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Health Literacy Risk in Older Adults With and Without Mild Cognitive Impairment

Yong B. Liu ▼ Yan L. Chen ▼ Hui P. Xue ▼ Ping Hou

Background: The relationship between an increasing elderly population and wide-ranging neurological conditions has led to heightened rates of cognitive function impairment. Some researchers have found that health literacy risk may be associated with cognitive impairment in older adults.

Objectives: The purpose of this study was to delineate the difference in health literacy risk between older adults with mild cognitive impairment and those with normal cognitive function.

Methods: We conducted a survey study to explore the health literacy risk in older adults with and without mild cognitive impairment. Data were collected from 412 subjects between 60 and 91 years of age (260 without and 152 with mild cognitive impairment) between June and December 2016 in China. Cognitive function was measured using the Mini-Mental Status Examination, Montreal Cognitive Assessment, Global Deterioration Scale, Activities of Daily Living, and Hamilton Depression Rating Scale. Health literacy was measured using the Chinese Citizen Health Literacy Questionnaire.

Results: The scores of total health literacy and its three dimensions (basic health knowledge and mind, basic skills, and health lifestyle and behavior) were lower in those with mild cognitive impairment. Older adults with normal cognitive function had adequate or marginal health literacy levels, whereas those with mild cognitive impairment had marginal or inadequate health literacy levels. Using multiple logistic regression analysis, we found that health literacy risk, education level, age, marital status, and body mass index were independent risk factors for mild cognitive impairment.

Discussion: These results suggest that low health literacy may be a predictor of mild cognitive impairment. Screening for lower health literacy risk should be included in multidimensional geriatric evaluation.

Key Words: health literacy risk • mild cognitive impairment • older adults

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China has the world's largest aging population. In 2015, the over 65-year-old population was estimated to be 10.1% of the total population; this is expected to increase to 17.2% of China's 1.4 billion residents by 2030 (He, Goodkind, & Kowal, 2015). The relationship between an increasing elderly population and wide-ranging neurological conditions has led to heightened rates of cognitive function impairment in the elderly adults, especially in the oldest (Arthanat, Nochajski, & Stone, 2004; St. John, Montgomery, Kristjansson, & McDowell, 2002). At least 10% of people over 65 years and 50% of those over 85 years have some form of cognitive function impairment, ranging from mild deficits to severe dementia (Jorm & Jolley, 1998). The growing proportion of older adults in China makes for a growing public health concern regarding age-related cognitive function impairment and dementia. Previous studies have found that the prevalence of mild cognitive impairment (MCI) was approximately 11.60%–21.46% in people over 60 years old in China (Liu, Shao, & Peng, 2005; Tang, Zhang, & Wu, 2007).

MCI is defined as a transitional stage from normal aging to dementia and is one of the most relevant issues in clinical aging studies (Paúl, Ribeiro, & Santos, 2010). MCI shows a clinical manifestation where a person has complaints of memory loss and finds objective evidence of cognitive function impairment but displays no evidence of dementia. Compared with normal cognitive function (NCF) older adults, MCI groups are at an increased risk of dementia. It is clinically significant to identify MCI; early intervention is beneficial for preventing further progression to dementia.

It is critical to identify the risk factors of cognitive function decline, as it may lead to prevention or intervention strategies. Currently, there are several aspects that may interfere with cognition, such as venerable age, lower education level, stroke, diabetes mellitus, psychiatric disorders, social isolation, and

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poor intellect (Campbell, Unverzagt, LaMantia, Khan, & Boustani, 2013; Paúl et al., 2010; Petersen, 2011). Some studies have found that even health literacy risk may be associated with cognitive impairment in older adults (L. Yu, Wilson, Schneider, Bennett, & Boyle, 2017).

