

Chinese version of the Delirium Rating Scale-Revised-98: reliability and validity

Ming-Chyi Huang^{a,b}, Chun-Hung Lee^c, Ying-Ching Lai^d, Yu-Fen Kao^a,
Hong-Yen Lin^a, Chun-Hsin Chen^{b,e,*}

^aDepartment of Psychiatry, Taipei City Psychiatric Center, Taipei City Hospital, Taipei, Taiwan

^bDepartment of Psychiatry, School of Medicine, Taipei Medical University, Taipei, Taiwan

^cDepartment of Psychiatry, Jianan Mental Hospital, Tainan, Taiwan

^dDepartment of Psychiatry, Cathay General Hospital, Taipei, Taiwan

^eDepartment of Psychiatry, Taipei Medical University -Wan Fang Hospital, Taipei, Taiwan

Abstract

Background: Delirium is commonly seen in patients in consultation-liaison psychiatry. Assessing delirium severity is important in clinical practice. The Delirium Rating Scale-Revised-98 (DRS-R-98) has been already established as a valid and reliable tool to achieve this goal. This study was aimed to evaluate the reliability and validity of the Chinese version of the DRS-R-98 (DRS-R-98-C) in Taiwan.

Method: We recruited 4 patient groups with delirium ($n = 28$), alcohol dependence ($n = 9$), dementia ($n = 11$), and schizophrenia and bipolar disorder ($n = 11$) and evaluated them with DRS-R-98-C and Mini-Mental Status Examination (MMSE) by 2 psychiatrists at a single assessment session.

Results: The results showed that mean DRS-R-98-C total and severity scores in delirious patients were found significantly higher than those in other patient groups. Interrater reliability of the DRS-R-98-C between 2 raters was high, with intraclass correlation coefficient of .98 for severity scale and .99 for total scale. Internal consistency was high with a Cronbach's α coefficient of .85 and .86 for DRS-R-98-C severity and total scales. A significant inverse correlation was found between the DRS-R-98-C and the MMSE score ($r = -0.63$, $P < .001$) for either severity or total scale among 28 delirious patients. Area under the curve established by receiver operating characteristic analysis was .93 and .96 for severity and total scales, respectively. Optimal cutoff of total score was 15.5, with sensitivity of 89.3% and specificity of 96.8%.

Conclusion: The DRS-R-98-C is a valid and reliable measure of delirium severity and can be used clinically to monitor the course of illness when administered serially.

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1. Introduction

Delirium is a disturbance of the consciousness level and a change in cognition that develops over a short time [1]. Occurrence of delirium ranges from 11% to 42% in medical inpatients during admission [2] and from 24% to 33% in alcoholic inpatients [3,4]. It is common in consultation-liaison psychiatry [5,6] and usually undiagnosed by the referring physicians [7]. Delirium may increase mortality at discharge, length of hospital stay, and institutionalization [2].

Although diagnostic criteria, such as *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) criteria [1], list standards to ensure diagnosis of the delirium syndrome, they do not provide the way to assess symptom severity. Some screening tools, such as Confusion Assessment Method [8], can detect patients with delirium but is not designed for assessing symptom severity. A practical instrument to evaluate the changes of delirium severity and better understand the progress of delirious course is important in clinical setting.

The 10-item Delirium Rating Scale (DRS) is the first instrument developed by Trzepacz et al [9,10] to assess the severity of delirium symptoms and has been widely used in consultation-liaison. However, some shortcomings of DRS, such as combining hypoactive and hyperactive in psychomotor behaviors, combining various cognitive deficits

* Corresponding author. Department of Psychiatry, Taipei Medical University-Wan Fang Hospital, III, Sec 3, Hsin-Long Rd, Taipei 116, Taiwan. Tel.: +886 2 29307930 x53961; fax: +886 2 29335221.

E-mail address: chunhsin57@yahoo.com.tw (C.-H. Chen).

