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.
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-

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
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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 CRS 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 \( r = +0.72, P < 0.001 \). 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 \( r = +0.67, P < 0.01 \). 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 scales 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 \( r = -0.86, P < 0.001 \). 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 \( r = +0.49, P < 0.001 \) 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
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).

Acknowledgements

Ms Julie Shaw collaborated on the early development of the CRS. Dr W. L. Dyson and Ms Sandra Similes assisted with revisions of the scale in 1972-1973. Since 1969, work on the scale has been supported by the National Health and Medical Research Council of Australia, by Research Training Funds from the U.S. Veterans Administration, by USPHS Grant MH-29234, and by the Mental Health Research Institute, University of Michigan. We thank Dr Roger F. Haskett, Dr Norman McI. James and Dr Meir Steiner, who contributed HRS ratings, and all our research assistants, particularly Ruth Metski, Catherine Doherty, R.N., Linda Blakey, and Susan Molnar.

References


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)
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.*

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<td>Day</td>
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<table>
<thead>
<tr>
<th>Patient Initials</th>
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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
2. I am losing weight
3. I have dropped many of my interests and activities
4. Since my illness I have completely lost interest in sex
5. I am especially concerned about how my body is functioning

*Printed forms with the item scoring key are available at nominal cost from the authors.
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. The best solution for me is crying 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 am worried or fearful 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 slow and 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 worthwhile 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 I have a 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 sleep and meet people Yes No
43. I think I appear calm on the outside Yes No
44. I think I am in good shape 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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(Received 20 June 1980)
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