Health literacy, or the degree to which individuals have the capacity to obtain, communicate, process, and understand basic health information and services needed to make appropriate health decisions (Kaphingst, Goodman, MacMillan, Carpenter, & Griffey, 2014), is an important predictor of health outcomes. However, despite prior studies showing a relationship between cognitive status and health literacy, cognitive status has generally been treated as exclusion criterion (Baker, Parker, Williams, & Clark, 1998; Baker, Parker, Williams, Clark, & Nurss, 1997) or has not been explicitly considered (Nielsen-Bohlman, Panzer, & Kindig, 2004; Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005) in most health literacy studies. Therefore, the relationship between cognitive dysfunction and health literacy needs to be further examined in older adults.

The aims of this study were to compare the health literacy risk between NCF and MCI older adults, analyze variables related with cognitive function impairment, and obtain evidence-based health literacy risk to implement more effective interventions to prevent or delay cognitive decline.

METHODS

Design

This was a cross-sectional study employing a simple random sample method of 412 older adults (aged over 60 years) at inpatient departments in two general hospitals (Grade 3) in Jiangsu province. In order to avoid subjectivity and conscious selection of samples—which caused selection bias—we used random numbers to select the participants. We numbered patients who met inclusion criteria by also using random numbers. Each patient received a random number, which was divided by 2; patients with a remainder of 1 were assigned to the NCF group, and those with a remainder of 0 were assigned to the MCI group.

Participants

Older adults were recruited between June and December 2016 through the inpatient department of the Yangzhou University's Affiliated Hospital and Clinical Medicine College Hospital. To be eligible for the research, older adults in the MCI group first met the MCI criteria proposed by Petersen et al. (1999), including (a) subjective memory complaint by the patient or his/her caregiver, (b) no or minimal impairment of daily life activities, (c) objective memory impairment adjusted for age and education, (d) preservation of general cognitive function, and (e) not having dementia. An additional criterion was added that cognitive function impairment must be restricted to memory loss. The final diagnosis of MCI was given by consensus of two highly qualified neurologists blinded to cognitive examine results, and each neurological evaluation was combined with other comprehensive material and medical histories collected during clinical testing.

Data Collection

In consideration of the older adults' difficulties in responding to the self-reported questionnaire, we conducted all the surveys using interviews. The investigators gathered anonymous data for demographics by asking questions with face-to-face visits, as well as responses to the scales of cognitive function and questionnaire of health literacy.

Cognitive Function Assessment The Mini-Mental Status Examination was used to measure MCI (Folstein, Folstein, & McHugh, 1975). The scale is well known and widely used to screen the cognitive state of older adults by identifying between subjects with and without cognitive impairment. We applied the Chinese version, which is adapted to different education levels and to those who are illiterate. Study participants needed to achieve a score between 27 and 30 points on the Mini-Mental Status Examination, with <27 indicating MCI.

Health Literacy Assessment The Chinese Citizen Health Literacy Questionnaire (Wang, Mao, & Tao, 2010) was developed by the China Health Education Center. The three dimensions of the questionnaire were basic health knowledge and mind, health lifestyle and behavior, and basic skills. The questionnaire included 15 true or false questions, 46 single choice, and 19 multiple choice. The test included 80 items, with 100 maximum points. The Cronbach α coefficient was .93, and for the three dimensions (basic health knowledge and mind, health lifestyle and behavior, and basic skills), it was .87, .77, and .80, respectively, indicating good reliability. From factor analysis, goodness of fit index = 0.951, the adjusted goodness of fit index = 0.923, comparative fit index = 0.966, Tucker-Lewis Index = 0.1.000, normed fit index = 0.924, root mean square error of approximation = 0.042, this questionnaire showed good construct validity. Grading for the health literacy questionnaire was as follows: $75 \leq$ scores ≤ 100 indicated adequate health literacy, $64 \leq$ scores < 75 indicated marginal health literacy, and $0 \leq$ scores < 64 indicated inadequate health literacy (Xue, 2017).