Table 1

Demographic characteristics and DRS-R-98-C scores of 4 diagnostic patients

	Delirium (n = 28)	Alcohol dependence (n = 9)	Dementia (n = 11)	Psychosis (n = 11)
Age, mean $\pm$ SD, y	55.4 $\pm$ 16.2	42.7 $\pm$ 7.1	73.9 $\pm$ 6.7	36.6 $\pm$ 16.7
Sex				
Male	25	8	4	7
Female	3	1	7	4
DRS-R-98-C severity				
Mean $\pm$ SD*	20.4 $\pm$ 8.2***	3.7 $\pm$ 4.3	10.1 $\pm$ 3.4	6.2 $\pm$ 3.8
Median (range)	20.5 (3.5–35.5)	1.0 (0–12)	10.5 (4–14)	5.0 (3–15)
DRS-R-98 total				
Mean $\pm$ SD**	25.5 $\pm$ 8.8***	4.5 $\pm$ 5.6	10.6 $\pm$ 3.1	6.2 $\pm$ 3.8
Median (range)	26.0 (8.5–40.5)	1.0 (0–16)	10.5 (5–14)	5.0 (3–15)

* $F = 23.88$, $df = (3, 55)$, $P < .001$.** $F = 35.85$, $df = (3, 55)$, $P < .001$.*** $P < .001$, compared with other 3 groups.

into 1 item, and not having a separate item to evaluate attention deficits, limit its use in clinical practice. The Delirium Rating Scale-Revised-98 (DRS-R-98) was modified to overcome the above-mentioned problems [11]. The DRS-R-98 is a 16-item clinician-rated scale with 2 sections composed of 13 severity items and 3 diagnostic items. Severity items are each rated from 0 to 3 points, and diagnostic items from 0 to 2 or 3 points. The scale has been already recognized as valid and reliable and can distinguish delirious patients from nondelirious psychiatric patients, such as dementia, depression, and schizophrenia [11].

The use of DRS-R-98 in Chinese has not been published in the literature. The aim of this study was to validate the reliability and validity of the Chinese version of the DRS-R-98 (DRS-R-98-C) for delirious patients in Taiwan.

2. Methods

2.1. Subjects

The study was conducted at National Taiwan University Hospital (NTUH) and Taipei City Psychiatric Center (TCPC) in northern Taiwan. It was approved by the institutional review board. We recruited patients with delirium, alcohol dependence, dementia, and psychosis (schizophrenia or bipolar disorder) to form the 4 different comparison groups. Delirious patients were referred and recruited from the service of consultation-liaison psychiatry in NTUH and the alcohol detoxification ward at TCPC. The other patient groups were recruited from other psychiatric inpatient wards at TCPC. The clinical diagnosis of delirium, alcohol dependence, dementia, schizophrenia, and bipolar disorder were based on the DSM-IV criteria [1] and were ascertained by senior psychiatrists (M.C.H. and C.H.L.).

2.2. Translation of the DRS-R-98-C

The DRS-R-98 (including instructions, items, and score sheet) was translated into Chinese by a senior psychiatrist (M.C.H.) and was back-translated into

English by another experienced psychologist. The translation version of the DRS-R-98-C was approved by the developer of the original DRS-R-98 (Trzepacz, P.T.). Eight well-trained psychiatrists participated in the research as raters for the scale, all of them having discussed the use of the DRS-R-98-C thoroughly before the recruitment of patients.

2.3. Procedures

After ascertaining the patients' diagnosis, 2 raters evaluated the patients with DRS-R-98-C and Mini-Mental State Examination (MMSE) in 1 session. One researcher evaluated the patients with the DRS-R-98-C and the other administered MMSE, but they scored both of the 2 rating scales independently. The Chinese version of MMSE has been validated and widely used in Taiwan [12,13]. Because we recruited patients with different diagnoses from their respective wards, it is difficult for the raters to be blind to the diagnoses of referred patients.

2.4. Statistical analysis

Data were expressed as descriptive statistics, such as mean $\pm$ standard deviation (SD), median, and range of scores. To assess empirical validity of the DRS-R-98-C as a delirium scale, severity and total scores were compared among 4 diagnostic groups by analysis of variance, with post hoc pairwise comparison to determine where the differences existed. Box plots were graphed to show medians and distributions of rating scales. We also used the Kruskal-Wallis test to assess the differences between groups.

We assumed that nondelirious patients had low DRS-R-98-C scores. To avoid overestimation of reliability, only DRS-R-98-C scores in delirious patients were used to estimate the internal consistency and interrater reliability. The internal consistency was estimated using Cronbach's α . The interrater reliability was measured by using intraclass correlation coefficient (ICC) between 2 raters for both the DRS-R-98-C severity and total scores. The ICC was calculated using 2-way random effects model.

