Research Article

Health-Related Quality of Life in Individuals with Mild Cognitive Impairment Elderly Individuals

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Abstract

Background: Mild Cognitive Impairment (MCI) has attracted a lot of interest as it possibly represents the earliest point at which treatments for dementia, particularly Alzheimer's disease. However, the predictors of Health-related Quality of Life (HRQoL) in elderly individuals with MCI are unclear. The current study aimed to analyze in how far MCI affects different facets of quality of life in community-dwelling elderly. **Method:** The stratified random cluster sampling was used to recruit elderly individuals. A total of 796 elderly individuals were included with 145 (18.2%) of MCI. Cognitive function of the participants was measured by using the Mini-Mental State Examination (MMSE). Multiple Linear Regression models (stepwise) (MLRS) were used to examine the association of MCI with HRQoL and analyze factors associated with HRQoL among MCI elderly individuals. **Results:** Individuals with MCI have poorer HRQoL than those without. MLRS indicated that the main risk factors on HRQoL among MCI individuals were advanced age, women, living alone, function disability, lack of religious service attendance, poor dietary habits, history of stroke and cardiovascular diseases and depression. **Conclusion:** Effects of MCI go beyond cognition and significantly impact the lives of those affected. Further research and practice should strive to manage the risk factors to improve the quality of life of MCI elderly.

Keywords: Mild cognitive impairment; Health-related quality of life; Predictors; Community-dwelling elderly; Dementia

Abbreviations: ADL: Activities of Daily Living; AFHS: Age-Friendly Health Systems; AD: Alzheimer's Disease; BP: Bodily Pain; CDRS: Chinese version of the Mattis Dementia Rating Scale; CNHS: Chinese Nutrition and Health Survey; CES-D: Center for Epidemiologic Studies Depression Scale; RE: Emotional Problems; GH: General Health Perceptions; MH: Mental Health; MCS: Mental Composite Scores; MMSE: Mini-Mental State Examination; MCI: Mild Cognitive Impairment; MLRS: Multiple Linear Regression Models (stepwise); HRQoL: Health-Related Quality of Life; IADL: Instrumental Activities of Daily Living; PF: Physical Function; RP: Physical Problems; PCS: Physical Composite Scores; QOL: Quality of Life; SF: Social Functioning; SD: Standard Deviations; SF-36: 36-item Short-Form survey; VT: Vitality

Introduction

Alzheimer's disease (AD) is a chronic and progressive disease that occurs in elderly adults. It is one of the most common and serious disorders in later life, with a prevalence of 5% and an incidence of 2% per year among peoples aged 65 years and older [1]. In China, there are over 7 million elderly adults with AD [2]. AD is responsible for an estimated 51.3-59.8 billion yuan in annual healthcare cost [2]. Individuals with Mild Cognitive Impairment (MCI) lead to have a significantly increased risk of AD [3].

MCI represents a transitional stage between healthy aging and dementia among the older population [4]. MCI also represents what researchers and clinicians view as a "window" in which it may be possible to intervene and delay progression to dementia. Individuals with MCI develop AD at a rate of 10-15% per year, whereas the rate for healthy controls is only 1-2% per year [4]. It is therefore crucial to understand the subjective implications of MCI for those affected. In the long run, this will help to develop suitable interventions and support.

Quality of life (QOL) is a key concept for understanding the subjective dimension of MCI and the impact it has on those affected. Most researchers shown multidimensional including physical, psychological and social aspects as well as daily life activities were related to QOL [5]. However, research-comparing QOL of individuals with and without MCI is rare and inconsistent. Some studies have demonstrated no difference between the two groups, others study lower QOL for individuals with MCI in almost all areas [6,7]. MCI can increase individuals' disability and reduced their QOL as the disease progresses [8,9]. Several studies indicated that a poor Health-Related Quality of Life (HRQoL) is a strong predictor of adverse cognitive function and death [10]. At the same time, poorer HRQoL of elderly adults were associated with poor mental state, functional abilities, level of activities, chronic diseases, and socio-demographic variables [11]. Our previous study found those risk predictors were also related with cognitive impairment [12].

Dietary patterns and some dietary components were also linked with cognitive function and QOL [13]. Epidemiologic studies have indicated that higher intake of fruits, vegetables, fish, nuts, legumes seemed to be associated with reducing risk of cognitive deficits and improving QOL of MCI individuals [14]. Otherwise, researches found that depression, behavioral disturbances, substantial cognitive impairment, and high dependence in Activities of Daily Living (ADL) might be related to poor HRQoL of people living at home [15,16]. Unfortunately, most researches refer to highly selective samples from memory clinics or nursing homes [17]. Less attention has been focused on the HRQoL among community-dwelling elderly individuals with MCI.

