302$)

Variables	Total score, M (SD)	Item score, M (SD)
Total score of dementia risk reduction lifestyle	83.61 ± 16.13	2.61 ± 0.50
Healthy responsibility	10.61 ± 2.97	2.65 ± 0.74
Brain-healthy exercise	9.72 ± 3.05	1.94 ± 0.61
Mental activity	3.84 ± 1.72	1.92 ± 0.86
Brain-healthy diet	13.73 ± 3.14	2.75 ± 0.63
Smoking cessation behavior	7.27 ± 1.39	3.63 ± 0.70
Interpersonal relationship	13.75 ± 3.95	2.75 ± 0.79
Stress management	12.26 ± 2.56	3.06 ± 0.64
Spiritual growth	12.40 ± 3.59	2.48 ± 0.72

Abbreviations: M, mean; SD, standard deviation

Table 3 Correlation analysis between dementia risk reduction lifestyle and other related scales in patients with MCI due to AD ($n = 302$)

Variables	Patients' DRRLS	MCLHB-DRR	PSSS	Caregivers' DRRLS	MS	Scores M (SD)
Patients' DRRLS	1					83.61 ± 16.13
MCLHB-DRR	0.727**	1				104.03 ± 14.46
PSSS	0.773**	0.604**	1			60.07 ± 13.05
Caregivers' DRRLS	0.532**	0.458**	0.369**	1		87.29 ± 16.24
MS	0.526**	0.410**	0.507**	0.318**	1	56.42 ± 11.67

Abbreviations: M, mean; SD, standard deviation; DRRLS, Dementia Risk Reduction Lifestyle Scale; MCLHB-DRR, Motivation to Change Lifestyle and Health Behaviors; PSSS, Perceived Social Support Scale; MS, Mutuality Scale

** $P<0.001$

Table 4 The multiple linear regression analysis of dementia risk reduction lifestyle in patients with MCI due to AD ($n = 302$)

Variables	B	SE	Beta	t	*P*
Patient					
Education level	0.757	0.844	0.039	0.897	0.371
Primary dwelling place	0.683	2.247	0.016	0.304	0.761
monthly individual income	2.246	0.979	0.096	2.294	0.023
presence of chronic disease	-2.975	0.955	-0.092	-3.114	0.002
MCLHB-DRR	0.323	0.044	0.290	7.301	<0.001
PSSS	0.534	0.049	0.432	10.874	<0.001
Caregiver					
Education level	1.161	0.977	0.058	1.188	0.236
Primary dwelling place	-0.402	2.533	-0.008	-0.159	0.874
monthly individual income	-0.268	1.049	-0.013	-0.255	0.799
Daily caregiving hours	-0.096	0.584	-0.005	-0.164	0.870
Self-perceived health status	-0.599	0.810	-0.023	-0.740	0.460
Co-caregivers	0.658	0.996	0.020	0.661	0.509
DRRLS	0.122	0.041	0.123	3.001	0.003
MS	0.153	0.048	0.111	3.203	0.002

Abbreviations: DRRLS, Dementia Risk Reduction Lifestyle Scale; MCLHB-DRR, Motivation to Change Lifestyle and Health Behaviors; PSSS, Perceived Social Support Scale; MS, Mutuality Scale

unhealthy lifestyle are linked to an increased risk of cognitive impairment [31, 32].

The results indicated that the patients obtained the lowest scores in the mental activity dimension, which is consistent with the finding of Sun et al. [26]. It is noteworthy that only 34.23% of individuals aged 60 and above in China have engaged in mental activities [33]. This may be associated with the generally lower level of education among older adults. Educational attainment can lead to individual differences in exposure to cognitive stimulation and acquisition of cognitive skills [34]. The dimension with the second-lowest score is brain-healthy exercise. The lack of physical activity can lead to an increased risk of cardiovascular diseases and accelerate the progression of dementia [35]. The American Academy of Neurology has incorporated physical activity as a non-pharmacological intervention for individuals with MCI in their updated guidelines [36]. However, the current state of physical activity among patients with MCI remains concerning. Research had found that 61% of participants with MCI exhibit insufficient levels of physical activity [37]. Negative perceptions of exercise, insufficient knowledge, and physical function impairment serve as significant barriers to physical activity participation among patients with MCI [38]. In conclusion, it is imperative for healthcare professionals to implement lifestyle interventions aimed at reducing dementia risk in patients with MCI due to AD. Understanding the facilitators and barriers that influence patients' adherence to dementia risk reduction lifestyle is crucial for the effective implementation of these interventions.

