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Clinical characteristics and quality of life of older adults with cognitive impairment in Macao

Running title: Cognitive function in older adults

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Abstract

Background: Little is known about the characteristics of older adults with cognitive impairment in Macao. This study aimed to determine the prevalence of cognitive impairment and quality of life (QOL) of older adults living in the community and nursing homes.

Methods: A consecutive sample of 413 subjects (199 from the community and 214 from nursing homes) was recruited and interviewed using standardized instruments. Cognition was measured with the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) and QOL with the World Health Organization Quality of Life-BREF.

Result: Altogether 87 subjects (21.0%) of the sample had cognitive impairment. On multivariate analyses, advanced age ($p<0.001$, OR=1.06, 95% CI: 1.02-1.1) and depressive symptoms ($p=0.04$, OR=1.07, 95% CI: 1.002-1.1) were positively associated with cognitive impairment. Married marital status ($p=0.01$, OR=0.3, 95% CI: 0.1-0.7) and higher education level ($P<0.001$, OR=0.1, 95% CI: 0.06-0.3) were negatively associated with cognitive impairment. After controlling for the confounders, cognitive impairment was significantly associated with lower psychological ($F_{(11,412)} = 6.3$, $P=0.01$) and social relationship domains of QOL ($F_{(11,412)} = 4.0$, $P=0.04$).

Conclusion: Cognitive impairment was found to be common in community-dwelling and nursing home resident older adults in Macao. Given its negative impact on QOL, appropriate strategies should be implemented to

improve access to treatment in this population.

Keywords: Cognitive impairment, quality of life, older adults, Macao

INTRODUCTION

The world's population aged 60 years and over has exceeded 900 million in 2015 and the figure is expected to increase to two billion by 2050.[1] Macao has been a Special Administrative Region of China since 1999 after four century of Portugal administration. Latest statistics released by the Macao Government showed that in 2015 the life expectancy was 84.4 years, while the percentage of older adults aged 65 years and above was 8.4% and this rate is expected to reach 20.7% by 2036.[2]

There is compelling evidence that cognitive function declines from the age of 50 years and the decline usually accelerates after the age of 65 as part of normal aging process.[3] Cognitive impairment is a state of impaired cognitive functioning with an intact ability completing basic daily activities referring to the transitional zone between normal aging and dementia.[4] Cognitive impairment and dementia may share similar pathological changes.[5] Although not all persons with cognitive impairment convert eventually to dementia, those with cognitive impairment have a greater risk of developing dementia, such as Alzheimer's disease (AD).[6] It has been proposed that cognitive impairment is a precursor to AD.[7] Epidemiological studies found that conversion rate from cognitive impairment to dementia ranged between 10% and 40% per year.[6,8,9] Further, it may take at least ten years from the start of dementia pathology before any clinically detectable symptoms appear.[10] Therefore, early detection of, and intervention in cognitive impairment is essential to delay the conversion to dementia, and hence

reduce the suffering of the patients and the burden on families and society.

Due to differences in racial, sociocultural, and environmental context and study methodology, large variation in the patterns of cognitive impairment have been found across studies. For example, the prevalence of cognitive impairment ranges between 19.2% and 38% in the USA, 2.4%-76.6% in China [11-14] and was 31.2% in Arabic countries, and 22.2% in Taiwan.[3,12,15,16] The main correlates of cognitive impairment include low education level, cerebrovascular disease, and advanced age.[17,18] Probably due to lower education and poorer economic conditions, the prevalence of cognitive impairment in developing countries appears higher than that in developed countries.[19] Therefore, the findings obtained in Western countries could not be applied to the other parts of the world.

The World Health Organization (WHO) defined quality of life (QOL) as the individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.[1] QOL has become an important measure because it reflects the impact of health problems on the individual and also helps professionals to more adequately plan health care.[20] Persons with cognitive impairment may suffer from a variety of symptoms, such as forgetfulness, lack of attention and poor problem-solving capabilities, all of which may have a detrimental effect on QOL.[21,22] To the best of our knowledge, there has been no

study examining the prevalence of cognitive impairment and its association with QOL in older adults in Macao, China.