Thus, the purpose of current study was to explore predictors of HRQoL of elderly individuals with MCI to provide critical information to facilitate improvements of HRQoL and develop effective intervention strategies or provide valuable reference material for a preventive strategy capable of reducing the incidence of dementia in China.

Material and Methods

A cross-sectional study was used to explore predictors of HRQoL among community-dwelling elderly individuals with MCI.

Definition of MCI

The study adopted the MCI diagnostic criteria from Petersen definitions as followings [18]: 1. memory complaints (either self-reported or reported by family members or caregivers); 2. objective evidence of impairment (from cognitive testing) in one or more cognitive domains, including memory, executive function, attention, language, or visuospatial skills; 3. preservation of independence in functional abilities (although individuals may be less efficient and make more errors at performing Activities of Daily Living (ADL) and instrumental activities of daily living (IADL) than in the past; 4. No evidence of a significant impairment in social or occupational functioning (i.e., "not demented").

Study Design and Participants

Detailed descriptions of the study design, a cross-sectional design have been previously reported [12]. A cluster sampling method was used to recruit the subjects. As a western big city in China, Xi'an has six districts and 760 communities.

According to the 2018 Chinese census, Xi'an has a population of 10.09 million population. Out of this total population, the percentage of elderly people (aged ≥60) is 14.83% (1.24/8.37). This study used a cluster sampling method to recruit participants and 11 communities were randomly selected. All elders ≥60 years who lived in the selected communities were recruited for a questionnaire survey. Once the investigator confirmed that the eligibility criteria were met, potential participants were approached via telephone call. If the elders exhibited an interest in the study, a face-to-face interview was conducted. The inclusion criteria were as follows: ≥60 years of age, no serious psychiatric and illness, and no sensory problems or other diseases that would make it impossible to participate in the study. Individuals were excluded if they had lived in the selected communities less than five years or were not permanent residents, had dementia, or were unable to fully communicate with the investigators.

Measures

Sociodemographic information and chronic diseases questionnaires

A sociodemographic information questionnaire was designed by the research group. The questionnaire included gender (male or female), age (years), ethnicity (Han or Hui), living arrangement (defined as alone, with or without spouse, children or other individuals), education (years of schooling), monthly income (RMB) (≤ 1000 yuan, 1000-1999 yuan, or ≥ 2000 yuan), religious attendance (Buddhism, Christianity, or Islam). Weight was measured without shoes and in light clothing to the nearest 0.1 kg. Height was determined to the nearest 0.1 cm without shoes. Body Mass Index (BMI) was calculated as weight (kg) divided by height (m) squared [19].

Individuals with hypertension or diabetes were diagnosed by grade A tertiary hospital or current use of antihypertensive or treatment diabetes drugs. A history of stroke was defined as a pre-existing sudden onset of nonconvulsive and focal neurologic deficit that persisted >24 h on the basis of all available clinical data.

Cognitive performance

All the elderly cognitive performance was assessed by two nurses and three neuropsychology professors in the community-dwelling. Meanwhile, some information was collected from individuals or family members such as chronological history of cognitive symptoms, medical history, current medications, current and history of memory performance. During the assessment, some neuropsychological scales were completed by individuals such as Mini-Mental State Examination (MMSE) [20], Chinese-language version of the Mattis Dementia Rating Scale (CDRS) [21], and six items on the ADL scale and 8 items of IADLs [22]. The full details of the questionnaire are described elsewhere [8].

The 36-item Short-Form survey (SF-36)

SF-36 questionnaire is one of the most common tools used to assess individuals HRQoL. The Chinese version of the SF-36 has a reasonable sensitivity (91.4%) and specificity (89.2%) [23]. It contains 36 items with eight subscales, including "physical function (PF)," "role limitation due to physical problems (RP)," "bodily pain (BP)," "general health perceptions (GH)," "vitality (VT)," "social functioning (SF)," "role limitation due to emotional problems (RE)," and "mental health (MH)." The subscales were summarized as physical and mental composite scores (PCS and MCS, respectively), which were calculated by assigning relative weights to each subscale as described by the developers of this instrument. The PCS subscale included PF, SF, RP, RE, and GH. The MCS subscale included MH, VT, and BP. For each dimension, the item scores were coded, summed, and transformed into a scale from zero (worst health) to 100 (best health) [17].

