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The Carroll Rating Scale for Depression
I. Development, Reliability and Validation

BERNARD J. CARROLL, MICHAEL FEINBERG, PETER E. SMOUSE, SARAH G. RAWSON and JOHN F. GREDEN

Summary: The Carroll rating scale (CRS) was developed as a self rating instrument for depression, closely matching the information content and specific items of the Hamilton rating scale (HRS). The CRS was found to have acceptable face validity and reliability. The concurrent validity of the CRS was acceptable, based on comparisons with the HRS and the Beck Depression Inventory (BDI). The internal consistency of the CRS was very similar to that of the HRS. The CRS contained information about HRS scores beyond what could be predicted from BDI scores, but the BDI did not predict HRS scores beyond what could be predicted from CRS scores. The CRS and BDI scores were strongly correlated and both had access to a subjective dimension of depression that could not be predicted from HRS scores. The complementary uses of self ratings and observer ratings are evident from these results. The CRS may be a useful alternative to the BDI as a self rating scale, with the additional advantage of closer correspondence to the HRS.

In research studies of depression a measure of the severity of illness is an important requirement; ratings by clinicians were introduced first and these were followed by self rating scales. The comparative performances of these two types of rating have been studied extensively in recent years. Self ratings generally have highly significant correlations with observer ratings but certain types of discordance have been described. For example Carroll *et al* (1973) found that the Hamilton rating scale (HRS) (Hamilton, 1960), completed by clinicians, was superior to the Zung self rating depression scale (SDS) (Zung, 1965) in discriminating global severity of depression across three treatment settings (inpatient, day hospital, general practice); Bailey and Coppen (1976) found satisfactory and significant correlations between the HRS and the self rated Beck Depression Inventory (BDI) (Beck *et al*, 1961) in only two-thirds of patients and often very divergent results were found in the remaining third. Neither type of rating scale should be used for making a diagnosis of depression (Hamilton, 1960; Carroll *et al*, 1973; Hedlund and Vieweg, 1979) although the self rating scales are often used as screening instruments.

The general problems of concordance between clinician ratings and self ratings were discussed by Prusoff *et al* (1972) and by Carroll *et al* (1973). While problems such as denial, exaggeration and loss of insight are unavoidable, at least the content of the two types of rating can be controlled. The HRS is largely concerned with the behavioural and somatic features of depression, whereas the BDI is more concerned with the psychological and cognitive features. The Zung SDS contains a broad sample of features but is limited in its access to information about several items because of the way it was constructed (Carroll *et al*, 1973).

Since the Hamilton scale is the most widely used observer rating instrument for depression, a self rating version of the HRS closely following the item content could be useful, and the development of such a scale (Carroll rating scale (CRS)) over a period of ten years, is presented here.

Methods

Design: The CRS was designed as a direct self rated adaptation of the original 17-item HRS. Items in the HRS that are scored 0–4 are represented in the new scale by four statements denoting progressively increasing severity of illness. Similarly, items scored 0–2 in the HRS are represented by two statements in the new scale. Thus, the maximum possible score is 52, as in the HRS. The complete list of CRS items, corresponding to the HRS items, is given in Appendix

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I. In the form that the patients complete (Appendix II) the 52 statements are randomly presented.

The direction of a response indicative of depression is YES for 40 statements, NO for 12 statements. Double-negative response constructions were avoided. Each statement is scored as one point towards the total score. While the logic of the set of statements for each item should require that patients answering positively to statement 4 also answer positively to statements 1, 2 and 3, we have not complicated the scoring procedure by assigning different weights to the statements. This allows the total score to be compared more readily with the HRS score by clinicians using the CRS. By means of a scoring key the CRS score for individual items can be obtained, in addition to the total score.

Reliability and validity: The CRS was completed by 119 adults aged 18–64, employed at the University of Michigan Medical Center; for reasons of confidentiality the sex of each respondent was not identified, nor was it known whether a respondent was receiving psychiatric treatment. The respondents were a representative sample of the population; they covered a wide range of socioeconomic status. For comparison with the results in this sample, we obtained psychiatrists' global ratings of severity, together with CRS ratings in patients being treated for depression. These concurrent ratings were obtained on 1191 occasions for over 200 patients. The global rating of severity of depression was made on a four-point (0–3) scale.