This study found that patients with higher monthly individual income levels were more inclined to adopt dementia risk reduction lifestyle. Economic income is an indicator of socioeconomic status. Socioeconomic status can influence an individual's perception of disease, access to health information, and the availability of healthcare services [39]. Individuals with higher socioeconomic status possess better health literacy and exhibit a stronger subjective willingness to adopt healthy lifestyle choices [40]. A previous study has found that lifestyle mediates the relationship between socioeconomic status and individual health [41]. Therefore, it is crucial to focus on patients with disadvantaged socioeconomic status in healthy lifestyle management.

This study found that patients without chronic disease were more inclined to adopt dementia risk reduction lifestyle. Existing evidence suggests that individuals with multimorbidity tend to have less healthy lifestyle [42]. Given the inherent characteristics of chronic diseases, patients often suffer from long-term physical and psychological distress. Patients with multimorbidity frequently experience limitations in physical function, compromised mental health, and impaired social interaction capabilities [43, 44]. These factors collectively exert a negative influence on the adoption of dementia risk reduction lifestyle. Consistent interaction and shared daily life with partners may attenuate the adverse effects of multimorbidity on role functioning among older adults [43, 44]. Therefore, it is advisable to encourage family caregivers to provide both practical assistance and emotional support to patients in lifestyle interventions, thereby enhancing the level of dementia risk reduction lifestyle in patients.

The findings of this study indicate that patients with stronger health beliefs exhibit higher levels of engagement in dementia risk reduction lifestyle. The Health Belief Model emphasizes that health belief serves as a driving force for individual behavioral change [45]. Health beliefs are influenced by individuals' level of disease cognition [46]. Educational interventions grounded in the Health Belief Model can significantly enhance individuals' disease cognition and health belief levels, thereby improving their health behaviors [47]. Consequently, healthcare providers must intensify health education efforts focused on dementia prevention, promoting accurate understanding and awareness of dementia and its preventive measures among patients. This will empower patients to adopt health beliefs and lifestyle practices that are conducive to the prevention of dementia.

The findings of this study indicate that patients with stronger social support exhibit higher levels of engagement in dementia risk reduction lifestyle. Social support provided by family members, friends, or other relatives plays a crucial role in the well-being of patients. On the

one hand, social support is essential for fostering self-efficacy and promoting emotional well-being [48]. The encouragement and companionship can foster patients' willingness to actively engage in dementia risk reduction lifestyle, thereby making it easier for them to adopt healthy behaviors. On the other hand, adequate social support can enhance patients' ability to access health information and use health care [49]. Therefore, healthcare professionals should focus on establishing social support networks for patients, expanding the sources of social support to meet patient needs, and promoting positive changes in their lifestyle.

The findings of this study indicate a positive correlation between the levels of dementia risk reduction lifestyle among family caregivers and those of the patients. The family serves as the primary caregiving setting for patients with MCI [15]. Health-related family caregiver social control refers to caregivers' attempts to influence patients' health-related behaviors [50]. Meta-analyses indicate that modeling behavior, as a positive social control strategy, is associated with improvements in patients' health behaviors [51]. A large-scale cohort study focusing on older adults revealed that when one spouse adopts healthier behaviors, such as quitting smoking, increasing physical activity, and reducing weight, the other spouse is more likely to engage in similar positive health behavior modifications [52]. Given the shared daily living environments of patients and family caregivers, dyadic interventions targeting both the patient and the caregiver may result in more sustained lifestyle modifications compared to interventions focusing solely on the patient.

The findings of this study indicate that family caregivers' mutuality positively predicts the level of dementia risk reduction lifestyle among patients with MCI due to AD. A strong mutuality can enhance caregivers' contributions to patients' self-management behaviors. Previous studies have shown that the joint participation of caregivers and patients in patients' self-management behaviors can improve patients' exercise adherence [53]. Therefore, positive mutuality contributes to maintaining dementia risk reduction lifestyle in patients with MCI. Mutuality also can influence the effectiveness of dyadic interventions [53, 54]. Healthcare providers may need to incorporate relationship-building strategies into dyadic lifestyle interventions to enhance the mutuality between patients and caregivers, thereby strengthening dyadic lifestyle changes.