This study aimed to (1) determine the prevalence of cognitive impairment in older adults aged 50 years and over living in Macao; (2) explore the independent socio-demographic and clinical correlates of cognitive impairment, and (3) examine the association between cognitive impairment and QOL.

METHODS

Study setting and participants

This was a cross-sectional study conducted between September 1 and November 30, 2015 in Macao. Macao has one of the highest population density in the world where older adults live in the community or nursing homes. Of the 20 nursing homes in Macao, 11 were randomly selected according to a computer-generated random number table. All the residents in the selected nursing homes were approached and invited to participate in the study. Residents living in the community were consecutively recruited from neighboring social centers in the same districts. The inclusion criteria were (1) age 50 years or older, (2) Chinese ethnicity and fluency in Cantonese or Mandarin, and (3) ability to communicate adequately to complete the interview. Persons with visual impairment and major neurological diseases (e.g. stroke) that would impact on cognitive performance were excluded. The cutoff for age for defining older adults varied from 50 to 65 years across Asian countries and territories according to local cultural and

professional traditions. In this survey, those aged >/=50 years were classified as 'older adults'. The same age cutoff was also used in WHO reports and other studies.[23-26]

Assessment instruments and evaluation

Participants' socio-demographic and clinical were collected using a standard form designed for this study in a 30-50 minutes interview by one of 36 trained research assistants.

Cognitive functions were measured with the Chinese version of Repeatable Battery for the Assessment of Neuropsychological Status (RBANS).[27,28] The RBANS is a brief, widely used neuropsychological performance tool that has been validated with good reliability and validity in China. The RBANS covers immediate memory, visuospatial/ constructional abilities, language, attention, and delayed memory. Twelve subtests make up the above five indices: list learning and story recall for the immediate memory index, figure copy and line orientation for the visuospatial/construction index, picture naming and semantic fluency for the language index, coding and digit span for the attention index, list recall, list recognition, story recall and figure recall for the delayed recall index. In this study, cognitive impairment was defined by a fall in the participant's performance by approximately 1.5 SD or more below age-corrected norms. This approach has been commonly used in clinical studies.[7,29,30] QOL was measured with the Chinese version of the World Health Organization Quality of Life-BREF

(WHOQOL-BREF).[31,32] The WHOQOL-BREF includes 26 items covering four domains: physical health, psychological health, social relationships and environmental factors. A higher score reflects better QOL. Depressive symptoms in the past week was measured with the Chinese version of the Patient Health Questionnaire (PHQ-9).[33-35] It has nine items; the score of each item ranges from 0 (not at all) to 3 (nearly every day) with a total score between 0 and 27. A higher score indicates more severe depressive symptoms.

Ethical issues

The study protocol was approved by the Clinical Research Ethics Committee of the Macau Polytechnic Institute. All participants provided written informed consent.

Statistical analysis

Data was analyzed using SPSS 20.0 for Windows. The comparison between the non-cognitive impairment and cognitive impairment groups regarding basic demographic and clinical characteristics were performed by independent sample t-test, Mann-Whitney U test, and Chi-square test, as appropriate. QOL were compared between the non-cognitive impairment and cognitive impairment groups with analysis of covariance (ANCOVA) after controlling for the potentially confounding effects of variables that significantly differed between the two groups in the above univariate analyses. Multiple logistic regression analyses

with the "enter" method were performed to determine the independent relationships between cognitive impairment and the socio-demographic and clinical variables. Cognitive impairment was the dependent variable, while variables that significantly differed between the two groups in the above univariate analyses (age, gender, marital status, living with others, education level, monthly household income and the PHQ-9 total score) were entered as the independent variables. The one-sample Kolmogorov-Smirnov test was used to check the normality of distribution for continuous variables. The level of significance will be set at 0.05 (two-tailed).

RESULTS

Altogether 470 older adults were invited to participate in the study; 413 (199 from the community and 214 from nursing homes) met the study criteria and completed the assessments, thus giving a participation rate of 87.8%.