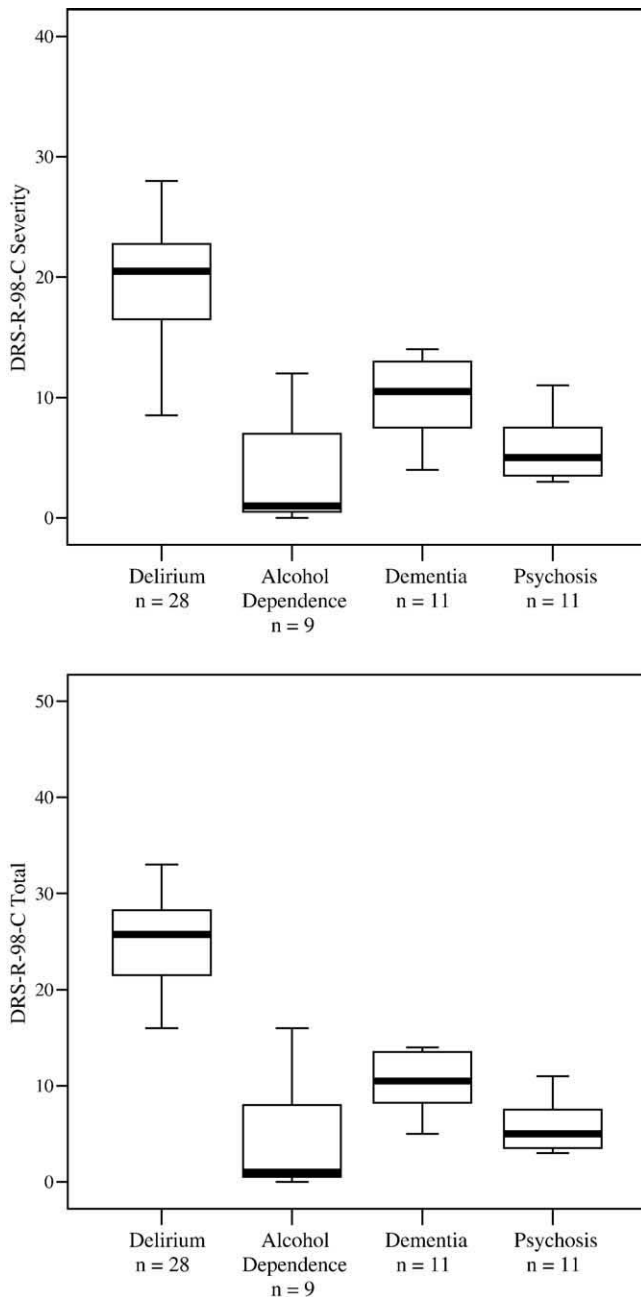


Fig. 1. The distribution of DRS-R-98-C severity and total scores in quartiles (middle 50% in the box) and median scores (in solid black lines) of 4 patient groups.

We assessed concurrent validity with Pearson's correlations between the DRS-R-98-C severity or total scores and the MMSE among delirious patients. Receiver operating characteristic (ROC) analysis was used to determine optimal cutoffs of DRS-R-98-C when comparing delirious subjects with all nondelirious subjects. The average scores between 2 raters were taken as reference values to perform the above-mentioned correlations and ROC analysis. Data were analyzed by using SPSS software (version 12.0).

3. Results

3.1. Subject and scale descriptive

We recruited 28 patients with delirium, 9 with alcohol dependence, 11 with dementia, and 11 with psychosis. The comorbid physical or psychiatric diseases of delirious patients included alcohol dependence ($n = 18$), liver cirrhosis ($n = 2$), malignancy ($n = 2$), infection ($n = 2$), cardiovascular diseases ($n = 2$), and other substance dependence ($n = 2$).

Table 1 shows the demographic characteristics and the DRS-R-98-C scores of 4 patient groups. Mean DRS-R-98-C severity and total scores were significantly different among 4 patient groups. In pairwise post hoc analysis, the mean DRS-R-98-C severity and total scores in delirious patients were significantly higher than those in the other 3 groups. No significant differences were found between 3 nondelirious groups. In addition to comparison of group means, Fig. 1 shows the distribution of DRS-R-98-C severity and total scores in 4 groups of patients in quartiles and median scores. On Kruskal-Wallis comparisons, the DRS-R-98-C severity and total scores were significantly different among groups ($P < .001$).

