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Psychometric evaluation of the Chinese version of the Activities of Daily Living Questionnaire (ADLQ-CV)

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ABSTRACT

Background: This study examines the psychometric properties of the Chinese version of the Activities of Daily Living Questionnaire (ADLQ-CV) in a sample of older Hong Kong Chinese adults with dementia.

Method: The ADLQ-CV was administered to primary family caregivers of 125 community-dwelling individuals with dementia. Assessments were then made of the scale's reliability, validity and factor structure.

Results: Factor analysis yielded six factors that closely resembled the six subscales proposed in the original scale. The ADLQ-CV demonstrated excellent convergent validity with the Chinese version of the Disability Assessment for Dementia ($r_p = -0.92$, $p < 0.001$). The internal consistency of the ADLQ-CV was good (Cronbach's $\alpha = 0.81$). Excellent test-retest reliability (ICC = 0.998) and inter-rater reliability (ICC = 0.997) of the ADLQ-CV were obtained. The ADLQ-CV showed a significant negative association with global mental states ($r_p = -0.80$, $p < 0.001$), but it did not correlate with the age or educational level of individuals with dementia.

Conclusion: The findings suggest that the ADLQ-CV is a valid and reliable instrument for evaluating the functional abilities of Hong Kong Chinese people with dementia. The brevity and simplicity of administration make it a potentially useful tool for routine assessment of functional status of people with dementia in community or hospital outpatient settings.

Key words: dementia, activities of daily living, functional assessment, Chinese version of ADLQ

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Introduction

Dementia is a growing health concern in many aging societies. Globally, it is estimated that 24.3 million elderly persons have dementia, with 4.6 million new cases occurring annually. The number of people affected is expected to double every 20 years, reaching 42 million by 2020 and 81 million by 2040 (Ferri *et al.*, 2005). Dementia is characterized by a progressive deterioration of cognitive functioning, particularly of memory and executive functions. Research has consistently shown that cognitive deficits are associated with a decline in functional status in persons with dementia (Baum *et al.*, 1996; Perry and Hodges, 2000; Tekin *et al.*, 2001). Generally, the performance of instrumental activities of daily living (IADL) is affected in the early stages of dementia, whereas impairments in basic activities of daily living (ADL) emerge in later stages of the disease (Carswell and Eastwood, 1993; Galasko *et al.*, 1995; Gauthier *et al.*, 1997).

Functional assessment is of fundamental importance in the field of dementia care. It provides health care professionals and policy-makers with valuable information with regard to diagnostic evaluation, service planning and allocation of health service resources. Among the currently available functional assessment tools, the Barthel Index (Mahoney and Barthel, 1965) and the Instrumental Activities of Daily Living Scale (Lawton and Brody, 1969) are two commonly used instruments for gauging the functional abilities of persons with dementia in clinical practice. However, emphasis in these two scales is placed on how impairment of physical functioning, rather than cognitive dysfunction, influences the performance of daily living tasks. In this regard, these measures may be less able to capture functional changes along the course of dementia.

Individuals with dementia often have difficulties in participating in the performance-based assessment of functional status due to the presence of cognitive impairment. Self-report measures are not considered reliable in collecting information of functional abilities of people with dementia because they are less able to make accurate judgments about their performance in functional tasks and tend to underestimate their functional deficits (Weinberger *et al.*, 1992; Ostbye *et al.*, 1997; Farias *et al.*, 2005). The use of proxy measures such as the Disability Assessment for Dementia (Gelinas *et al.*, 1999) and the Activities of Daily Living Questionnaire (ADLQ; Johnson *et al.*, 2004) can overcome the practical limitations associated with self-report and performance-based measures.

Dementia-specific functional measures that have been validated to date for use in the Chinese population are limited. The psychometric properties of the Chinese version of the Disability Assessment for Dementia (CDAD) have been established for Hong Kong Chinese people with dementia (Mok *et al.*, 2005), but the utility of this instrument is somewhat limited because of the interview-based administration. It may not always be feasible to have a trained interviewer in certain clinical settings. There is a need for a validated dementia-specific functional measure that can be easily administered. The ADLQ was constructed in the form of a caregiver-rated questionnaire, involving a minimum of the health professional's time.