Table 1 shows the basic demographic and clinical characteristics of the whole sample and by community and nursing home groups. Table 2 presents the comparison between the non-cognitive impairment and cognitive impairment groups regarding demographic and clinical characteristics and QOL. Compared to the non-cognitive impairment group, participants with cognitive impairment were more likely to be older, reside in nursing homes, had less monthly household income, lower education level and more severe depressive symptoms, while they were less likely to be male, married and living with others. After

controlling for the above significant variables between the two groups, there were significant differences between the two groups in the psychological ($F_{(11,412)}$ = 6.3, P=0.01) and social ($F_{(11,412)}$ = 4.0, P=0.04), but not in physical ($F_{(11,412)}$ = 0.6, P=0.4) and environmental QOL domains ($F_{(11,412)}$ = 1.5, P =0.2).

Table 3 displays the subtest and index scores of RBANS by age groups. Cognitive performance declined with increasing age, especially after 60 years. Table 4 shows the independent correlates of cognitive impairment. Advanced age (P<0.001, OR=1.06, 95% CI: 1.03-1.1) and severe depressive symptoms (P=0.03, OR=1.07, 95% CI: 1.005-1.1) were positively associated with cognitive impairment, while married marital status (P=0.01, OR=0.3, 95% CI%:0.1-0.7) and higher education level (P<0.001, OR=0.1, 95% CI: 0.06-0.3) were negatively associated with cognitive impairment.

DISCUSSION

To the best of our knowledge, this was the first study on cognitive impairment and its association with QOL in older adults living in Macao. The cognitive impairment rate of 21.0% is broadly consistent with previous findings in older adults in China (2.4-76.6%).[11-13] The wide variation in the prevalence of cognitive impairment could be due to differences in diagnostic criteria, rating instruments and sampling methods. For example, some studies established the diagnosis of cognitive impairment with the Mini-Mental State Examination (MMSE)[12,14,36,37] while others used the Clinical Dementia Rating scale (CDR).[38] In

addition, different age ranges may also influence the results. For example, in persons aged 90 years and older and persons aged 50 years and older, the prevalence of cognitive impairment was 77.6% and 2.4%, respectively.[12,13]

Consistent with previous findings,[39] advanced age was positively associated with cognitive impairment; the prevalence of cognitive impairment was 9.3%, 5.6%, 22.2% and 44.1% in 50-59, 60-69, 70-79 and 80 years and older groups, respectively. Results of this study are consistent with the finding that after the age of 60 years the prevalence of cognitive impairment increases significantly with age[19]; cognitive function declines from the age of 50 years and accelerates after 65 years of age.[3] Consistent with earlier findings,[40] in this study higher education level was negatively associated with cognitive impairment ($P<0.001$, OR=0.1, 95% CI: 0.06-0.3) indicating that higher education may be a protective factor for cognitive impairment.

The association of the severity of depressive symptoms with cognitive impairment found in this study replicates the results of several other studies.[41-44] Depression is closely associated with certain cognitive components, such as memory, attention and decision making.[45] A longitudinal community-based study found that although depressive symptoms were transiently associated with impaired cognitive performance, they did not necessarily increase the risk of conversion to dementia.[46] In addition, measures on depression may overlap with items measuring cognitive deterioration. For example, the item "Trouble concentrating on things, such as reading the newspaper or watching television"

in the PHQ-9 reflect aspects of both mood and cognition. Furthermore, the underlying neuropathological conditions leading to cognitive impairment may also generate depressive symptoms.[19] Finally, it has been suggested that the relationship between depression and cognitive impairment could be mediated by confounding factors, such as hypothyroidism,[47] antidepressant use,[48] chronic distress,[49] and vascular diseases.[44,50,51,53] It is likely, however that the association between depressive symptoms and cognitive impairment is bidirectional. Due to the cross-sectional design of this study, the causal relationship between them could not be examined leaving this task to future investigations.

In this study, cognitive impairment significantly reduced the psychological and social relationship domains of QOL. According to the distress/protection QOL model,[54] QOL is determined by an interaction between protective (e.g., social support) and distressing factors (e.g., major medical conditions). Owing to the personal suffering related to decline in attention, memory, language and thinking in the context of cognitive impairment, cognitively impaired older adults were expected to have a lower QOL[55], which was confirmed by this study.