General Information A standardized self-designed questionnaire was used for the survey and included detailed questions about older adults' sociodemographic characteristics and self-reported information, such as gender, age, marital status, living arrangements, educational level, chronic disease, physical activity, and body mass index (BMI). Several terms should be defined: Chronic disease (chronic noncommunicable diseases [NCDs]) is an umbrella term of a sick state in the complex system of human body (M. Yu & Lu, 2014); NCDs do not refer to a specific disease, but a group disease. NCDs lack clear

evidence of the disease cause although the disease course is obstinate and incurable. NCDs mainly include several diseases: cardiovascular and cerebrovascular diseases (hypertension, stroke, and ischemic heart disease), cancer, diabetes, chronic respiratory diseases, and so forth.

Physical activity was defined as two to three times a week at a moderate intensity for 30–60 minutes. Physical activity is measured by asking participants for a detail activity program of the previous 12 months or more. If the participant could satisfy the criteria, we divided them into physical activity group (Kang, Park, & Wallace, 2018).

BMI is a person's weight in kilograms divided by the square of height in meters. BMI can be used to screen for weight categories that may lead to health problems, but it is not diagnostic of the body fatness or health of an individual. According to the criteria of the Chinese working group on obesity, BMI < 18.5 kg/m^2 is underweight, BMI = 18.5–23.9 kg/m^2 is normal or healthy weight, BMI = 24–27.9 kg/m^2 is overweight, and BMI $\geq$ 28 kg/m^2 is obese (Qi et al., 2018).

Ethical Considerations

All procedures were approved by the ethics review board of medicine of the Yangzhou University, and written informed consent was gained from all older adults or their families.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences, Version 20.0, for Windows (SPSS, Inc., Chicago, IL).

TABLE 1. Baseline Characteristics of Participants (*N* = 412)

Variables	Total (*N* = 412), *M* (*SD*) or *n* (%)	NCF (*n* = 260), *M* (*SD*) or *n* (%)	MCI (*n* = 152), *M* (*SD*) or *n* (%)	*p*
Age (years)	69.87 (6.74)	69.00 ± 6.72	71.38 ± 6.19	<.001
Gender				.223
Male	282 (68.45)	181 (69.61)	101 (66.45)	
Female	130 (31.55)	79 (30.39)	51 (33.55)	
Marriage				<.001
Spouse	353 (85.68)	240 (92.30)	113 (74.34)	
Widow	59 (14.32)	20 (7.69)	39 (25.66)	
Education level				<.001
Primary and below	97 (23.54)	63 (24.23)	34 (22.37)	
Junior school	156 (37.86)	77 (29.62)	79 (51.97)	
High school	96 (23.31)	65 (25.00)	31 (20.39)	
Undergraduate and above	63 (15.29)	55 (21.15)	8 (5.27)	
Number of family members				.008
1	36 (8.74)	17 (6.54)	19 (12.50)	
2	187 (45.39)	117 (45.00)	70 (46.05)	
3	189 (45.87)	126 (48.46)	63 (41.45)	
Monthly family income				<.001
500–999	9 (2.18)	4 (1.54)	5 (3.29)	
1,000–1,999	71 (17.23)	35 (13.46)	36 (23.68)	
2,000–4,999	236 (57.28)	159 (61.15)	77 (50.66)	
≥5,000	96 (23.31)	62 (23.85)	34 (22.37)	
Previous occupation				.125
Mental activity	259 (62.86)	177 (68.08)	80 (52.63)	
Physical activity	121 (37.14)	83 (31.92)	72 (47.37)	
Chronic disease				.112
None	141 (34.22)	73 (28.08)	68 (44.74)	
Have	271 (65.78)	187 (71.92)	84 (55.26)	
BMI				<.001
<18.5	19 (4.61)	7 (2.69)	12 (7.89)	
18.5–23.9	254 (61.65)	150 (57.69)	104 (68.42)	
24–27.9	126 (30.58)	92 (35.38)	34 (22.37)	
≥28	13 (3.16)	11 (4.23)	2 (1.32)	
Physical activity				.112
None	270 (65.54)	181 (69.62)	89 (58.55)	
Have	142 (34.46)	79 (30.38)	63 (41.45)	