The ADLQ assesses the competence of people with dementia in performing functional activities as compared to that prior to the onset of disease. It consists of 28 items encompassing six functional domains: self-care, household care, employment and recreation, shopping and money, travel and communication. These six domains provide a comprehensive profile of dementia-related deficits in everyday functioning, ranging from basic ADL to more complex daily activities. A recent study suggested that the ADLQ was a useful tool for measuring the functional abilities of individuals with different clinical forms of neurodegenerative dementia, including Alzheimer's disease and frontotemporal dementia (Wicklund *et al.*, 2007).

In view of the limited availability of validated functional measures for use with persons with deteriorating cognitive functions in Chinese societies, the aim of the present study is to investigate the psychometric characteristics of the Chinese version of the ADLQ (ADLQ-CV) when used with older Hong Kong Chinese adults with dementia. The relationships of the ADLQ-CV with the characteristics of people with dementia were also examined.

Method

Participants

The convenience sample consisted of individuals with dementia and their primary family caregivers. The primary caregiver was defined as the person who had the most frequent contact with, and who was most directly involved in looking after the daily functioning of the individual with dementia (Johnson *et al.*, 2004). Inclusion criteria of participants with dementia were (1) clinically diagnosed as having dementia according to DSM-IV criteria (American Psychiatric Association, 1994); (2) minimum age of 60 years; (3) of both genders; and (4) community dwellers. Exclusion criteria included the presence of psychiatric illness or physical disabilities that could significantly interfere with functional performance in daily living tasks.

A total of 125 participants with dementia and their caregivers were recruited from two community organizations and eight day care centers for elderly people in Hong Kong. Of the 125 participants with dementia, 64% were females. The mean age and years of education were, respectively, 75.5 ± 5.6 and 2.6 ± 2.6. The Cantonese version of the Mini-mental State Examination (CMMSE; Chiu *et al.*, 1994) scores ranged from 3 to 17 with a mean score of 10.8 ± 3.7, suggesting that most participants with dementia showed moderate impairment in global cognitive functioning. The mean scores of the ADLQ-CV and the CDAD were 59.4 ± 27.6 and 43.7 ± 27.1 respectively, indicating a moderate level of functional impairment in this sample of participants with dementia.

The majority of the primary caregivers were female (70%). Two-thirds of them (66%) were aged between 51 and 70 years, with only 15% being aged under 50 years. Over half of the caregivers (54%) were spouses, the remainder being children (42%) or relatives/friends (4%). Most of them (73%) had primary level of education or below.

Instruments

ADLQ-CV

The 28-item ADLQ is rated on a four-point scale from 0 (no problem) to 3 (no longer capable of carrying out the task). A rating of "9" is given when the item is not applicable. The total score, which has a range of 0–100, is calculated by summing the individual item scores but excluding those rated as "9". The total score and subscale scores were expressed as a percentage to indicate the level of functional impairment. The amount of functional impairment is classified as "severe" (>66%), "moderate" (34–66%), or "none to mild" (0–33%). Satisfactory psychometric properties of the ADLQ have been demonstrated (Johnson *et al.*, 2004).

After obtaining consent from the author of the ADLQ, the English version was translated into Chinese and then back-translated into the original language. The content validity of the ADLQ-CV in aspects of cultural relevance, content representativeness and quality of translation was determined by an expert panel comprising one geriatrician, three occupational therapists, two nurses and two family caregivers. Three items of the ADLQ – home maintenance, home repairs and organizations – were identified as being not culturally relevant to older Hong Kong Chinese people, and were therefore omitted. In the "recreation" item, the recreational activities of "bridge and golf," which are not common pursuits among the elderly in Hong Kong, were replaced by "mahjong playing." As recommended by the expert panel, the item on dressing was modified to include the difficulty of selecting appropriate clothing. The Chinese translation of the ADLQ was generally accepted, with minor revisions made to a few items to enhance clarity. The 25-item ADLQ-CV was tested in a pilot study of five family caregivers of people with dementia and no major modifications to the questionnaire were found to be necessary.

