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A study of the reliability and validity of the Chinese version of the Dementia Rating Scale

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ABSTRACT

Background: The present study aims to develop and validate a Chinese version of the Dementia Rating Scale (DRS) for use with Chinese populations in psychogeriatric settings.

Methods: The DRS was translated into Chinese and its content validity was evaluated by an 11-member expert panel. To assess reliability and concurrent validity, 52 subjects with dementia were recruited from medical and psychogeriatric settings using purposive sampling.

Results: With percentage of agreement as an indicator, 28 out of 36 items (78%) had satisfactory content validity. Items with a percentage of agreement below 70% were reviewed and modified, based on the comments of the experts. The CDRS had excellent test-retest and inter-rater reliability, with intraclass correlation coefficient (ICC) at 0.94 and 0.93 respectively. Intraclass correlation coefficients ranged between 0.75 and 0.89 for the subscales. The internal consistency of the CDRS subscale, as measured by Cronbach's α, ranged from 0.57 to 0.82. The CDRS had high correlations with the Chinese Mini-mental State Examination ($r = 0.80$ for total score, $r = 0.58$ to 0.84 for subscales.

Conclusions: The CDRS is a valid instrument for the assessment of dementia in Chinese–speaking subjects.

Key words: Dementia, cognitive assessment, CDRS, content validity, concurrent validity, test-retest reliability, internal consistency, item analysis

Introduction

In response to the demand for service for people with dementia and other psychiatric disorders in Hong Kong, the government set up district psychogeriatric

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assessment teams to serve the elderly in different geographical areas. These teams provide a full range of services, including assessment, diagnosis, treatment, consultation and support to caregivers. Using a package of standardized assessment tools, the psychogeriatric teams conduct detailed assessments on the physical impairment, cognitive impairment and functional performance of patients to determine their need for support and treatment.

The assessment of cognitive impairment is a major focus of the assessment conducted by the psychogeriatric team, particularly for people with dementia. The Mini-mental Status Examination (MMSE, Folstein *et al.*, 1975) is commonly used as a brief mental status screening tool, while the Rivermead Behavioral Memory Test (RBMT) (Neuro-rehabilitation Working Group, 1998) is used in the assessment of specific memory functions. The Chinese versions of the MMSE and RBMT were developed and validated in Chinese populations (Fan, 1992; Chiu *et al.*, 1994; the Neuro-rehabilitation Working Group, 1998). Unlike the MMSE and RBMT, the Dementia Rating Scale (DRS) (Mattis, 1988; Vitaliano *et al.*, 1984) was designed to address the specific cognitive domains of people with dementia. It is an important tool to assist in early screening and diagnosis of dementia and to bridge the inadequacy of MMSE and RBMT in clinical practice. The development and validation of the Chinese version of DRS (CDRS) will add to and enhance the assessment procedures for persons with dementia.

The DRS is designed to obtain a detailed cognitive function profile of people with dementia. The face validity of the DRS is satisfactory, as it contains items targeting assessment of the symptoms of dementia. It includes a broad range of tasks assessing attention, initiation/perseveration, construction, conceptualization and memory, key areas of impairment found in different types and stages of dementia (Mattis, 1988).

In studies of concurrent validity, DRS scores had a moderate to strong relationship with tests of intelligence and memory function. Coblentz *et al.* (1973) showed that the DRS had high correlations with the Wechsler Adult Intelligence Scale (WAIS) ($r = 0.75$) and the Paired Associate Learning subtest of the Wechsler Memory Scale (WMS) ($r = 0.86$). In a similar study by Chase *et al.* (1984), the DRS had high correlation with WAIS full scale IQ ($r = 0.67$) and WMS memory quotient ($r = 0.70$). The DRS also had high correlations ($r = 0.82$ and 0.78 respectively) with the MMSE in two studies by Salmon *et al.* (1990), and Bobholz and Brandt (1993). Hofer and Piccinin (1996) demonstrated that the total DRS score could discriminate between subjects with probable Alzheimer's disease (AD), mild dementia and normal subjects, and DRS score was found to distinguish more clearly between the stages of dementia than instrumental activities of daily living (IADL) scores (Shay *et al.*, 1991). In another study of its validity (Monsch *et al.*, 1995), the memory and

initiation/perseveration subscales were found to be significant predictors to discriminate between people with AD and normal control subjects. Findings from studies of reliability showed that the reliability of DRS was good when it was evaluated using test-retest, split-half, and internal consistency methods (Coblentz *et al.*, 1973; Gardner *et al.*, 1981; Vitaliano *et al.*, 1984).