TABLE 2. Relationship Between Normal Cognitive Function (NCF) and Mild Cognitive Impairment (MCI) in Health Literacy and the Three Dimension Scores (*M* ± *SD*)

Scale/subscale	NCF	MCI	*t*	*p*
Health literacy	69.56 ± 8.97	63.87 ± 12.64	5.321	<.001
Total score				
Subscales				
Basic health knowledge and mind	35.72 ± 4.76	32.87 ± 6.14	5.257	<.001
Basic skills	17.25 ± 4.75	15.45 ± 4.98	3.645	<.001
Health lifestyle and behavior	16.52 ± 3.24	15.64 ± 3.58	2.046	.041

Descriptive statistics were used to summarize data, including frequency, percentage, mean, and standard deviation. *T* test was used to compare health literacy scores between the NCF group and the MCI group. A chi-square test was performed to compare counting data. Multiple logistic regression analysis was performed to assess the risk of MCI based on the presence or absence of health literacy risk. Statistical significance was defined at values of $p < .05$.

RESULTS

Characteristics of Participants

Among the 412 participants, there were 260 (63.11%) NCF and 152 (36.89%) MCI subjects. The age range of the subjects was 60–91 years (mean age = 69.87 ± 6.74 years), and 68.45% were male. The average educational-level aspects are as follows: 23.54% ($n = 97$) of the subjects had primary and below education (≤5 years), 37.86% ($n = 156$) of the subjects received junior school education (8 years), 23.31% ($n = 96$) of the subjects received high school education (10 years), and 15.29% ($n = 63$) of the subjects received undergraduate and above education (≥14 years). Table 1 shows the differences between the MCI and NCF groups based on sociodemographic variables, chronic disease, BMI, and physical activity.

In addition, in MCI groups, higher aged, widowhood, lower education levels, lack of family members, and lower monthly family incomes were greater than in NCF groups ($p < .05$).

Health Literacy

Table 2 shows the comparison between the MCI and NCF groups for total health literacy and its three dimensions (basic health knowledge and mind, basic skills, and health lifestyle and behavior). MCI group scores were lower than NCF group scores ($p < .05$).

Table 3 shows that there were significant differences between the NCF and MCI groups in health literacy levels ($p < .05$). The NCF group showed mainly adequate and marginal health literacy, whereas the MCI group showed mainly marginal and inadequate health literacy.

Relationship Between MCI and Relative Risk Factors

We performed a multiple logistic regression analysis to determine the relationship between health literacy and MCI. Table 4 shows that the independent factors for MCI were health literacy, education level, age, marital status, and BMI. The findings showed that higher health literacy level was associated with lower risk of MCI. High education levels, being younger, having a spouse, and being overweight decreased the risk of MCI. Being underweight increased the risk of MCI.

DISCUSSION

In this research, we found that health literacy and three dimensions scores were higher in the NCF group compared with the MCI group. Thus, there was a corresponding improvement in health literacy with increased cognitive level of older adults. Furthermore, there was a higher frequency in marginal or inadequate health literacy scores in the MCI group compared with the NCF group, in which there was a higher frequency in the marginal or adequate health literacy scores. In line with this concept, the risk of lower health literacy was associated with MCI (Han, Boyle, James, Yu, & Bennett, 2015).

However, the interrelationships between MCI and health literacy risk are complex and reciprocal. We could not determine if MCI preceded poor health literacy or vice versa. The study by Lee, Hong, Cheong, and Oh (2009) demonstrated that self-rated literacy is a better predictor of cognitive function in old age, stressing the importance of systematic health literacy assessment in MCI. The relationship between health literacy and MCI should receive more attention by clinicians and policymakers because both are becoming common health problems.