Our findings hold significant implications for both clinical practice and future research. First, there is an urgent to improve the levels of dementia risk reduction lifestyle among patients with MCI due to AD. Second, patients' socio-demographic characteristics and behavior-related influence their adoption of dementia risk reduction lifestyle. Third, family caregivers play important roles in patients' lifestyle. Their lifestyle and mutuality had a direct effect on patients' lifestyle. Our study explored the factors influencing dementia risk reduction lifestyle from the perspectives of both the patients and their caregivers. Health providers should regard patients with MCI due to AD and their family caregivers as a team and develop dyadic interventions based on these pertinent influencing factors to improve patients' lifestyle.

Notwithstanding the contributions of this study, several limitations warrant consideration. Primarily, the adoption of a cross-sectional research design inherently constrains the capacity to establish causal relationships. Furthermore, the utilization of convenience sampling may precipitate selection bias, potentially resulting in a sample that is not representative of the broader population of individuals with mild cognitive impairment, thereby limiting the generalizability of the findings.

Conclusion

The present study revealed that patients with MCI due to AD demonstrated inadequate levels of dementia risk reduction lifestyle. Notably, significant associations were observed between patients' monthly individual income, presence of chronic disease, health beliefs, social support, and dementia risk reduction lifestyle. Furthermore, family caregivers' lifestyle and mutuality were found to exert a significant influence on patients' dementia risk reduction lifestyle. This investigation constitutes the first examination of the relationship between caregiver characteristics and patients' dementia risk reduction lifestyle, underscoring the significance of dyadic interventions targeting lifestyle modifications in patients with MCI due to AD. Consequently, healthcare providers can devise targeted dyadic intervention strategies predicated on various influencing factors to enhance patients' dementia risk reduction lifestyle, thereby slowing their cognitive decline.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12883-025-04183-8.

Supplementary Material 1

Acknowledgements

The authors express their sincere gratitude to the participants for their invaluable support and contributions to this study.

Author contributions

H.C.: experimental design; data curation and analysis; writing-original. A.D.: data collection. X.L.: data collection. H.T.: data collection. A.S.: data collection. J.W.: data curation and analysis. Y.D.: data analysis; writing-original. Y.Q.: experimental design; writing-review and editing; All authors reviewed the manuscript.

Funding

This research received no external funding.

Data availability
The datasets utilized and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
This study was approved by the Ethics Committee of Xuanwu Hospital, Capital Medical University ([2024]319-001) and was performed in accordance with the Declaration of Helsinki. Prior to the initiation of the study, patients provided written informed consent for themselves. Additionally, primary family caregivers provided written informed consent both on behalf of the patients and for their own participation.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Clinical trial number
Not applicable.