The Center for Epidemiologic Studies Depression Scale (CES-D)

The CES-D was used to assess depressive symptoms. It begins with "Now I have some questions about your feelings during the past week. For each of the following statements, tell me if you felt that way". The depression is identified when the score is 16 or higher [24].

Dietary habits

Dietary data were collected using the Chinese Nutrition and Health Survey (CNHS) [25], which assessed the typical frequency of food intake over the previous four weeks. This questionnaire has been demonstrated to be a valid, inexpensive, and easy tool to provide a reasonably accurate ranking of intake and to identify individuals with low intake.

Data collection and quality control

Five research nurses and two neurologists were selected as investigators. They were trained before the survey to ensure that they understood the purpose and requirements of the study. Face-to-face interviews were conducted with the subjects. An investigator explained the purpose and details of the questionnaire to ensure each subject understood every item. After the explaining, the subject selected one answer according to his/her actual status, and the investigator recorded it on the questionnaire. One of the main investigators carefully rechecked the questionnaires. Telephone interviews were conducted to obtain lost or incomplete information.

Statistical analysis

All completed questionnaires were anonymized with individual numbered. Double data entry was conducted by two independent professional data-entry workers using Epidata Version 3.1. (EpiData Association, Odense, Denmark) was used to input data. Computer and manual checks ensured accurate data coding. Data were analyzed using the SPSS 17.0 for Windows (SPSS Inc., Chicago, IL, USA).

Quantitative data were expressed as mean and Standard Deviations (SD) and the data is normally distributed. Subjects' characteristics were analyzed by t-test and ANOVA analysis and Pearson correlation, as an ANOVA analysis SNK-q test and LSD-t test were applied by pairwise comparisons. The t-test was conducted to compare differences in continuous variables between MCI and Non-MCI. Factors associated with PCS and MCS subscales of HRQoL among MCI individuals were analyzed by t-test and ANOVA analysis. Multiple Linear Regression Models (stepwise) (MLRS) was used to examine the risk factors for HRQoL in MCI elderly. Eight subscales, MCS and PCS subscales of SF-36 served as dependent variable and the 17 factors served as the independent variables, which included the sociodemographic

variables (age, gender, monthly household income, level of education, living arrangement, spouse, and religious service attendance), BMI, ADL, dietary habits, depression, chronic disease (hypertension, history of stroke, diabetes, cardiovascular disease and cancer) and the MMSE score. The adjusted R^2 contribution was compared with the variance of the dependent variable. The regression model was checked for colinearity diagnostics. The statistical significance for all test was set at $P < 0.05$.

Results

Characteristics of Individuals According to Cognitive Function Status

Eight hundred and fifteen elder were selected to participate in this study, and 796 subjects fully completed the questionnaires (response rate 97.7%). The total prevalence of MCI was 18.2% (145/796). Of these 62.7% were female and 32.8% were male, with a mean age of 71.4 ± 6.8 years. The prevalence of MCI for males and females was 15.3% (40/261) and 19.6% (105/535), respectively. As shown in table 1, the significant differences of HRQoL scores were observed on subjects' gender, age, education status, income, marital status, ADL, religious attendance, depression, stroke and cardiovascular diseases ($P < 0.05$).

Variables	Ratio (n, %)	HRQoL	t/F/r	p
Gender [a]			4.259	<0.001
Male	261 (32.8)	71.97±11.24		
Female	535 (62.7)	68.09±13.51		
Ethnicity [a]			1.220	0.375
Han nationality	777 (97.6)	70.24±10.67		
Other nationalities	19 (2.4)	69.71±9.93		
Age [b]			1.554	0.212
60-70	368 (46.2)	70.13±12.32		
71-80	357 (44.8)	68.46±13.71		
≥81	71 (8.9)	69.83±11.91		
Education status [b]			3.581	0.007
No formal education	109(13.7)	66.40±13.56		
Primary school	190(23.9)	67.65±13.08		
Junior high school	249(31.3)	70.88±12.65		
Senior high school	167(21.0)	70.37±12.91		
College or above	81(10.2)			
Income (yuan/ month) [b]			6.554	0.002
<1000	169 (21.2)	66.05±13.46		
1001-2000	463 (54.4)	68.97±13.31		
≥2001	194 (24.4)	70.88±12.17		
MCI [a]			2.425	0.016
Without MCI	651 (81.8)	69.88±12.65		
With MCI	145 (18.2)	64.00±13.97		
Marital status [a]			-4.089	<0.001