CDAD

The CDAD is a 47-item informant-based instrument measuring the functional disability of persons with dementia. During an interview, caregivers are asked to rate ADL and IADL performance of individuals with dementia on a dichotomous scale. A total score is calculated by adding the rating for each item, with the exception of the "non-applicable" item. The total score range is 0–100, with a lower score denoting a greater degree of functional impairment. The CDAD has demonstrated good construct validity, high internal consistency (Cronbach's $\alpha = 0.91$), excellent inter-rater reliability (ICC = 0.98) and test-retest reliability (ICC = 0.99) (Mok *et al.*, 2005).

Procedures

Ethical approval for the study was granted from the Human Research Ethics Committee of the Hong Kong Polytechnic University. Informed consent was obtained from all participants prior to the study. The CMMSE, a screening measure of global cognitive function, was administered to all participants with dementia. All primary caregivers completed the ADLQ-CV on their own. They were also interviewed using the CDAD. To determine the inter-rater reliability

of the ADLQ-CV, 18 family caregivers who assumed a similar caregiving role as the primary caregivers completed the questionnaire independently on the same day. Another subsample of 22 caregivers completed the ADLQ-CV twice at an interval of two weeks for the purpose of establishing the test-retest reliability.

Data analysis

Statistical analyses were conducted using SPSS 14 for Windows. Descriptive statistics were used to summarize the sample characteristics. Pearson's correlations were performed to explore the association of the ADLQ-CV with the educational level and age of participants with dementia. Independent sample t-tests were administered to examine the gender difference in the ADLQ-CV. The strength of the relationship between the CMMSE and the ADLQ-CV was calculated using Pearson's correlations.

The factor structure of the ADLQ-CV was analyzed by principal components analysis with varimax rotation. The number of factors to be extracted was determined by the Kaiser criterion (eigenvalues > 1) and the scree test. Only significant loadings ≥ 0.4 were included to interpret the factors. The convergent validity of the ADLQ-CV with the CDAD was determined using Pearson's correlations. The internal consistency of the ADLQ-CV was estimated by Crobach's α coefficient. The test-retest reliability and inter-rater reliability for the subscales and total score of the ADLQ-CV were measured using the intraclass correlation coefficient (ICC).

Results

Factor structure of the ADLQ-CV

The item "driving" was rated by almost all caregivers (98.4%) as "not applicable", and hence this item was excluded from the analyses. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.802 and Bartlett's test was highly significant ($p < 0.001$), indicating that the data was appropriate for factor analysis. Six factors emerged, accounting for 85.4% of the total variance (Table 1). The item "employment" did not load on any one of the factors. The first factor showed primary loading for self-care items, and accounted for 20.3% of the variance. Factor 2 was closely related to communication, accounting for 15.8% of the variance. Although the items "using the telephone," "talking" and "understanding" loaded on both Factor 1 and Factor 2, they had higher loadings on Factor 2. The four items related to household chores were all loaded on Factor 3, and accounted for 15.8% of the variance. Factor 4 was comprised of items concerning travel and mobility, accounting for 12.5% of the variance. Factor 5, which accounted for 11.1% of the variance, had loadings for items related to shopping and money management. Factor 6 consisted of two items related to leisure activities and one item "taking pills or medicine," accounting for 9.8% of the variance.

Table 1. Varimax-rotated factor loadings of the ADLQ-CV items

	FACTOR LOADING					
ITEM	1	2	3	4	5	6
Elimination	0.91					
Interest in personal appearance	0.90					
Dressing	0.90					
Eating	0.89					
Bathing	0.82					
Laundry			0.94			
Housekeeping			0.93			
Setting the table			0.92			
Preparing meals, cooking			0.89			
Recreation						0.94
Travel						0.93
Taking pills and medicine						0.64
Handling cash					0.91	
Managing finances					0.86	
Food shopping					0.84	
Travel outside familiar environment				0.97		
Mobility around the neighborhood				0.97		
Public transportation				0.94		
Writing		0.88				
Reading		0.87				
Using the telephone	0.49	0.78				
Understanding	0.49	0.77				
Talking	0.49	0.77				
% of variance	20.33	15.81	15.80	12.50	11.14	9.80

Loadings of ≥ 0.40.