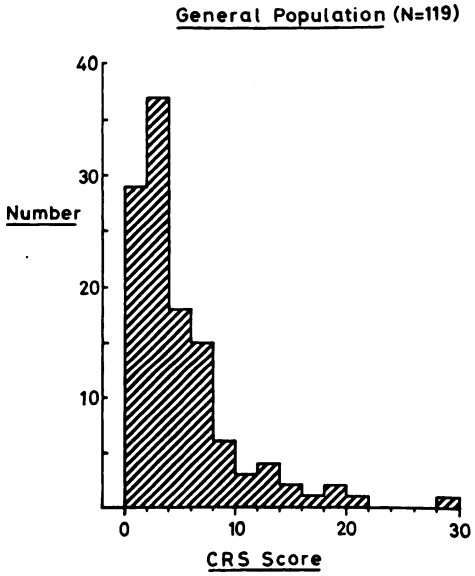
The concurrent validity of the CRS was estimated by comparing CRS scores with HRS scores in patients suffering from endogenous depression. The clinical diagnoses were made as described by Carroll *et al* (1980) and were supported in 98 per cent of cases by the Research Diagnostic Criteria (Spitzer *et al*, 1977). The two scores were obtained on the same day in each patient. Psychiatrists carrying out the HRS ratings received preliminary training in the use of this scale. In addition the CRS was compared with the BDI. For this comparison HRS, CRS and BDI ratings were obtained from 278 inpatients representing a range of psychiatric diagnoses, similar to the range employed by Beck (1967) for his validation of the BDI. Correlations and partial correlations among the three severity scales were determined.

The internal consistency of the CRS was examined in patients with endogenous depression by correlating individual item scores with the total score, in parallel with an identical analysis of matched HRS ratings. The split-half reliability of the CRS was tested by correlating the sums of odd- and even-numbered statements with each other and with the total score. Similarly, the effect of direction of response was examined by correlating the sums of YES- and NO-response items with each other and with the total score. For these analyses we used all available ratings, which included sequential ratings in many patients. Separate analyses revealed only minor changes in correlations within subjects compared to correlations across subjects (see Table I of the third paper of this series).

Results

General population scores: The mean CRS score of 119 subjects from the general population was 4.6, s.e. 0.4. The distribution of these scores was skewed heavily towards low values, with the median score being three (Figure). From inspection of the Figure we would propose a score of 10 as a reasonable cut-off point if the CRS is to be used as a screening instrument for depression. The higher scores reflect significant depressive symptoms in at least 9 per cent of this general population sample and this finding may be compared with a rate of 17 per cent found by Weissman and Myers (1978), using another self-report instrument in an urban community survey. For comparison, analysis of the 1191 concurrent global ratings and CRS ratings of patients revealed that 80 per cent of global ratings greater than 0, and 99 per cent of global ratings greater than 1, were associated with CRS scores above 10.

Split-half reliability: The split-half reliability was calculated with a total of 3725 CRS ratings. The sum of the odd-numbered statements correlated well with



FIG—CRS scores obtained from 119 persons in the general population.

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TABLE

Correlations for pairs of CRS and HRS items, correlations for particular CRS items and HRS total, and correlations for particular HRS items and CRS total

		Carroll Item																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	CRS-Total
Hamilton Item	1	.67	.43	.48	.25	.34	.28	.51	.46	.42	.55	.21	.30	.51	.21	.26	.01	.17	.68
	2	.48	.48	.31	.15	.10	.05	.40	.39	.26	.35	.11	.12	.26	.11	.28	.05	.06	.46
	4	.69	.46	.72	.15	.21	.11	.48	.46	.39	.49	.21	.32	.41	.24	.21	−.02	.16	.65
	4	.08	.09	.02	.73	.43	.36	.16	.15	.24	.31	.23	.26	.23	.06	.10	−.02	.20	.36
	5	.12	.09	.02	.47	.67	.49	.22	.17	.27	.24	.26	.27	.17	.10	.09	.02	.16	.38
	6	.06	.05	−.03	.37	.57	.68	.14	.07	.20	.25	.20	.12	.24	.05	.13	.11	.05	.31
	7	.57	.40	.37	.27	.30	.30	.64	.54	.44	.53	.25	.37	.54	.26	.22	.06	.16	.68
	8	.21	.17	.18	.05	.08	.06	.32	.27	.21	.26	.11	.13	.23	.24	.13	.06	.16	.31
	9	.12	.11	.05	.38	.26	.23	.16	.16	.23	.29	.18	.22	.09	.01	.15	.00	.17	.29
	10	.30	.19	.09	.31	.25	.26	.24	.23	.38	.52	.28	.28	.35	.07	.27	.09	.10	.44
	11	.35	.15	.13	.28	.28	.30	.31	.24	.37	.47	.41	.33	.39	.15	.23	.08	.15	.48
	12	.32	.15	.22	.18	.30	.29	.40	.37	.42	.43	.36	.63	.34	.26	.17	.16	.42	.54
	13	.40	.30	.26	.21	.22	.25	.40	.38	.33	.46	.21	.20	.60	.22	.25	.10	.12	.53
	14	.30	.30	.18	.10	.07	.02	.25	.33	.12	.25	.01	.13	.29	.53	.23	−.00	.14	.35
	15	.04	.04	−.04	.16	.23	.25	.07	.03	.11	.18	.27	.14	.15	.20	.28	.03	.16	.22
	16	.02	−.07	.01	.07	.12	.11	−.01	.05	.06	.08	.08	.06	−.04	.04	−.13	−.06	.03	.04
	17	.05	.06	.04	.14	.18	.19	.20	.19	.21	.20	.12	.44	.11	.07	.09	.20	.60	.28
HRS-Total		.57	.40	.36	.48	.51	.47	.56	.52	.53	.67	.38	.47	.57	.32	.34	.09	.30	.80