3.2. Reliability and validity

Interrater reliability of the DRS-R-98-C between 2 raters was high, with ICC of .98 for severity scores and .99 for total scores. Internal consistency was also high, with a Cronbach's α coefficient of .85 and .86 for DRS-R-98-C severity and total scales, respectively. Table 2 shows α coefficients of both DRS-R-98-C severity and total scales after each item was removed from the scales. The coefficients ranged from .83 to .86 for the DRS-R-98-C severity and from .84 to .87 for the DRS-R-98-C total scale.

There is a significant inverse correlation between the DRS-R-98-C and the MMSE score ($r = -0.63$; $P < .001$) for either severity or total scale among 28 delirious patients. Fig. 2 shows the regression plot between DRS-R-98-C total score and MMSE.

Area under the ROC curve (AUC) was .93 for DRS-R-98-C severity scale and .96 for total scale. Table 3 shows cutoffs, sensitivity, and specificity of DRS-R-98-C severity and total scales when comparing delirious group with all nondelirious groups. Optimal cutoffs were 15.5 for total scale with sensitivity of 89.3% and specificity of 96.8%, and 12.25 to 15.5 for severity scale with sensitivity of 82.1% to 85.7% and specificity of 83.9% to 100%.

4. Discussion

The study showed that the DRS-R-98-C was a valid and reliable measure for delirium severity. Its mean and median scores were significantly higher in delirium subjects than those in any of its nondelirious comparison groups, such as alcohol dependence, dementia, and psychosis.

Table 2
Internal consistency of DRS-R-98-C scale in 28 delirious patients

Item		α^a	α^a
		DRS-R-98-C Total	DRS-R-98-C Severity
(1)	Sleep-wake cycle disturbance	.85	.83
(2)	Perceptual disturbances and hallucinations	.86	.85
(3)	Delusions	.86	.85
(4)	Lability of affect	.85	.84
(5)	Language	.84	.83
(6)	Thought process abnormalities	.84	.83
(7)	Motor agitation	.85	.83
(8)	Motor retardation	.87	.86
(9)	Orientation	.85	.84
(10)	Attention	.85	.84
(11)	Short-term memory	.86	.85
(12)	Long-term memory	.85	.84
(13)	Visuospatial ability	.85	.83
(14)	Temporal onset of symptoms	.86	NA
(15)	Fluctuation of symptom severity	.85	NA
(16)	Physical disorder	.86	NA

^a Coefficients correspond to scale's α if this item is deleted.

Compared with other studies, delirious patients in this study were almost male and younger. The composition of our delirious group, in which 20 of 28 patients had alcohol or substance use disorders, could account for low percentage of female patients and younger age of subjects. However, the distribution of DRS-R-98 scores for delirious patients in our study approximated to other studies. The range of DRS-R-98 total score in our delirious patients was 8.5 to 40.5, whereas 11 to 39 [11], 14 to 37 [14], and 7 to 39 [15] in previous studies. The median of DRS-R-98 total scores for delirious

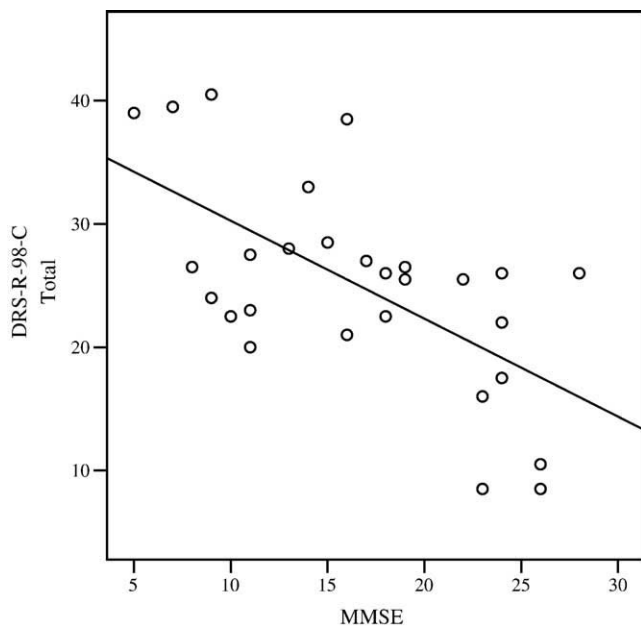


Fig. 2. Regression plot between DRS-R-98-C total scores and MMSE in 28 delirious patients.