Without spouse	533 (67.0)	66.71±14.27		
With spouse	263 (33.0)	70.67±12.03		
Living arrangement [a]			2.192	0.30
With spouse/children/others	677(85.1)	69.85±12.43		
Alone	119(14.9)	66.60±15.30		
BMI [b]			2.183	0.089
Underweight (BMI<18.5 kg/m²)	12 (4.6)	70.53±11.94		
Normal (BMI: 18.5~24 kg/m²)	106 (40.6)	69.02±13.55		
Overweight (BMI: 25~28 kg/m²)	113 (43.3)	68.00±12.94		
Obese (BMI>28 kg/m²)	30 (11.5)	65.75±12.26		
Religion attendance [a]			7.759	0.005
Attendance religious activity	679 (85.3)	69.64±12.62		
Never attendance	117 (14.7)	67.74±14.64		
ADL [a]			-9.289	<0.001
Dependent	85 (10.7)	60.42±15.58		
Independent	711 (89.3)	71.97±10.75		
Depression [a]			4.904	0.003
Without depression	130 (16.3)	67.34±11.07		
With depression	666 (83.7)	60.56±14.46		
Stroke [a]			6.996	<0.001
Without stroke	654 (81.0)	71.11±11.70		
With stroke	151 (19.0)	61.85±15.20		
Hypertension [a]			5.089	<0.001
Without hypertension	452 (56.8)	71.41±11.64		
With hypertension	344 (43.2)	66.64±14.04		
Cardiovascular diseases [a]			8.000	<0.001
Without cardiovascular diseases	594 (74.6)	73.24±10.32		
With cardiovascular diseases	202 (25.4)	66.34±13.93		
Cancer [a]			2.415	0.016
Without cancer	786 (98.7)	69.48±12.85		
With cancer	10 (1.3)	59.03±17.12		
Dietary habits scores [c]			-0.177	<0.001
[a] Analyzed by t-test; [b] Analyzed by ANOVA; [c] Analyzed by Pearson Correlation.				

Table 1: Comparison of HRQoL scores by subjects' characteristics (n=796).

Comparison of Scores of SF-36 among Individuals According to Cognitive Function Status

Table 2 showed that the score of individuals with MCI was significantly lower than that of those non-MCI individuals in 3 domains (PF, VT and SF) and MCS subscale of SF-36.

Variables	MCI (n=145)	Non-MCI (n=651)	t	P
Domains of SF-36				
Physical function (PF)	82.24±15.90	87.10±14.17	3.652	<0.001
Role limitation due to physical problem (RP)	71.90±38.62	75.58±36.73	1.081	0.280
Bodily pain (BP)	77.52±17.43	80.23±16.23	1.789	0.074
General health perceptions (GH)	60.22±18.27	60.87±17.91	0.790	0.697
Vitality (VT)	69.97±19.22	74.28±13.66	3.168	0.002
Social function (SF)	75.63±17.78	80.82±14.13	3.799	0.000
Role limitation due to emotional problem (RE)	77.93±34.52	80.54±30.90	0.901	0.368
Mental health (MH)	58.97±8.63	59.28±8.24	0.393	0.695
Subscales of SF-36				
Physical composite scores (PCS)	73.15±16.75	75.93±15.99	0.509	0.476
Mental composite scores (MCS)	60.84±13.90	63.85±11.82	6.875	0.009

Table 2: Comparison scores of SF-36 by cognitive function status (mean, SD; n=796).

Comparison of Scores of SF-36 among MCI Individuals

As shown in table 3, the significant differences of PF were gender, age, education status, marital status, ADL and depression (p<0.05); the significant differences of RP were ADL, depression, stroke, hypertension, cardiovascular, stroke and hypertension (p<0.05); the significant differences of BP were gender, ADL and stroke (p<0.05); the factors of GH were marital status, ADL and cardiovascular diseases (p<0.05); the significant differences of VT were age and marital status (p<0.05); the factors of SF were gender, ADL, depression, stroke and cardiovascular diseases (p<0.05); the significant differences of RE were ADL, hypertension and cardiovascular disease (p<0.05); the significant differences of MH were depression and hypertension (p<0.05); the relative predictors of PCS subscale of HRQoL were gender, age, education status, income, marital status, ADL, depression, stroke, hypertension and cardiovascular diseases among MCI individuals, however, age, income, marital status, living arrangement, ADL, depression and hypertension were factors of MCS subscale of HRQoL (p<0.05).