Received: 4 March 2025 / Accepted: 7 April 2025
Published online: 17 April 2025

References

1. Gustavsson A, Norton N, Fast T, Frölich L, Georges J, Holzapfel D, Kirabali T, Krolak-Salmon P, Rossini PM, Ferretti MT, et al. Global estimates on the number of persons across the Alzheimer's disease continuum. ALZHEIMERS DEMENT. 2023;19(2):658–70.
2. Jack CJ, Andrews JS, Beach TG, Buracchio T, Dunn B, Graf A, Hansson O, Ho C, Jagust W, McDade E, et al. Revised criteria for diagnosis and staging of Alzheimer's disease: Alzheimer's association workgroup. ALZHEIMERS DEMENT. 2024;20(8):5143–69.
3. Han Y, Jia J, Li X, Lv Y, Sun X, Wang S, Wang Y, Wang Z, Zhang J, Zhou J, et al. Expert consensus on the care and management of patients with cognitive impairment in China. NEUROSCI BULL. 2020;36(3):307–20.
4. Frederiksen KS, Nielsen TR, Winblad B, Schmidt R, Kramberger MG, Jones RW, Hort J, Grimmer T, Georges J, Frölich L, et al. European academy of neurology/european Alzheimer's disease consortium position statement on diagnostic disclosure, biomarker counseling, and management of patients with mild cognitive impairment. EUR J NEUROL. 2021;28(7):2147–55.
5. Ngandu T, Lehtisalo J, Solomon A, Levälahti E, Ahtiluoto S, Antikainen R, Bäckman L, Hänninen T, Jula A, Laatikainen T, et al. A 2 year multidomain intervention of diet, exercise, cognitive training, and vascular risk monitoring versus control to prevent cognitive decline in at-risk elderly people (FINGER): a randomised controlled trial. Lancet. 2015;385(9984):2255–63.
6. Frisoni GB, Altomare D, Ribaldi F, Villain N, Brayne C, Mukadam N, Abramowicz M, Barkhof F, Berthier M, Bieler-Aeschlimann M. Dementia prevention in memory clinics: recommendations from the European task force for brain health services. Lancet Reg Health–Europe 2023, 26.
7. Siette J, Dodds L, Deckers K, Köhler S, Heger I, Strutt P, Johnco C, Wuthrich V, Armitage CJ. A pilot study of BRAIN BOOTCAMP, a Low-Intensity intervention on diet, exercise, cognitive activity, and social interaction to improve older adults' dementia risk scores. JPAD-J PREV ALZHEIM. 2024;11(5):1500–12.
8. Bonita R, Magnusson R, Bovet P, Zhao D, Malta DC, Geneau R, Suh I, Thankappan KR, McKee M, Hospedales J, et al. Country actions to Meet UN commitments on non-communicable diseases: a Stepwise approach. Lancet. 2013;381(9866):575–84.
9. Peng M, Cai X, Wang Q, Li Z, Cao R, Guan B, Yang Y, Xu S, Yang Y, Yang S, et al. Effects of visualized health education based on health belief model on Self-Management of patients undergoing maintenance Hemodialysis. WESTERN J NURS RES. 2025;47(2):89–99.
10. Li H, Zhang J, Wang L, Yang T, Yang Y. A health promoting-lifestyle prediction model for dementia prevention among Chinese adults: based on the health belief model. BMC Public Health. 2022;22(1):2450.
11. Hu Y, Guo X, You H, Liu L, Wang Y. Mediating effect of social support on the relationships between caregiver burden and quality of life in family caregivers of people with dementia: a cross-sectional study in rural China. BMC NURS. 2025;24(1):37.
12. Bidwell JT, Vellone E, Lyons KS, D'Agostino F, Riegel B, Juárez-Vela R, Hiatt SO, Alvaro R, Lee CS. Determinants of heart failure Self-Care maintenance and management in patients and caregivers: A dyadic analysis. RES NURS HEALTH. 2015;38(5):392–402.
13. Zhang X, Li C, Liu M, Sun J, Yue H, Bao H. The mediation effect of health literacy on social support and health lifestyle of patients with chronic diseases. APPL NURS RES. 2024;75:151763.
14. Khoshnood Z, Rayyani M, Tirgari B. Theory analysis for Pender's health promotion model (HPM) by Barnum's criteria: a critical perspective. Int J Adolesc Med Health 2018, 32(4).
15. Xiao J, Li J, Wang J, Zhang X, Wang C, Peng G, Hu H, Liu H, Liu J, Shen L. China Alzheimer's disease: facts and figures. Hum Brain 2023, 2.