Convergent validity

There was a significant negative association between the total score of the ADLQ-CV and the CDAD total score ($r_p = -0.917$, $p < 0.001$).

Reliability

Cronbach's α coefficients of the 24-item and the 23-item (with the "employment" item deleted) ADLQ-CV were 0.825 and 0.813 respectively. Cronbach's α coefficients of the six subscales ranged from 0.92 to 0.98 (Table 2). It is of note that the removal of the item "employment" increased the value of Crobach's α for the "employment and recreation" subscale from 0.69 to 0.98.

The inter-rater reliability for the ADLQ-CV total score was 0.997 (95% CI = 0.993 to 0.999), and the ICC of the six subscales ranged from 0.982 to 0.999. For test-retest reliability, the ICC for the ADLQ-CV total score was

Table 2. Internal consistency of the ADLQ-CV subscales

SUBSCALE	CRONBACH'S α
Self-care activities	0.92
Household care	0.97
Recreation	0.98
Shopping and money	0.92
Travel	0.98
Communication	0.92

Table 3. ICC for test-retest reliability and inter-rater reliability of the ADLQ-CV

SUBSCALE	INTER-RATER RELIABILITY	TEST-RETEST RELIABILITY
Self-care activities	0.998 (95%CI = 0.994 to 0.999)	0.998 (95%CI = 0.994 to 0.999)
Household care	0.999 (95%CI = 0.997 to 1.00)	0.999 (95%CI = 0.997 to 0.999)
Recreation	0.982 (95%CI = 0.951 to 0.993)	0.986 (95%CI = 0.966 to 0.994)
Shopping and money	0.985 (95%CI = 0.960 to 0.994)	0.997 (95%CI = 0.992 to 0.999)
Travel	0.998 (95%CI = 0.993 to 0.999)	0.993 (95%CI = 0.982 to 0.997)
Communication	0.991 (95%CI = 0.975 to 0.996)	0.995 (95%CI = 0.988 to 0.998)
Total	0.997 (95%CI = 0.993 to 0.999)	0.998 (95%CI = 0.994 to 0.999)

0.998 (95% CI = 0.994 to 0.999); the ICC of the six subscales was notably high (Table 3).

Relationships with the characteristics of participants with dementia

There was no significant gender difference in the ADLQ-CV ($t_{123} = -0.58$, $p = 0.56$). The ADLQ-CV was not significantly associated with age ($r_p = 0.14$, $p = 0.12$) or years of education ($r_p = -0.11$, $p = 0.22$) of participants with dementia. A significant negative relationship was found between the ADLQ-CV and the CMMSE ($r_p = -0.799$, $p < 0.001$).

Discussion

To our knowledge, this is the first study to investigate the factor structure of the ADLQ. Factor analysis of the ADLQ-CV yielded six factors, which corresponded reasonably well to the six subscales proposed in the original scale (Johnson *et al.*, 2004). The item "employment" failed to load on any of the factors and was therefore deleted from the final version of the ADLQ-CV. The deletion of this item improved the internal consistency of the "employment and recreation" subscale. This subscale was subsequently renamed "recreation" to better reflect its constituents. Although the items "using the telephone," "talking" and "understanding" were cross-loaded on more than one factor, they were assigned to Factor 2 (communication) on account of their relatively high loading on this factor. Conceptually, they were also more relevant to the communication domain.

It was rather unexpected that the item "taking pills and medicine" did not load onto the "self-care" factor as proposed in the original version. Broadly speaking, functional activities can be categorized as ADL and IADL (Law, 1993). The former include basic self-care activities that are routinely performed, whilst the latter are more complex functional tasks necessary for independent community living. The five items "eating," "dressing," "bathing," "elimination" and "interest in personal appearance" that loaded highly on Factor 1 have long been regarded as basic personal care activities, thus representing a coherent factor. On the other hand, managing medication is regarded as a high-order functional activity requiring greater complexity of neuropsychological organization (Lawton and Brody, 1969), which may explain its failure to load on Factor 1. Despite this, it is considered more appropriate to retain the item "taking pills and medicine" with Factor 1 as this item lacks the conceptual coherence of Factor 6 which represents "recreation." Further research is needed to examine this item in relation to the overall factor structure of the ADLQ-CV.