Variables	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Age [a]										
60-70	8.72±1.32	18.22±9.37	39.57±8.64	11.49±4.08	17.12±5.53	37.87±9.34	26.11±11.17	11.77±1.71	77.06±15.01	63.22±12.34
71-80	7.94±1.72	17.70±9.95	38.34±8.59	12.42±3.46	15.67±4.35	37.88±8.56	25.30±12.11	11.90±1.69	74.04±17.21	62.88±12.57
≥81	7.50±1.39	18.26±10.03	37.38±10.02	12.57±2.25	13.17±1.81	37.17±9.18	29.05±9.67	12.00±1.08	73.87±15.76	65.79±10.10
F	5.690	0.054	0.499	1.161	3.541	0.036	0.598	0.149	3.550	1.671
p	0.004	0.948	0.608	0.316	0.014	0.964	0.556	0.862	0.029	0.189
Gender [b]										
Male	8.6±1.54	19.06±9.05	41.15±6.27	11.98±3.84	18.18±4.79	38.19±7.76	25.83±12.16	12.08±1.63	78.65±14.43	65.31±10.92
Female	8.08±1.59	17.56±9.89	37.85±9.35	12.07±3.60	17.23±4.81	34.67±9.34	26.03±11.30	11.77±1.65	73.86±16.71	62.31±12.77
t	2.770	0.837	2.448	-0.131	1.078	3.215	-0.092	1.008	4.146	3.440
p	0.009	0.404	0.016	0.896	0.283	0.003	0.926	0.315	<0.001	<0.001
Education status [a]										
No formal education	7.47±1.90	16.93±10.00	36.83±9.84	11.47±3.22	16.57±4.87	37.50±8.86	22.69±14.08	12.26±1.76	70.85±16.73	61.92±13.40
Primary school	8.40±1.25	18.08±8.96	37.73±9.09	12.78±2.82	18.78±3.02	39.95±7.10	26.95±10.55	11.94±1.45	72.93±16.84	62.36±11.72
Junior high school	8.62±1.46	18.45±9.85	40.89±7.67	12.05±4.33	17.17±6.42	37.30±10.13	26.19±11.72	11.67±1.67	77.96±15.59	63.82±12.27
Senior high school	7.73±1.88	18.26±10.14	38.40±9.03	11.51±4.13	16.92±4.49	34.40±9.56	25.21±11.13	11.50±1.82	76.81±15.50	63.92±12.50
College and above	9.16±0.26	16.66±12.91	41.17±3.87	10.80±3.69	15.84±2.92	40.74±5.73	33.33±0.00	12.26±1.68	76.80±14.96	64.40±11.43
F	3.496	0.128	1.218	0.923	1.396	1.889	1.228	0.916	5.392	3.787
p	0.009	0.972	0.306	0.452	0.238	0.116	0.302	0.457	<0.001	0.052
Income (yuan/ month) a										
<1000	8.29±1.82	20.83±7.99	37.73±9.31	12.36±3.36	17.38±5.24	40.74±7.92	27.51±12.48	11.54±2.03	71.58±16.30	60.51±13.79
1001-2000	8.15±1.54	16.48±10.20	37.55±9.85	11.72±4.15	16.87±5.24	36.44±9.94	25.25±11.62	11.86±1.59	74.71±16.58	63.21±12.36
≥2001	8.28±1.58	18.64±9.40	40.50±6.74	12.29±3.14	18.23±4.02	38.31±7.70	26.24±11.14	11.85±1.57	77.42±15.42	64.33±11.49
F	0.125	1.875	1.953	0.466	1.244	2.039	0.331	0.489		4.375
p	0.883	0.157	0.146	0.628	0.291	0.134	0.719	0.614		0.013