16. Caggianelli G, Alivernini F, Chirico A, Iovino P, Lucidi F, Uchmanowicz I, Rasero L, Alvaro R, Vellone E. The relationship between caregiver contribution to self-care and patient quality of life in heart failure: A longitudinal mediation analysis. PLoS ONE. 2024;19(3):e0300101.
17. Huelsnitz CO, Jones RE, Simpson JA, Joyal-Desmarais K, Standen EC, Auster-Gussman LA, Rothman AJ. The dyadic health influence model. PERS SOC PSYCHOL REV. 2022;26(1):3–34.
18. ZHANG J, PENG Y, LIU X, WANG L, LI J, YANG Y. Dementia risk reduction lifestyle status and influencing factors among Community-dwelling Middle-aged and elderly adults. Chin Gen Pract. 2023;26(13):1577.
19. Reynolds GO, Tremont G, Santorelli GD, Denby C, Margolis SA, Ott BR. Healthy lifestyle behaviors and viewpoints among members of an alzheimer prevention registry. ALZ DIS ASSOC DIS. 2022;36(2):111–7.
20. Jinying Z, Hua LI, Xiao L, Li W, Yan P, Yanni Y. Development, reliability and validity of the dementia risk reduction lifestyle scale. Chin Gen Pract. 2022;25(13):1595.
21. Kim S, Sargent-Cox K, Cherbuin N, Anstey KJ. Development of the motivation to change lifestyle and health behaviours for dementia risk reduction scale. DEMENT GER COGN D EX. 2014;4(2):172–83.
22. Zimet GD, Powell SS, Farley GK, Werkman S, Berkoff KA. Psychometric characteristics of the multidimensional scale of perceived social support. J PERS ASSESS. 1990;55(3–4):610–7.
23. Jiang Q. Perceived social support scale. Chin J Behav Med Sci. 2020;10(10):41–3.
24. Archbold PG, Stewart BJ, Greenlick MR, Harvath T. Mutuality and preparedness as predictors of caregiver role strain. RES NURS HEALTH. 1990;13(6):375–84.
25. Shyu YI, Yang CT, Huang CC, Kuo HC, Chen ST, Hsu WC. Influences of mutuality, preparedness, and balance on caregivers of patients with dementia. J NURS RES. 2010;18(3):155–63.
26. Sun Y, Zhang R, Mao Z, Yin J, Zhou Y, Wu Y. Association between Multi-Domain Lifestyle and Objective Cognitive Impairment in Elderly People with SCD and MCI in Chinese Communities. *HEALTHCARE-BASEL* 2024, 12(18).
27. Tomaszewski FS, Cahn-Weiner DA, Harvey DJ, Reed BR, Mungas D, Kramer JH, Chui H. Longitudinal changes in memory and executive functioning are associated with longitudinal change in instrumental activities of daily living in older adults. CLIN NEUROPSYCHOL. 2009;23(3):446–61.
28. Gagliardi C, Papa R, Postacchini D, Giuli C. Association between cognitive status and physical activity: study profile on baseline survey of the my Mind project. INT J ENV RES PUB HE 2016, 13(6).
29. Zhang Z, Bian Y. Association between social networks and cognitive impairment among older Chinese adults: the mediating effect of depression. FRONT AGING NEUROSCI. 2024;16:1495694.
30. Ismail Z, Elbayoumi H, Fischer CE, Hogan DB, Millikin CP, Schweizer T, Mortby ME, Smith EE, Patten SB, Fiest KM. Prevalence of depression in patients with mild cognitive impairment: A systematic review and Meta-analysis. JAMA PSYCHIAT. 2017;74(1):58–67.
31. Ornish D, Madison C, Kivipelto M, Kemp C, McCulloch CE, Galasko D, Artz J, Rentz D, Lin J, Norman K, et al. Effects of intensive lifestyle changes on the progression of mild cognitive impairment or early dementia due to Alzheimer's disease: a randomized, controlled clinical trial. ALZHEIMERS RES THER. 2024;16(1):122.
32. Duan H, Zhou D, Xu N, Yang T, Wu Q, Wang Z, Sun Y, Li Z, Li W, Ma F, et al. Association of unhealthy lifestyle and genetic risk factors with mild cognitive impairment in Chinese older adults. JAMA NETW OPEN. 2023;6(7):e2324031.
33. Guo XR, Cheng TZ, Guo J. The relationship between leisure activity participation and cognitive function among older Chinese adults: the differences across gender and age. ARCH PUBLIC HEALTH. 2024;82(1):201.