Use of the DRS in research and clinical practice has increased over the past ten years because of its good psychometric properties. The development of a Chinese version of the DRS is important to promote both clinical and research development of dementia care in Chinese populations.

Methods

Objectives

This study aims to translate and develop a Chinese version of the DRS and to assess its validity and reliability. The detailed objectives were:

1. To study the content validity of the CDRS
2. To evaluate its test-retest and inter-rater reliability
3. To evaluate concurrent validity by studying the relationship between the CDRS and the Chinese version of the MMSE

Translation and content validity

Approval was first obtained from the publisher to translate the DRS and validate the translated Chinese version. The original version of the DRS was translated from English to Chinese by the researcher and a trained translator verified the quality of the translation. Another professional translator then translated the completed Chinese version back into English. Discrepancies between the two versions were revised, in order to ensure the accuracy of the translation and the equivalence of the Chinese and English versions. Two approaches to translation, the normative approach and the "interpreting and representing" approach were used (Heylen, 1987). Direct translation was used for all major items of the original DRS, as most of the constructs were directly transferable. Four items were modified to make them more culturally relevant.

An 11-member expert panel reviewed the content validity of the CDRS. Using a self-completed questionnaire, the experts were asked to examine the relevance of each test item to its respective subscale, and to comment on the representativeness of the items addressing the content domain. The expert panel included experienced members from three groups of professionals who were the potential users of the scale: psychogeriatricians, clinical psychologists and occupational therapists. Finally, the test items were further refined and modified according to the suggestions of the experts before the CDRS was administered to subjects for the study of its reliability and validity.

Study of concurrent validity and reliability

The studies of concurrent validity and reliability were conducted using the same sample. The Chinese version of MMSE (CMMSE) was selected as the key measure for comparison as it had been validated, demonstrating excellent psychometric properties, in previous studies. Five hospitals participated in the study, with subjects recruited using the following criteria:

1. Age 65 or above
2. Inpatients, day patients or outpatients
3. Clinically diagnosed as having dementia of any type
4. No severe visual impairment, hearing problems or language barrier
5. The primary diagnosis is not depression

Subjects with depression were excluded because the effect of depression-related cognitive impairment might skew the results of the study. Subjects with defective hearing and vision were excluded in order to avoid errors arising from barriers in communication. A training workshop was conducted for raters to ensure consistency in the administration of the CDRS. The raters were occupational therapists from the participating hospitals and subjects' case therapists. To evaluate test-retest reliability, the CDRS was administered to all subjects 2 weeks later by the same or another rater.

Results

The expert panel comprised 5 occupational therapists and 3 psychogeriatricians who were working in psychogeriatric or geriatric teams in different hospitals and 3 clinical psychologists working in universities or a social services center.

Descriptive statistics showed that 80% of items had a satisfactory percentage of agreement in relevance, and 83% a satisfactory percentage of agreement in representativeness. On the whole, 78% of the items reached a satisfactory percentage of agreement in both content relevance and representativeness. The items that had a relatively low percentage of agreement in relevance were: item 3 (single command), items 30 and 31 (counting distraction), item 34 (verbal recognition with presentation of words), items 7 and 8 (consonant and vowel perseveration), and item 29 (orientation). The items with a relatively low percentage of agreement in representativeness were items 3, 34, 7, 8, 29 and 26 (similarities by multiple choice). The range of the percentage agreement of these items was between 54% and 63%. Based on the results of the content validity, these items with a lower percentage of agreement were modified according to the suggestions of the experts before the translated version was finalized and administered to the study sample.