Multiplelogistic regression analysis revealed that the independent influencing factors for MCI were health literacy, education level, age, marital status, and BMI. For these variables, health literacy was a protective factor. If we regarded adequate

TABLE 3. Relationship Between the Normal Cognitive Function (NCF) and Mild Cognitive Impairment (MCI) Groups in Different Health Literacy Levels

Health literacy				
Total scores	NCF ($n = 260$)	MCI ($n = 152$)	χ^2	*p*
Adequate	91 (35.00%)	34 (22.37%)	12.000	.035
Marginal	110 (42.31%)	56 (36.84%)		
Inadequate	59 (22.69%)	62 (40.79%)		

TABLE 4. Multiple Logistic Regression Analysis for Mild Cognitive Impairment With Risk Factors

Risk factors	Partial regression coefficient	*SE*	Wald χ^2	*p*	*OR*	95% CI
Health literacy (Inadequate)	–0.051	0.015	13.254	.000	0.933	[0.909, 0.972]
Education level			16.178	.001		
Primary	1.865	0.874	4.903	.023	6.536	[1.239, 34.356]
Junior	1.585	0.596	6.852	.007	4.755	[1.487, 15.231]
Age	1.810	0.886	4.105	.041	6.062	[1.050, 34.531]
Marriage (widow)	–2.453	0.619	14.087	.000	0.097	[0.023, 0.319]
BMI			16.072	.001		
<18.5	0.687	0.609	1.543	.012	2.146	[0.638, 7.211]
24–27.9	–0.799	0.352	7.621	.005	0.367	[0.180, 0.751]

health literacy as a reference, the MCI risk would improve 0.933 times in older adults with inadequate health literacy.

Longitudinal studies have suggested that higher literacy skills at baseline reduce the rate of cognitive decline in older adults and literacy is consistently more predictive of cognitive decline than years of education (Federman, Sano, Wolf, Siu, & Halm, 2009). Thus, lower literacy is associated with an early manifestation of age-related cognitive function decline and may act as an indicator of future adverse outcomes (Boyle et al., 2013). The finding that impaired health literacy in older adults is an important indicator of cognitive function decline has clear implications for public policy and interventions that improve health literacy in older adults. For healthcare professionals, screening for health literacy risk should be included in multidimensional geriatric assessment. Moreover, health-related information should be redesigned to be more accessible, understandable, and relevant, especially for older adults with a mild degree of cognitive function impairment.

Consistent with previous research (Borenstein et al., 2010; Cova et al., 2016; Hall, Gao, Unverzaget, & Hendrie, 2000; Lee et al., 2016), the higher age, widowhood, lower education level, and being underweight were risk factors of MCI in this study. Brain function degradation of older adults is a natural part of aging and become an influencing factor of MCI. Some surveys have reported insufficient knowledge of dementia among older adults with low levels of education. As a result, older adults may be unfamiliar with the disease progression of MCI and might postpone seeking medical help. Because marital status and MCI were significantly correlated, older adults may be able to learn about disease process by receiving information from household members. For those who are widowed, lack of support, companionship, and communication may increase MCI risk. Finally, researchers have shown that BMI predicts the risk degree for MCI progression; being underweight could increase the risk from MCI to dementia.

There were some limitations to our study. First, it was a cross-sectional survey design. Thus, whether impaired health literacy risk leads to an increased MCI state is not clear. The hypothesis that improving health literacy may promote cognitive function should be explored by prospective longitudinal cohort studies. Second, we enrolled only older adults in hospitals; thus, our results may not be representative of all elderly Chinese adults. Further studies will continue to assess the association between health literacy and MCI in community-dwelling older adults.

CONCLUSION

We studied the relationship between health literacy and MCI in older adults in hospital settings. Our results suggested that lower health literacy is an independent risk factor for age-related cognitive function decline in older adults. The relationship between health literacy and MCI warrants more attention by clinicians, policymakers, and healthcare professionals. In addition, we need more prospective longitudinal tests to confirm that improving health literacy by various intervention methods can promote the cognitive function of older adults.

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Ethical Conduct of Research: All procedures were approved by the ethics review board of medicine of the Yangzhou University. We signed a formal ethical conduct of research (Medical Ethics Review Report) with the medical ethics review board of Yangzhou University, and written informed consent was gained from all older adults or their families.

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