34. Lövdén M, Fratiglioni L, Glymour MM, Lindenberger U, Tucker-Drob EM. Education and cognitive functioning across the life span. PSYCHOL SCI PUBL INT. 2020;21(1):6–41.
35. de Rezende LF, Rey-López JP, Matsudo VK, Do CLO. Sedentary behavior and health outcomes among older adults: a systematic review. BMC Public Health. 2014;14:333.
36. Petersen RC, Lopez O, Armstrong MJ, Getchius T, Ganguli M, Gloss D, Gronseth GS, Marson D, Pringsheim T, Day GS et al. Practice guideline update summary: Mild cognitive impairment: Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology. *NEUROLOGY* 2018, 90(3):126–135.
37. Eymundsdottir H, Chang M, Geirsdottir OG, Gudmundsson LS, Jonsson PV, Gudnason V, Launer L, Jonsdottir MK, Ramel A. Lifestyle and 25-hydroxyvitamin D among community-dwelling old adults with dementia, mild cognitive impairment, or normal cognitive function. AGING CLIN EXP RES. 2020;32(12):2649–56.
38. Mohammad HJ, Mat LA, Singh D, Subramaniam P, Shahar S. Motivation, barriers and preferences of lifestyle changes among older adults with frailty and mild cognitive impairments: A scoping review of qualitative analysis. PLoS ONE. 2025;20(1):e0314100.
39. Vellakkal S, Subramanian SV, Millett C, Basu S, Stuckler D, Ebrahim S. Socioeconomic inequalities in non-communicable diseases prevalence in India: disparities between self-reported diagnoses and standardized measures. PLoS ONE. 2013;8(7):e68219.
40. Cockerham WC. The intersection of life expectancy and gender in a transitional State: the case of Russia. SOCIOL HEALTH ILL. 2012;34(6):943–57.
41. Wang J, Geng L. Effects of socioeconomic status on physical and psychological health: lifestyle as a mediator. INT J ENV RES PUB HE 2019, 16(2).
42. Niebuur J, Vonk JM, Du Y, de Bock GH, Lunter G, Krabbe P, Alizadeh BZ, Snieder H, Smidt N, Boezen M, et al. Lifestyle factors related to prevalent chronic disease Multimorbidity: A population-based cross-sectional study. PLoS ONE. 2023;18(7):e0287263.
43. Zhao YW, Haregu TN, He L, Lu S, Katar A, Wang H, Yao Z, Zhang L. The effect of Multimorbidity on functional limitations and depression amongst middle-aged and older population in China: a nationwide longitudinal study. AGE AGEING. 2021;50(1):190–7.
44. Müller F, Hagedoorn M, Tuinman MA. Chronic Multimorbidity impairs role functioning in middle-aged and older individuals mostly when non-partnered or living alone. PLoS ONE. 2017;12(2):e0170525.
45. Pasalari Z, Ezati RR, Hosseini Z, Torki H, Ghanbarnejad A, Aghamolaei T. Effect of an educational intervention based on health belief model on preventive behaviors against malaria in over 18-year-old Afghan immigrants living in Parsian. BMC INFECT DIS. 2024;24(1):1101.
46. Badawy Y, Bin YA, Alasri M, Alamri NA, Alrifai K. The knowledge and health belief model of osteoporosis prevention among females in Saudi Arabia. CUREUS J MED Sci. 2024;16(12):e75350.
47. Noman S, Elarusy N, Rahman HA, Ismail S, Azzani M, Taresh SM, Aljaberi MA. Investigating the effect of the educational intervention based on the health belief model on the knowledge and beliefs of Yemeni teachers in the use of breast cancer screening: a randomized controlled trial study. BMC Cancer. 2024;24(1):1506.
48. Lin Y, He M, Zhou W, Zhang M, Wang Q, Chen Y, Wang L, Guo H. The relationship between physical exercise and psychological capital in college students: the mediating role of perceived social support and self-control. BMC Public Health. 2025;25(1):581.
49. Liu YB, Hou P, Xue HP, Mao XE, Li YN. Social support, health literacy, and health care utilization among older adults. ASIA-PAC J PUBLIC HE. 2019;31(4):359–66.
50. Rook KS, Thuras PD, Lewis MA. Social control, health risk taking, and psychological distress among the elderly. PSYCHOL AGING. 1990;5(3):327–34.
51. Craddock E, VanDellen MR, Novak SA, Ranby KW. Influence in relationships: A meta-analysis on health-related social control. BASIC APPL SOC PSYCH. 2015;37(2):118–30.
52. Jackson SE, Steptoe A, Wardle J. The influence of partner's behavior on health behavior change: the english longitudinal study of ageing. JAMA INTERN MED. 2015;175(3):385–92.
53. Beverly EA, Wray LA. The role of collective efficacy in exercise adherence: a qualitative study of spousal support and type 2 diabetes management. HEALTH EDUC RES. 2010;25(2):211–23.
54. Yorgason JB, Sandberg JG, Weinstock RS, Trief PM, Fisher L, Hessler D. The importance of relationship processes for Lowering BMI over time in women with type 2 diabetes in a randomized controlled trial. OBES RES CLIN PRACT. 2019;13(6):599–601.

Publisher's note