Marital status [b]										
Without spouse	7.83±1.79	18.52±9.40	37.34±9.41	11.83±3.61	16.11±5.78	37.75±8.52	24.49±12.48	11.85±1.84	72.38±17.80	61.03±13.40
With spouse	8.45±1.41	17.56±9.84	39.64±8.20	12.17±3.69	18.31±3.92	37.87±9.14	26.87±10.90	11.86±1.53	76.93±15.07	64.41±11.52
t	-2.182	0.522	-1.518	-0.536	-2.724	-0.061	-1.204	-0.026	-3.551	-3.506
p	0.032	0.603	0.131	0.593	0.007	0.951	0.231	0.979	<0.001	<0.001
Living arrangement [b]										
Alone	8.65±1.65	20.38±8.69	39.30±7.74	11.83±3.61	17.97±3.89	37.79±9.10	22.70±10.93	11.48±2.08	75.91±15.53	63.79±11.86
With spouse/ children/others	8.14±1.65	17.52±9.80	38.66±8.91	12.17±3.69	14.94±7.73	37.92±7.79	22.70±14.00	11.92±1.55	72.64±19.15	60.56±14.15
t	-1.413	-1.306	-0.324	-0.536	2.838	-0.062	1.493	1.202	1.768	2.341
p	0.160	0.194	0.746	0.593	0.005	0.950	0.138	0.231	0.079	0.021
Religious attendance [b]										
attendance religious activity	8.26±1.47	18.38±8.96	38.97±8.62	11.97±3.63	17.20±4.42	37.89±8.86	26.14±11.23	11.84±1.72	75.74±15.78	63.54±12.12
Never attendance	8.21±1.63	17.84±9.89	38.07±9.09	12.27±3.79	17.57±4.93	37.58±9.070	25.92±11.63	11.88±1.42	73.56±18.16	61.90±13.09
t	-0.169	-0.281	0.526	-0.418	0.395	0.861	-0.096	-0.104	1.271	1.260
p	0.866	0.779	0.600	0.676	0.694	0.921	0.923	0.917	0.226	0.209
ADL [b]										
Independent	8.72±1.14	19.80±8.21	40.38±7.13	12.69±3.48	17.92±4.86	39.40±7.69	27.10±10.70	12.08±1.65	78.93±13.26	65.01±10.86
Dependent	6.80±1.82	12.83±11.53	34.20±10.98	10.15±3.52	16.28±4.49	33.33±10.49	22.80±13.15	11.78±1.64	63.42±19.18	57.48±14.80
t	-6.119	-3.432	-3.239	-3.814	-1.820	-3.783	-1.196	0.991	-10.129	-6.355
p	<0.001	0.001	0.002	<0.001	0.071	<0.001	0.048	0.323	<0.001	<0.001
Depression [b]										
With depression	6.24±1.08	13.05±10.94	38.04±6.92	11.05±5.02	16.02±4.38	9.75±5.52	23.04±11.25	10.04±4.84	68.02±18.45	58.09±13.40
Without depression	8.55±1.31	19.27±8.17	39.47±9.65	12.64±3.97	17.54±4.61	12.98±3.60	26.37±12.33	12.33±4.65	77.03±14.99	64.84±10.77
t	3.405	3.501	1.941	2.076	1.530	4.025	2.160	2.970	5.066	6.032
p	0.002	0.001	0.143	0.063	0.752	<0.001	0.072	0.013	<0.001	<0.001
Stroke [b]										

With stroke	7.49±1.96	13.60±11.56	36.91±10.30	10.50±3.88	16.43±4.96	39.38±7.54	22.87±13.66	11.82±1.67	65.99±18.94	57.72±14.63
Without stroke	8.45±1.39	19.31±8.61	39.32±8.13	12.50±3.47	17.81±4.72	32.67±9.92	26.92±10.65	11.95±1.61	77.63±14.59	64.60±11.27
t	2.664	2.662	1.420	2.826	1.473	4.052	1.810	-0.389	7.053	5.407
p	0.011	0.002	0.158	0.005	0.143	<0.001	0.072	0.698	<0.001	<0.001
Hypertension [b]										
With Hypertension	7.90±1.74	16.10±10.44	38.54±8.52	11.68±3.67	17.53±4.60	36.61±9.41	23.47±12.81	11.84±1.67	72.05±17.51	61.26±13.30
Without Hypertension	8.53±1.78	19.76±8.53	39.06±8.94	12.38±3.60	17.44±5.03	38.96±8.25	28.37±9.58	11.87±1.63	77.05±14.55	64.85±11.20
t	2.423	2.302	0.420	1.156	0.108	1.596	2.617	0.102	4.033	5.069
p	0.017	0.023	0.675	0.250	0.914	0.113	<0.001	0.919	<0.001	<0.001
With Cardiovascular diseases	7.92±1.66	15.92±10.60	37.14±9.79	10.21±3.78	17.09±5.18	36.30±9.42	22.22±14.38	11.97±1.65	68.73±17.51	59.13±13.94
Without Cardiovascular diseases	8.63±1.42	20.80±7.37	39.34±8.30	12.67±3.40	18.03±4.20	39.90±7.70	27.31±10.04	11.90±1.64	77.70±15.0	64.71±11.32
t	2.755	3.267	1.336	3.694	1.158	2.515	2.379	-0.412	6.498	5.137
p	0.007	0.001	0.184	<0.001	0.249	0.013	0.019	0.681	<0.001	<0.001
[a] Analyzed by ANOVA; [b] Analyzed by t-test ; ADL: Activity of Daily Living.										