Table 1. Demographic data showing the characteristics of the sample ($N = 52$)

DEMOGRAPHIC VARIABLE	VALUES	*n*	%
Gender	Male	18	35
	Female	34	65
Patient Status	Inpatients	19	37
	Day patients	22	42
	Outpatients	11	21
Education	No formal education	18	35
Level	Below or at primary level	24	46
	Secondary or above	10	19
Age (years)	< 60	2	4
	60–70	12	23
	71–80	22	42
	81–90	14	27
	> 90	2	4
Diagnosis	Dementia of Alzheimer type	41	79
	Vascular dementia	5	2
	Schizophrenia with dementia	5	10
	Alcoholic dementia	1	10

Reliability

The studies of concurrent validity and reliability were conducted using the same study sample, see Table 1. Both Pearson correlation coefficient (r) and the intraclass correlation coefficient (ICC) were used to estimate test-retest reliability. The use of r enables the comparison between the results of this study and previous studies in which the Pearson correlation coefficient was commonly used. The intraclass correlation coefficient is now widely accepted as a better estimate of reliability. It evaluates the agreement between repeated measurements, which overcomes the limitations of the Pearson correlation coefficient (Portney and Watkins, 1993). Test-retest reliability of the CDRS subscales was high, with r ranging from 0.77 to 0.90, and test-retest reliability estimate of the total score was 0.94. The ICC for the subscales ranged from 0.75 to 0.89, and the ICC for the CDRS total score was 0.94.

Estimates of inter-rater reliability were also high, with Pearson correlation coefficient r ranging from 0.78 to 0.90 for the subscales, and r was 0.93 for the total score. The ICC estimates of inter-rater reliability ranged between 0.75 and 0.89, and that for the total score was 0.93. Table 2 shows the test-retest reliability and the inter-rater reliability of the CDRS. The results are comparable to those of the DRS reported by Coblentz *et al.* (1973).

The internal consistency of the subscales was computed by scores of a single administration. The data collected in the first administration of the CDRS used. The estimates of internal consistency (Cronbach's α) for all subscales

Table 2. A comparison of the reliability estimates of the Dementia Rating Scale (DRS) and the Chinese Dementia Rating Scale (CDRS)

		CDRS ($N=52$)			
		TEST-RETEST		INTER-RATER	
DRS/CDRS SUBSCALES	DRS* ($N=30$) TEST-RETEST (r)	R	ICC	r	ICC
Attention	0.61	0.77	0.75	0.78	0.75
Initiation/Perseveration	0.89	0.87	0.86	0.86	0.87
Construction	0.83	0.82	0.82	0.83	0.81
Conceptualization	0.94	0.88	0.88	0.86	0.87
Memory	0.92	0.90	0.89	0.90	0.89
Total Score	0.97	0.94	0.94	0.93	0.93

* Data from Coblentz *et al.* (1973).

Table 3. Comparison of internal consistency of the Dementia Rating Scale (DRS) and the Chinese Dementia rating Scale (CDRS)

DRS/CDRS SUBSCALES	DRS + ($N=34$)	CDRS ($N=52$)
Attention	0.95	0.74
Initiation/Perseveration	0.87	0.57
Construction	–	0.82
Conceptualization	0.95	0.74
Memory	0.75	0.69

* Data from Vitaliano *et al.* (1984).
+ No estimates are available for Construction subscale, because this was not reported in the article.

were satisfactory ($\alpha = 0.57 - 0.82$). The results were compared with the previous results of Vitaliano *et al.* (1984) (Table 3).

Item analysis

Item analysis was carried out using the data collected in the first administration of the CDRS. Descriptive statistics including item range, item mean, item SD, item-subscale correlation and item α were computed for analysis of item difficulty and item characteristics. The item-subscale correlation was good for each item (ranging from 0.28 to 0.89). It was noted that a high proportion of the subjects (89% to 98%) obtained the maximum score in Items 3, 4, 11, 13, 14 and 20. This means that a "ceiling effect" occurred in these items, implying that they were too easy for the subjects in the study sample. The low percentage of severely demented patients in the sample may account for this. On the other hand, Items 32 and 33 showed a "floor effect", as 85% and 90% respectively of the subjects scored the minimum. These two items were probably too difficult for the subjects in the study sample (Table 4).