the sum of the even-numbered statements ($r = +0.87$, $P < 0.001$). The sum of each half-set of statements correlated highly with the total score ($r = +0.97$, $+0.96$, respectively). The sum of YES statements correlated highly with the sum of NO statements ($r = +0.74$, $P < 0.001$) in the same set of 3725 CRS ratings. The sum of the 12 NO statements correlated $+0.87$ with the total score, while the sum of the 40 YES statements correlated $+0.98$ with the total score.

Correlation with HRS: The matrix of correlations between items and total scores for 278 matched HRS–CRS ratings in 97 patients with endogenous depression is presented in the Table. The correlation of HRS total with CRS total was highly significant ($r = +0.80$, $P < 0.001$). Those CRS items strongly correlated with the HRS total (e.g., items 1, 7, 10) were also strongly correlated with several HRS items, and conversely for those CRS items only weakly correlated with the HRS total (e.g., items 14, 15, 16, 17). The same comment applies to HRS items and the CRS total. The matching items for the two scales (the principal diagonal terms) were generally more highly correlated than other pairs of items; they ranged from -0.06 to $+0.73$, indicating that the design of the CRS items was not uniformly successful in matching the content of HRS items. The median correlation of the matching items was $+0.60$ ($P < 0.001$).

To evaluate this range of correlations further, and to examine the internal consistency of both the HRS and CRS, the correlations of HRS items with HRS items, and of CRS items with CRS items, were calculated. (For reason of economy this matrix is not printed here but is available from the authors.) It was found that those CRS items strongly correlated with the CRS total (e.g. items 1, 7, 8, 10) were generally also strongly correlated with other CRS items, and conversely for those CRS items that were weakly correlated with the CRS total (e.g. items 14, 15, 16, 17). Furthermore there was a similar profile of internal correlations for the HRS items. Individual CRS items exhibited correlations with the CRS total of between $+0.05$ and $+0.78$ with a median of $+0.55$. Similarly, individual HRS items had correlations with the HRS total of between $+0.19$ and $+0.78$ with a median of $+0.54$. The rank order of CRS item correlations with the total CRS score was similar to the rank order of HRS item correlations with the total HRS score ($r_s = +0.72$, $P < 0.001$). In addition, the rank order of HRS item correlations with the total HRS score was similar to the rank order of CRS item correlations with the total HRS score ($r_s = +0.67$, $P < 0.01$). The conclusions from these results are that (a) the total scores of the CRS and HRS correlated well; (b) matching items of the two scales correlated to a variable degree; (c) the internal consistency of the CRS was similar to that of the HRS; (d) the least informative items for the HRS total score also tended to be the least informative items for the CRS total score; (e) the clinician-rated items that were least predictive of the total HRS score tended to be the same items, upon translation into the CRS format, that were still least predictive of the HRS score. Thus, certain items (14, 15, 16, 17) may be so weakly correlated with global severity (either because they contribute so little to the total variance, or because they are difficult to rate reliably) that they have low predictive utility in either their HRS or CRS versions. A further analysis of the patterns of responses to items in the two series is presented in the second paper of this series.

Comparison with BDI and HRS: Same-day ratings of severity of depression by the HRS, CRS and BDI were obtained on 279 occasions with inpatients having a range of psychiatric diagnoses. Each scale correlated highly with each of the other two. The two self rating instruments (CRS and BDI) had the highest correlation ($r = +0.86$, $P < .001$). The correlation of the CRS with the HRS ($r = +0.71$) was somewhat better than that of the BDI with the HRS ($r = +0.60$). This suggests that the CRS design feature of matching the information content of the HRS was at least partly achieved. The partial correlation was significant for HRS–CRS ($r = +0.49$, $P < .001$) and for CRS–BDI ($r = +0.77$, $P < .001$) but was not significant for the HRS–BDI ($r = -0.03$). These results indicate that the BDI did not contain information about the HRS beyond what was shared in common by both the BDI and CRS. The CRS did contain information about the HRS beyond what could be predicted from the BDI scores.