The results of this study should be interpreted with caution due to several methodological limitations. First, due to the cross-sectional design of the survey, the causality between cognitive impairment and other variables could not be explored. Second, other sources of information associated with cognitive impairment, such as activities of daily and neuro-imagining tests on vascular

diseases were not available. Third, a fall in the subject's performance by approximately 1.5 SD or more below age-corrected norms recommended to define cognitive impairment by previous studies,[7,29,30] was used in this study without testing the psychometric properties of this criterion. Finally, the participation of genders was not equal; the preponderance of women in the study sample reflects the real gender ratio of older adults in Macao.

In conclusion, considering the negative consequences of cognitive impairment, it is critical to address the issue of cognitive decline in older adults in Macao and implement appropriate strategies to improve access to treatment. Longitudinal studies are warranted to investigate the socio-demographic and clinical predictors of cognitive impairment.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest concerning this article.

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Table1. Comparison of basic demographic and clinical characteristics of the sample according to different settings (n=413)

	Total sample (n=413)		Community (n=199)		Nursing home (n=214)	
	N	%	N	%	N	%
Age group (years)						
50-59	54	13.1	50	25.1	4	1.9
60-69	142	34.4	114	57.3	28	13.1
70-79	99	24.0	30	15.1	69	32.2
>/=85	118	28.6	5	2.5	113	52.8
Male	87	21.1	60	30.2	27	12.6
Married/cohabitating	205	49.6	146	73.4	59	27.6
Living with others	321	77.7	183	92	138	64.5
Education						
Illiterate or primary school	242	58.6	69	34.7	173	80.8
Junior high school and above	171	414	130	65.3	41	19.2
Religious beliefs	258	62.5	111	55.8	147	68.7
Household monthly income < 1000 MOP	335	81.3	133	66.8	202	94.8
Major medical conditions	361	87.4	168	84.4	193	90.2
Verbal abuse	49	11.8	23	11.6	26	12.1
Health perception						
Poor	49	12.0	18	9.0	31	14.7
Fair	266	64.9	127	63.8	139	65.9
Good	95	23.2	54	27.1	41	19.4
Depression	48	11.6	9	4.5	39	18.2
Cognitive impairment	87	21.1	6	3.0	81	37.9
Current suicidality	14	3.4	3	1.5	11	5.1
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age	71.6	10.5	64.1	6.6	78.6	8.4
PHQ-9	4.3	4.1	2.8	2.9	5.7	4.5
Physical QOL	13.8	2.5	14.6	2.2	13.1	2.5
Psychological QOL	13.9	2.4	14.6	2.2	13.2	2.4
Social QOL	14.3	2.4	14.4	2.3	14.1	2.4
Environmental QOL	13.6	2.0	13.7	2.1	13.6	2.0
RBANS Immediate Memory	75.6	21.2	86.3	18.7	65.7	18.5
RBANS Visuospatial	70.8	13.5	77.2	12.8	64.6	11.2
RBANS Language	89.4	17.1	98.5	11.5	80.9	17.3
RBANS Attention	92.2	19.1	104.0	15.7	81.5	15.3
RBANS Delayed Memory	75.0	19.9	86.0	14.5	64.7	18.7
RBANS Total standard score	75.7	17.2	87.1	13.0	65.0	13.6

a=Mann-Whitney U test; 1 USD=8.0 MOP; PHQ-9=Patient Health Questionnaire-9; QOL=quality of life, RBANS= Repeatable Battery for the Assessment of Neuropsychological Status

Table 2. Comparison between those with and without cognitive impairment with respect to basic demographic and clinical characteristics