Table 4. Item analysis of the Chinese Dementia Rating Scale (CDRS)

SUBSCALES*	ITEMS	ITEM RANGE	TOTAL ITEM SCORE	ITEM MEAN	ITEM SD	ITEM-SUBSCALE CORRELATION	ALPHA IF ITEM DELETED
Attention (0.74)	1	3–8	8	5.26	1.47	0.59	0.73
	2	0–2	2	1.61	0.69	0.54	0.71
	3	**2–4**	**4**	**3.96**	**0.28**	**0.56**	**0.73**
	4	**2–4**	**4**	**3.96**	**0.28**	**0.56**	**0.73**
	30	0–6	6	5.03	1.36	0.65	0.69
	31	0–6	5	4.32	1.12	0.72	0.67
	34	0–4	4	3.11	1.53	0.66	0.72
	36	0–4	4	2.84	1.46	0.76	0.67
Initiation/	5	0–20	20	7.11	4.57	0.89	0.63
Perseveration	6	0–8	8	5.38	2.25	0.76	0.39
(0.57)	7	0–1	1	0.59	0.50	0.43	0.54
	8	0–1	1	0.86	0.34	0.47	0.55
	9	0–1	1	0.55	0.50	0.43	0.54
	10	0–1	1	0.61	0.49	0.49	0.54
	11	**0–1**	**1**	**0.98**	**0.14**	**0.28**	**0.56**
	12	0–1	1	0.25	0.44	0.50	0.54
	13	**0–1**	**1**	**0.92**	**0.27**	**0.46**	**0.55**
	14	**0–1**	**1**	**0.88**	**0.32**	**0.40**	**0.55**
	15	0–1	1	0.65	0.48	0.58	0.53
Construction	16	0–1	1	0.59	0.50	0.73	0.79
(0.82)	17	0–1	1	0.42	0.50	0.73	0.77
	18	0–1	1	0.59	0.50	0.76	0.77
	19	0–1	1	0.67	0.47	0.75	0.79
	20	**0–1**	**1**	**0.84**	**0.36**	**0.49**	**0.83**
	21	0–1	1	0.65	0.48	0.73	0.78
Conceptualization	22	0–16	16	12.21	3.4	0.80	0.71
(0.74)	23	0–8	8	2.13	2.35	0.70	0.68
	24	0–3	3	1.30	1.38	0.68	0.69
	25	0–3	3	1.98	1.15	0.71	0.68
	26	0–8	8	5.48	2.33	0.70	0.67
	28	0–1	1	0.53	0.50	0.60	0.73
Memory (0.69)	29	0–9	9	2.96	2.43	0.88	0.55
	32	**0–4**	**4**	**0.36**	**0.95**	**0.56**	**0.65**
	33	**0–3**	**3**	**0.17**	**0.32**	**0.43**	**0.69**
	35	0–5	5	3.40	1.79	0.72	0.62
	37	0–4	4	3.01	1.36	0.67	0.60

* Cronbach's α for the subscales are shown in brackets. (Bold items are the items with "ceiling" or "floor" effect)

Concurrent validity

To collect evidence on the concurrent validity of the CDRS, Pearson correlation between the CDRS scores and the CMMSE score was calculated. The correlation coefficient (r) ranged from the lowest value of 0.57 (initiation/perseveration subscale) to the highest value of 0.84 (memory subscale). There was a strong relationship between CDRS total score and the CMMSE score ($r = 0.80$). The results were comparable with those of the previous study reported by Bobholz and Brandt (1993) (Table 5).

Table 5. Correlation between Chinese Dementia Rating Scale (CDRS) and Chinese Mini-mental State Examination (CMMSE)

	CORRELATION BETWEEN	
DRS/CDRS SUBSCALES	DRS AND MMSE*	CDRS AND CMMSE
Attention	0.50	0.69
Initiation/Perseveration	0.68	0.58
Construction	0.57	0.61
Conceptualization	0.66	0.64
Memory	0.64	0.84
Total DRS/CDRS Score	0.78	0.80

* Data from Bobholz and Brandt (1993).

Demographic data and CDRS scores

The relationship between several demographic variables and the CDRS scores was analyzed using *t*-test and ANOVA. Male subjects had higher means than females on the attention subscale ($t = 2.10, p = 0.04$), memory subscale ($t = 3.43$, $p = 0.01$), and CMMSE score ($t = 2.32$, $p = 0.02$). Analysis of variance also revealed that there were significant differences in CDRS scores among different educational groups, but there was no significant difference in scores among groups of different patient status. ($F = 6.79$, $p = 0.00$; $F = 1.95$, $p = 0.15$).