The item "driving" was consistently rated by the vast majority of the caregivers as "not applicable" and so was not included in the final version of the ADLQ-CV. Sociocultural factors may explain the non-applicability of this item. Hong Kong has an extensive and well-established public transport network that makes local travel relatively convenient and driving is therefore not considered an essential IADL.

The ADLQ-CV demonstrated good internal consistency, with Cronbach's α coefficients exceeding 0.8 (Nunnally and Bernstein, 1994). The inter-rater reliability of the ADLQ-CV was excellent, suggesting that this instrument produces consistent scores across independent caregivers. Consistent with the validation study of the original version (Johnson *et al.*, 2004), the test-retest reliability of the ADLQ-CV was excellent (ICC values ≥ 0.9), indicating that the instrument is relatively stable over time.

The strong relationship between the ADLQ-CV and the CDAD provided evidence of the convergent validity of the ADLQ-CV. Both the ADLQ-CV and the CDAD were designed to evaluate the performance in ADL and IADL of community-dwelling persons with dementia, and therefore the two scales tap similar content domains. Additionally, both instruments were culturally adapted for use with Hong Kong Chinese people with dementia. It was not surprising to find that there was a high correlation between the two scales.

The lack of associations of the ADLQ-CV with age, gender or education level of participants with dementia suggested that the instrument can be applied to people with dementia of both genders, different age groups and different levels of educational attainment. The ADLQ-CV showed a significant negative correlation with the global mental state of individuals with dementia, which was in line with the findings reported by Johnson *et al.* (2004). A considerable number of studies revealed a significant association between functional capability of persons with dementia and their global cognitive functioning (Perry and Hodges, 2000; Senanarong *et al.*, 2003; Marshall *et al.*, 2006).

Although the ADLQ-CV was developed to assess functional capabilities of community-dwelling people diagnosed with dementia, its application may be

extended to individuals with mild cognitive impairment (MCI) because the scale covers a broad array of complex functional tasks. Recent research has reported that individuals with MCI demonstrate functional impairment in performing advanced daily activities (Artero *et al.*, 2001; Perneczky *et al.*, 2006; Tam *et al.*, 2007). Future studies could be undertaken to examine the psychometric properties of the ADLQ-CV in individuals with MCI and to determine whether the five items deleted in the current version are representative of the MCI population.

There are some limitations inherent in this study. First, the research design was cross-sectional. A longitudinal study is suggested to examine the sensitivity of the ADLQ-CV to detect functional changes of people with dementia over the course of the disease. Secondly, this study recruited only primary family caregivers who could comprehend the written Chinese language and complete the ADLQ-CV on their own. As such, it represented a biased sample. To allow a wider application of the ADLQ-CV, further study is recommended to examine the equivalence of the interview-based and informant-rated versions of the ADLQ-CV. Thirdly, the ADLQ-CV is an informant-based measure. It has been argued that the use of a proxy is potentially subject to personal bias, which may result in either underestimation or overestimation of the person's level of functional impairment (Zanetti *et al.*, 1999; Lowenstein *et al.*, 2001). Further research is suggested to explore the relationship between the caregiver's report of functional ability using the ADLQ-CV and direct observation of the actual performance among cognitively impaired persons. Fourthly, the inter-rater reliability study was limited by its relatively small sample size as it was difficult to recruit a second family caregiver. It is not uncommon that non-Chinese speaking domestic helpers, who are employed to assist the primary caregiver in the day-to-day care of people with dementia, are unable to complete the ADLQ-CV independently. Given the small sample size, the inter-rater reliability results should be interpreted with caution.

In conclusion, the present study suggests that the 23-item ADLQ-CV is a reliable and valid proxy measure of the functional status of persons with dementia. Five items – home maintenance, home repairs, organizations, employment and driving – were not included in the Chinese version of the ADLQ. The ADLQ-CV can be used by health practitioners to assist in intervention planning and outcome evaluation.

Conflict of interest

None.

Description of authors' roles

K.C. Chu designed the study, supervised the data collection, statistically analyzed the data, and wrote the paper. C.C. Chung was involved in designing the study, data interpretation, preparing and revising the manuscript.

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