	No cognitive impairment (n=326)		Cognitive impairment (n=87)		Statistics		
	N	**%**	**N**	**%**	**χ^2**	**df**	**p**
Place of living					75.2	1	**<0.001**
Community	193	59.2	6	6.9			
Nursing house	133	40.8	81	93.1			
Age (years)					62.4	**3**	**<0.001**
50-59	49	15	5	5.7			
60-69	136	41.1	8	9.2			
70-79	77	23.6	22	25.3			
>/=80	66	20.2	52	59.8			
Male	80	24.5	7	8.0	11.2	1	**0.001**
Married/cohabitating	189	58.0	16	18.4	43.0	1	**<0.001**
Living with others	263	80.7	58	66.7	7.7	1	**0.005**
Education					50.5	1	**<0.001**
Illiterate or primary school	162	49.7	80	92.0			
Junior high school and above	164	50.3	7	8.0			
Religious beliefs	196	60.1	62	71.3	3.6	1	0.057
Household monthly income < 10000 MOP	252	77.3	83	96.5	16.5	1	**<0.001**
Major medical conditions	295	87.4	76	87.4	0.001	1	0.9
Verbal abuse	34	10.4	15	17.2	3.0	1	0.08
Health perception					0.4	2	0.7
Poor	37	11.4	12	14.1			
Fair	212	65.2	54	63.5			
Good	76	23.4	19	22.4			
Current suicidality	9	2.8	5	5.7	1.8	1	0.1
	Mean	**SD**	**Mean**	**SD**	**T / Z**	**df**	**p**
Age	69.3	9.5	80.0	9.7	-9.2	411	**0.5**
PHQ-9	3.8	3.7	6.3	4.8	-8.0	**--[a]**	**<0.001**
Physical QOL	14.1	2.4	12.8	2.6	4.4	411	0.1
Psychological QOL	14.2	2.3	12.7	2.5	5.3	411	0.4
Social QOL	14.4	2.3	13.5	2.6	3.0	411	0.4
Environmental QOL	13.7	2.0	13.3	2.2	1.5	411	0.4

Bolded values are p<0.05; a=Mann-Whitney U test; 1 USD=8.0 MOP; PHQ-9=Patient Health Questionnaire-9; QOL=quality of life

Table 3. Means and standard deviations for RBANS subtests and index scores stratified by age

	50-59 years (n=54) Mean, (SD)	60-69 years (n=144) Mean, (SD)	70-79 years (n=99) Mean, (SD)	>/=80 years (n=119) Mean, (SD)
List learning	23.3(6.9)	22.8(6.5)	18.4(6.7)	12.8(6.8)
Story memory	13.8(4.9)	13.5(4.8)	10.9(5.2)	7.8(4.9)
Figure copy	10.4(4.7)	9.9(4.5)	8.5(5.1)	6.7(4.9)
Line orientation	16.0(3.6)	15.6(3.3)	12.9(4.3)	10.0(4.3)
Picture naming	9.7(0.5)	9.5(0.8)	9.1(1.3)	8.1(2.1)
Semantic fluency	19.8(5.9)	19.0(5.7)	15.2(5.7)	11.5(4.5)
Digit span	13.7(2.4)	13.6(2.2)	11.9(2.9)	10.9(2.8)
Coding	34.2(15.1)	32.7(15.2)	19.7(13.2)	9.4(8.8)
List recall	4.4(2.7)	4.5(2.8)	3.2(2.8)	1.0(2.0)
List recognition	18.3(2.0)	18.4(1.8)	17.0(2.6)	15.1(3.2)
Story recall	7.11(2.9)	7.3(2.8)	5.3(3.3)	2.9(2.9)
Figure recall	6.3(4.3)	5.3(3.8)	4.6(3.9)	2.3(2.8)
Immediate Memory	83.2(19.9)	82.0(20.0)	75.0(19.8)	65.0(19.9)
Visuospatial	77.7(15.1)	75.4(12.2)	69.2(13.0)	63.4(10.9)
Language	95.4(12.1)	96.3(13.2)	88.0(16.6)	79.4(18.7)
Attention	99.7(17.8)	101.0(16.8)	88.3(20.1)	81.6(14.7)
Delayed Memory	81.9(17.9)	83.5(16.1)	74.0(19.3)	62.5(18.8)
Total score	83.9(15.9)	83.81(14.2)	73.7(16.8)	63.8(14.0)

Table 4. Socio-demographic correlates of cognitive impairment (logistic regression analysis)

	Cognitive impairment		
	p	OR	95% CI
Age (years)	**<0.001**	1.06	1.03-1.1
Male	0.4	0.6	0.2-1.7
Married/cohabitating	**0.01**	0.3	0.1-0.7
Living with others	0.1	1.7	0.8-3.2
Education	**<0.001**	0.1	0.06-0.3
Household monthly income < 10000 MOP	0.5	0.6	0.1-2.4
PHQ-9	**0.03**	1.07	1.005-1.1

PHQ-9=Patient Health Questionnaire-9; QOL=quality of life