Table 3
Cutoffs, sensitivity, and specificity of DRS-R-98-C when comparing delirious group with all non-delirious groups, based on ROC analysis

DRS-R-98-C Total			DRS-R-98-C Severity		
Score	Sensitivity	Specificity	Score	Sensitivity	Specificity
9.25	92.9	67.7	8.25	92.9	67.7
10.00	92.9	71.0	10.75	89.3	74.2
12.50	89.3	80.6	12.25	85.7	83.9
15.50	89.3	96.8	14.50	82.1	96.8
16.75	85.7	100	15.50	82.1	100

patients was also similar between our study (26.0) and other studies (from 22 to 27.3) [11,14,15]. Furthermore, we also compared the distribution of DRS-R-98 scores for patients with dementia, a patient group potentially confounded with delirium, between studies. In this study, the range of DRS-R-98 total score in patients with dementia was 5 to 14, paralleled with 9 to 22 [11], 3 to 22 [14], and 0 to 23 [14] in previous studies. The median of DRS-R-98 total score in patients with dementia was also similar between our subjects (10.5) and others (from 5 to 13.9) [11,14,15]. Therefore, the results of our study were comparable to previous western studies. Meanwhile, DRS-R-98 seems also applicable to patients with wide range of ages.

We found the interrater reliability, with ICC of .98 to .99 for both the total and severity scales, which was similar to that in English, Spanish, Portuguese, or Dutch version of DRS-R-98 [11,14–17]. Internal consistency of total and severity scale was high, with Cronbach's α coefficient of .86 and .85, respectively. The item coefficients ranged from .84 to .87 for the DRS-R-98-C total and from .83 to .86 for the DRS-R-98-C severity scale. The results also paralleled with those of the original DRS-R-98 and some other versions [11,14,18] but were somewhat higher than those in Spanish version, that is, .78 for the severity scale and .73 to .81 for its items [16]. Based on the results, we suggest that a high degree of internal consistency among items of the scale. Concurrent validity was highly based on significant correlation with the MMSE, although the DRS-R-98 is used to assess more than cognitive symptoms of delirium. The correlations are comparable with the MMSE correlations with the Spanish version ($r = -0.64$) and Korean version ($r = -0.68$) of DRS-R-98 [16,18].

The AUCs of DRS-R-98-C severity scale (0.93) and total scale (0.96) show that DRS-R-98-C can successfully discriminate delirious patients from nondelirious patients. Previous studies also showed similar AUCs, which ranged from .95 to .99 [14,17]. In our study, optimal cutoff of DRS-R-98-C was 15.5 for total score and 12.5 to 15.5 for severity score. Optimal cutoff of DRS-R-98 total score and severity score in past literatures ranged from 14 to 21.5 and from 10.5 to 16, respectively [11,14,17,18]. The sensitivity and specificity, ranging from 82%–93% and 94%–98%, differed between studies [11,14,17]. High variation of cutoffs, sensitivity, and specificity might be due to relatively small sample size of delirious patients ($n = 17$ –27) in these studies.

Larger sample size would be needed to get more precise and valid cutoff scores in the future.

The study has some limitations. First, we used the MMSE, which is not specific for the delirious patients, for validity analysis, rather than using specific measures for delirious patients, such as Cognitive Test for Delirium [19]. Second, we did not use the DRS-R-98-C to assess delirium severity change for delirious patients although serial assessments of the DRS-R-98 permits repeated administration. Third, we did not assess the clinical severity, such as Clinical Global Impression, for each diagnostic group, especially in the delirious group. So we are unable to test external validity of DRS-R-98-C. Fourth, all raters in our study were psychiatrists. Psychometric properties of the scale should be evaluated when used by nonpsychiatrists.

In conclusion, the DRS-R-98-C is a reliable and valid tool to assess the severity of delirium in patients either with medical illnesses or alcohol dependence. It can successfully distinguish delirious patients from patients with dementia and other psychiatric diagnoses and can be used to monitor the course of delirium when administered serially.

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