Discussion

Psychometric properties of the CDRS

The CDRS demonstrated good psychometric properties in this study, and the results were comparable to those obtained in the original evaluation of the DRS. For both test-retest and inter-rater reliability, the CDRS had high reliability for the total scores as well as for the subscales. A relatively lower correlation coefficient was found for the attention subscale. This may be due to the fact that the attention span of the demented elderly is likely to fluctuate and be affected by environmental factors.

Evidence on the concurrent validity of the CDRS was obtained by calculating the Pearson correlation coefficient between the CDRS scores and the CMMSE score. The strength of the correlation was comparable to that of a similar overseas study by Bobholz and Brandt (1993) (Table 5). The initiation/perseveration subscale had a relatively lower correlation ($r = 0.57$) with the CMMSE. A possible reason for this lower correlation is that the CMMSE was not designed to assess the cognitive aspect of initiation/perseveration. The CDRS provides additional information on the cognitive function profile of subjects.

A test of internal consistency, Cronbach's α was high for all CDRS subscales. A relatively low α value was found for the initiation/perseveration subscale $\alpha = 056$). The relatively low value does not necessarily indicate that the test items are not unidimensional (Crocker and Algina, 1986). The variation in the scoring system of the items within this subscale might account for the relatively low α value. When comparing the internal consistency results with the study of Vitaliano *et al.* (1984), the α values of the present studies are lower. The difference in the sample size of the two studies may account for the discrepancies between the α values of the subscales.

Test performance

The sample was recruited from five clinical settings, 54% from a general hospital. Even though a different number of subjects was recruited from each setting, the *t*-test result showed that there was no significant difference in mean scores between participants from different referral sources. This suggested that the sample was homogeneous. From the summary statistics of the CDRS, it was noted that the distributions of both scores were positively skewed; a large proportion of the subjects obtaining a score at the lower end of the CMMSE scale. For the CDRS score, positive skew was observed only in the distribution of the initiation/perseveration and memory subscales, while negative skew was noted in the attention, construction, and conceptualization subscales and in the total scores. These results implied that participants did better on the subscales for attention, construction and conceptualization than for initiation/perseveration and memory. This result was consistent with the general clinical picture of dementia, as memory and verbal fluency are the cognitive domains found to have early changes in dementia (Monsch *et al.*, 1995).

Cultural issues

One of the major challenges in the translation of the instrument was how to maintain, simultaneously, the original meaning of items and their cultural relevance to local practice. The researcher often faced a choice between the "normative" (i.e. direct) translation approach, and the "interpreting and representing" approach, which places more emphasis on the cultural context of the translation (Heylen, 1987). As a result of this lengthy process, four items were modified during translation and further items were refined after the study of content validity, to make the test more culturally relevant for Chinese populations. However, the expert panel did not review the modified items, and the level of agreement was not calculated on the revised items.

It was noted that 35% of the research participants were illiterate. With some items modified, the CDRS was successfully administered to this group without

any obvious problems. This suggests that the use of the CDRS with illiterate Chinese subjects is possible.

Recommendation for further studies

Using purposive sampling, a large proportion of the research participants was found to have mild to moderate dementia, and only 6 subjects (11.5%) had severe dementia (MMSE score below 10). A study with even distribution of subjects at different stages of dementia would permit comparison of the score profile of subjects at each stage.

Due to constraints of time, manpower and resources, the number of subjects recruited was limited to 52. This sample size is adequate for obtaining reliability estimates and correlation coefficients with reasonable statistical power, but not for carrying out the item analysis. In future validation studies, the sample size should be sufficiently large for item and factor analysis. These analyses are useful quantitative methods to examine the dimensionality of the scale and for data reduction, and their results, together with the results of content validity analysis, could provide support for further refinement of the scale.

Additional studies to improve the clinical utility of the CDRS are recommended. The establishment of local norms, based on healthy and non-demented elderly samples, is important, as are studies of the discriminant and predictive validity of the CDRS. These could contribute to the local application of the instrument, especially in occupational therapy, where the use of the CDRS score to predict the outcome of functional assessment of demented patients could significantly assist occupational therapists in case management.

Conclusion

The CDRS is a reliable and valid instrument for assessment of cognitive deficits in people with dementia. It showed sensitivity in the assessment of elderly in an early or middle stage of dementia, which will facilitate its local application and contribute to the screening and diagnosis of Chinese demented elderly. Furthermore, it can provide a more detailed assessment of cognitive function, and the information obtained from subtest items can be used to guide treatment planning.

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