Discussion

The overall performance of the CRS was consistent with the purposes for which it was designed. As a self rating scale for severity of depression it yielded low scores in the general population. Virtually all patients with a global rating of more than mild depression recorded CRS scores greater than the cutoff score of 10 which was derived from the general population study. The split-half reliability of the CRS was acceptable, being equal to that reported for the BDI (Beck, 1967). The subsets of YES- and NO-response statements showed a less strong but still acceptable correlation in a very large number of ratings.

The correlation of CRS total with HRS total scores in patients with endogenous depression was high. This result compares favourably with correlations reported between the HRS and the BDI or Zung SDS (Hedlund and Vieweg, 1979). Some of the CRS items failed to match the information content of

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the corresponding HRS items, despite the overall good agreement for total scores. Nevertheless, the internal consistency of the CRS was very similar to that of the HRS. Both scales showed a wide and comparable range of correlations of individual items with total scores, both within-scale and across scales. Further, the same items tended to be the least correlated with the total score in both the CRS and HRS. The internal consistency of the HRS in our sample was no worse than that reported by Hamilton (1967). He found item correlations with total score ranging from +0.11 to +0.69 (median +0.39) in women, and similar figures in men. By comparison, we found item correlations with total score ranging from +0.19 to +0.78 (median +0.54) for the HRS. For the CRS, the corresponding figures were +0.05 to +0.78 (median +0.55). These results indicate acceptable cross-validation between the CRS and HRS, which is most obvious when the total scores are considered.

The results obtained on comparing the CRS with both the HRS and BDI were of interest. The primary correlations of each scale with the two others were highly significant. When the partial correlations were examined, however the HRS–BDI correlation dropped to zero, while the others remained significant. Apparently, the BDI did not contribute information predictive of the HRS score, beyond what was already contained in the CRS. On the other hand the CRS did correlate significantly with the HRS after their intercorrelations with the BDI were partialled out. Furthermore, the two self rating scales retained a high partial correlation after their intercorrelations with the HRS were partialled out. Thus, both the CRS and BDI seem to have access to a subjective dimension of depression that is not predicted by the HRS. These results suggest that the CRS may be a useful alternative to the BDI as a self rating scale, with the additional advantage of closer correspondence to the HRS. The findings also confirm the complementary uses of both observer and self rating scales for assessing the severity of depression (Hedlund and Vieweg, 1979).

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Appendix I

Carroll rating scale items grouped by the corresponding items of the Hamilton rating scale.

For Hamilton items scored 0–4: 4 statements in the self rating scale.

For Hamilton items scored 0–2: 2 statements in the self rating scale.

Items designed to reflect increasing severity of symptoms, approximately in accordance with the scoring guide provided by Hamilton for his scale.

'Positive' responses indicated in parentheses.

1. *Depression*

I feel in good spirits (no)
I am miserable or often feel like crying (yes)
I think my case is hopeless (yes)
There is only misery in the future for me (yes)

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2. *Guilt*
I think I am as good a person as anybody else (no)
I feel worthless and ashamed about myself (yes)
Things which I regret about my life are bothering me (yes)
I am being punished for something bad in my past (yes)

3. *Suicide*
I feel that life is still worth living (no)
I often wish I were dead (yes)
I have been thinking about trying to kill myself (yes)
Dying is the best solution for me (yes)

4. *Initial insomnia*
I take longer than usual to fall asleep at night (yes)
Getting to sleep takes me more than half an hour (yes)

5. *Middle insomnia*
My sleep is restless and disturbed (yes)
I wake up often in the middle of the night (yes)

6. *Delayed insomnia*
I wake up before my usual time in the morning (yes)
I wake up much earlier than I need to in the morning (yes)

7. *Work and interests*
I get pleasure and satisfaction from what I do (no)
I still like to go out and meet people (no)
I have dropped many of my interests and activities (yes)
I am still able to carry on doing the work I am supposed to do (no)

8. *Retardation*
My mind is as fast and alert as always (no)
My voice is dull and lifeless (yes)
I get hardly anything done lately (yes)
I am so slowed down that I need help with bathing and dressing (yes)

9. *Agitation*
I think I appear calm on the outside (no)
I am restless and fidgety (yes)
It must be obvious that I am disturbed and agitated (yes)
I have to keep pacing around most of the time (yes)