Table 3: Factors Associated with PCS and MCS Subscales of HRQoL among MCI Individuals (mean, SD; n=145).

Multiple Linear Regression Model for Factors Affecting HRQoL among MCI Individuals

As shown in Table 4, the MLSR analysis indicated that age was negatively associated with PF and VT ($p<0.05$). Gender was negatively related with PF, RP, SF and PCS ($p<0.05$). Living arrangement was associated with PF ($p<0.05$). ADL was negatively associated with PF, RP, BP, GH, VT, SF, PCS and MCS ($p<0.05$). Attendance religious was associated with PF and PCS ($p<0.05$). Dietary habits score was negatively associated with MH and MCS ($p<0.05$). History of stroke was associated with RE ($p<0.05$). History of hypertension was negatively related with RP and RE ($p<0.05$). History of cardiovascular diseases was associated with RP, GH, VT and PCS ($p<0.05$). Depression was related with PF, SF, MH, PCS and MCS ($p<0.05$). MMSE score was associated with poor status of physical function, general health, physical and mental composite scores ($p<0.05$).

Variables	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Adjust R²	0.682	0.562	0.501	0.573	0.494	0.516	0.469	0.478	0.670	0.502
Age	-4.51	—	—	—	-2.77	—	—	—	—	—
Gender	-2.91	-2.75	—	—	—	-3.46	—	—	-6.35	—
Living arrangement	6.97	—	—	—	—	—	—	—	—	—
Religious attendance	6.04	—	—	—	—	—	—	—	7.78	—
ADL	-1.92	-2.77	-1.42	-1.19	-0.91	-1.42	—	—	-7.57	-3.67
Depression	-8.92	—	—	—	—	-6.98		-7.95	-11.32	-9.06
Stroke	—	—	—	—	—	—	-6.04	—	—	—
Hypertension	—	-2.60	—	—	—	—	-3.24	—	—	—
Cardiovascular diseases	—	-3.81	—	-3.76	-4.22	—	—	—	-5.86	—
Dietary habits scores	—	—	—	—	—	—	—	-2.82	—	-4.33
MMSE scores	2.01	—	—	5.69	—	—	—	—	7.31	5.89
[a] Analyzed by multivariate linear regression analysis. The data in the table represent standardized partial regression coefficients. Variables removed: education status, income, marital status, BMI, cancer										

Table 4: Multiple linear regression model for factors influence HRQoL among MCI individuals (n=145) [a].

Discussion

MCI is an intermediate stage between normal cognitive function and dementia, its main clinical feature is memory impairment. In the current study, the prevalence of MCI was 18.2% in community-dwelling elders, which corresponded to 15.3% in males and 19.6% in females. The individuals with MCI have significantly worse HRQoL than those without MCI individuals in PF, Vitality and MCS of the SF-36. In the study, the individuals with MCI experienced worse HRQoL, poorer physical function and mental status in community-dwelling elderly. This study provides detailed information that can help health care providers determine the HRQoL of patients with MCI and then take measures to improve the HRQoL of elderly with MCI.

The current study found that advanced age, female elderly, history of chronic diseases, high dependences in ADL and high levels of depression were associated with poor HRQoL of individuals with MCI in community-dwelling elderly. Aging was associated with poor HRQoL in MCI older adults, especially in PF and vitality domains of HRQoL. Aging is a stage of life in which individual encounters memory and other cognitive impairment that influence the basic daily living activities of elderly. Cognitive impairment is basis for loss of independence and autonomy with a consequent decrease of PF and vitality domains of HRQoL [26]. Similarity, study showed that negative impact on HRQL was increased by the aging among MCI individuals [24]. Measures should be taken into account for MCI elderly such as creating Age-Friendly Health Systems (AFHS) in China, o providing older adults with the best care possible, reducing health care-related harms to older adults, and improving the quality of care for older adults with cognitive impairment.

The study indicated that female was associated with worse PF and SF domains of HRQoL among MCI individuals. This may be due to female elderly often preferred sedentary lifestyles [12].

As to traditional Chinese culture, female engaged in stationary chat with other elders or handwork as their main daily activities. These phenomena were strongly associated with the PF and SF subscales of HRQoL. The results suggested that some activities should be carried out such as reading books, dancing, outing or taking part in classes for senior female may enhance quality of life meant for community-dwelling MCI individuals.