10. *Psychological anxiety*
I can concentrate easily when reading the papers (no)
I feel irritable or jittery (yes)
Much of the time I am afraid but don't know the reason (yes)
I am terrified and near panic (yes)

11. *Somatic anxiety*
I am having trouble with indigestion (yes)
My heart sometimes beats faster than usual (yes)
I have a lot of trouble with dizzy and faint feelings (yes)
My hands shake so much that people can easily notice (yes)

12. *Gastrointestinal*
I still enjoy my meals as much as usual (no)
I have to force myself to eat even a little (yes)

13. *General somatic*
I feel just as energetic as always (no)
I am exhausted much of the time (yes)

14. *Libido*
My sexual interest is the same as before I got sick (no)
Since my illness began I have completely lost interest in sex (yes)

15. *Hypochondriasis*
I worry a lot about my bodily symptoms (yes)
I am especially concerned about how my body is functioning (yes)
My trouble is the result of some serious internal disease (yes)
My body is bad and rotten inside (yes)

16. *Loss of insight*
All I need is a good rest to be perfectly well again (yes)
I got sick because of the bad weather we have been having (yes)

17. *Loss of weight*
I am losing weight (yes)
I can tell that I have lost a lot of weight (yes)

Appendix II

Carroll Rating Scale presented in the form as completed by patients.*

Date of Visit

				Visit Number	
Month		Day	Year		

Patient Initials

F	M	L

Hospital Reg. No.

Complete *ALL* the following statements by *CIRCLING* YES or NO, based on how you have felt during the *past few days.*

1.	I feel just as energetic as always	Yes	No
2.	I am losing weight	Yes	No
3.	I have dropped many of my interests and activities	Yes	No
4.	Since my illness I have completely lost interest in sex	Yes	No
5.	I am especially concerned about how my body is functioning	Yes	No

* Printed forms with the item scoring key are available at nominal cost from the authors.

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6.	It must be obvious that I am disturbed and agitated	Yes	No
7.	I am still able to carry on doing the work I am supposed to do	Yes	No
8.	I can concentrate easily when reading the papers	Yes	No
9.	Getting to sleep takes me more than half an hour	Yes	No
10.	I am restless and fidgety	Yes	No
11.	I wake up much earlier than I need to in the morning	Yes	No
12.	Dying is the best solution for me	Yes	No
13.	I have a lot trouble with dizzy and faint feelings	Yes	No
14.	I am being punished for something bad in my past	Yes	No
15.	My sexual interest is the same as before I got sick	Yes	No
16.	I am miserable or often feel like crying	Yes	No
17.	I often wish I were dead	Yes	No
18.	I am having trouble with indigestion	Yes	No
19.	I wake up often in the middle of the night	Yes	No
20.	I feel worthless and ashamed about myself	Yes	No
21.	I am so slowed down that I need help with bathing and dressing	Yes	No
22.	I take longer than usual to fall asleep at night	Yes	No
23.	Much of the time I am very afraid but don't know the reason	Yes	No
24.	Things which I regret about my life are bothering me	Yes	No
25.	I get pleasure and satisfaction from what I do	Yes	No
26.	All I need is a good rest to be perfectly well again	Yes	No
27.	My sleep is restless and disturbed	Yes	No
28.	My mind is as fast and alert as always	Yes	No
29.	I feel that life is still worth living	Yes	No
30.	My voice is dull and lifeless	Yes	No
31.	I feel irritable or jittery	Yes	No
32.	I feel in good spirits	Yes	No
33.	My heart sometimes beats faster than usual	Yes	No
34.	I think my case is hopeless	Yes	No
35.	I wake up before my usual time in the morning	Yes	No
36.	I still enjoy my meals as much as usual	Yes	No
37.	I have to keep pacing around most of the time	Yes	No
38.	I am terrified and near panic	Yes	No
39.	My body is bad and rotten inside	Yes	No
40.	I got sick because of the bad weather we have been having	Yes	No
41.	My hands shake so much that people can easily notice	Yes	No
42.	I still like to go out and meet people	Yes	No
43.	I think I appear calm on the outside	Yes	No
44.	I think I am as good a person as anybody else	Yes	No
45.	My trouble is the result of some serious internal disease	Yes	No
46.	I have been thinking about trying to kill myself	Yes	No
47.	I get hardly anything done lately	Yes	No
48.	There is only misery in the future for me	Yes	No
49.	I worry a lot about my bodily symptoms	Yes	No
50.	I have to force myself to eat even a little	Yes	No
51.	I am exhausted much of the time	Yes	No
52.	I can tell that I have lost a lot of weight	Yes	No

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