Religious service attendance or participation in religious organizations can improve PF and PCS domains of HRQoL in the MCI individuals. However, the relationship between religious service attendance and MH and MCS domains of HRQoL was not found in this study. Our previous study determined that attendance at religious services can protect cognitive function in elderly individuals [12]. For elderly individuals, church services can offer networking opportunities, structure and organization, and a sense of purpose. Previous studies indicated that older individuals who attend religious events are more likely to use religion as a form of consolation or a coping method when faced with health problems [28]. These findings should be taken into account when developing preventive MCI strategies or improving quality of life for community-dwelling older individuals.

In the present study, the history of stroke and cardiovascular diseases were negatively associated with HRQoL in MCI individuals. The follow-up study indicated that chronic diseases such as hypertension, stroke and diabetes can decrease HRQoL and cause poor psychological status during rehabilitation because of depression and anxiety [29]. With cardiovascular diseases individuals tend to experience worse HRQoL than health individuals. The poor HRQoL was associated with increased the rate of re-hospitalization and cardiac death [30]. Therefore, the intervention on improving HRQoL of MCI individuals should be taken to prevent the prevalence of chronic diseases.

Dietary habits were also found to be correlated with MH and MCS domains of HRQoL in elderly individuals with MCI, and unhealthy lifestyles and dietary patterns can affect mental health. In this study, MCI individuals were characterized by unhealthy lifestyles and dietary patterns such as eating more high salt and less grains, vegetables, and fruits. The close association of sugar with the brain reward system suggests that distortions in the dopaminergic and opioid transmission pathways may play a role in developing mental disorders [31]. Excess sugar intake may contribute to mental illness, and individuals with a mental illness tend to consume more rewarding foods [32]. Some studies indicated that adherence to a Mediterranean-type diet was associated with slower cognitive decline and better HRQoL because Mediterranean-type diet contain rich fruits and vegetables and contain variety of substances such as vitamins, antioxidants, minerals and phytochemicals that could be beneficial for cognitive function and physical status and improve HRQoL [33]. To postpone cognitive decline and enhance HRQoL, keeping healthy dietary pattern is recommended in community-dwelling MCI elderly.

Depression was found to be closely associated with HRQoL among MCI individuals. Many researches demonstrated that depression is most strongly associated with reduced elderly QoL and has been shown to have a negative impact on ADL, even after adjusting for degree of cognitive decline and medical conditions [34,35]. However, the relationship between depression and the risk for later development of dementia is not still clear. A personal history of depression has been related to increased risk for developing MCI or dementia later in life, although this finding has not been universal [36]. Initial management of depression in MCI should first of all involve consideration of cognitive behavior interventions such as exercise training and pleasant activities or caregiver problem solving skills.

Our study identified negative correlations between ADL and HRQoL among MCI group. Similarity, some researches have showed that ADL disability can significantly affect HRQoL in elderly individuals [37]. During the early stages of cognitive impairment, individuals have difficulty with complex IADL, this loss of IADL performance was followed by a reduction in self-care ADL such as eating, dressing, and bathing, which eventually lead to decrease of HRQoL [37]. It is possible to improve quality of life for aging adults with MCI by stabilizing progressive cognitive dysfunction through health promotion programs. Such interventions should also aim to improve physical and psychology health statuses and promote social and interpersonal interactions. These activities promote cognitive function, contribute to the prevention of dementia and decrease functional limitations in adults with MCI [38,39].

Despite these novel findings, this study has several limitations that should be considered. First, this study used a cross-sectional design and questionnaires that lacked an interview follow up, thus, the findings cannot provide evidence of a causal relationship between HRQoL and MCI [40]. Longitudinal data are needed to further explore this association. Second, only a few tests and scales were used, which may increase the number of false positive results for participants with fewer years of education. Third, Petersen's definition of MCI cannot classify sub-types of MCI such as amnestic MCI, which maybe not analyzed factors impacting on the HRQoL by sub-types of MCI. To our knowledge this is the first study to examine HRQoL factors in elderly individuals with MCI in China. Furthermore, the study excluded participants with dementia or severe cognitive impairment, and none of the participants had previously been institutionalized.

Ethnical Approval

This study was approved by the Ethics Committee of the Fourth Military Medical University. Oral information about the

purpose of the study was given to the participants before the survey. A written informed consent was obtained from each participant.

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Author Contributions

Wencheng Wang designed the experiments, Xiangni Su performed, collected and interpreted the data and drafted the manuscript, Feng Yang, Cuicui Li and Pei Shao helped performing experimental and interpreted the data. All authors reviewed the manuscript.

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