British Journal of Psychiatry (1993), **163** (suppl. 22), 39–44

Assessing Depression in Schizophrenia: The Calgary Depression Scale

DONALD ADDINGTON, JEAN ADDINGTON and ELEANOR MATICKA-TYNDALE

Since existing depression scales were designed for assessment of depression in non-psychotic populations, such scales have items which do not distinguish depressed from non-depressed psychotic subjects. The authors describe a new scale, the Calgary Depression Scale, which was designed for the assessment of depression in schizophrenia. The scale was derived from two existing scales by factor analysis and reliability analysis. It has been further tested in two new samples. In the first it has been shown to be reliable, congruent with a self-report scale and valid. In the second sample it has been shown that there is no overlap with negative or extrapyramidal symptoms.

The psychopharmacology of schizophrenia is progressing in a number of different areas, including the treatment-resistant patient (Kane *et al*, 1988) and the reduction of extrapyramidal syndromes (Lapierre *et al*, 1990). In addition, there is a continuing interest in the treatment of negative symptoms (Meltzer *et al*, 1986), in optimal strategies for maintenance medication (Schooler, 1991), and in the treatment of secondary syndromes (Siris, this supplement). There is also increasing concern with a more global perspective on outcome of social and pharmacological interventions, commonly subsumed under the concept of quality of life (Awad, 1992).

The accurate assessment of depression is an important issue in evaluating each of the above areas. Accurate assessment of depression is also necessary for evaluating the benefits of different maintenance strategies and is an integral part of assessing quality of life.

The lack of a suitable measure of depression for schizophrenia has arisen because existing depression rating scales were developed to measure levels of depression in non-psychotic populations. This has led to a number of problems, including overlap between extrapyramidal, negative and depressive syndromes (Hirsch, 1982; Johnson, 1986; Siris *et al*, 1988) and redundant items for predicting the presence of a major depressive episode (Addington *et al*, 1992).

In an attempt to overcome these problems, the authors have developed the Calgary Depression Scale (CDS) for the assessment of levels of depression in schizophrenics (Addington *et al*, 1990). The scale is being developed in three stages. The first stage is item selection by factor analysis and tests of internal reliability, the second stage is an analysis of reliability and validity and the third is an analysis of the specificity of the scale.

Item selection

In the first step of scale development, a sample of 50 schizophrenics was assessed on two measures of depression, the Present State Examination (PSE: Wing *et al*, 1974) and the Hamilton Depression Rating Scale (HDRS: Hamilton, 1960). Subjects were assessed first as in-patients at a stage of relapse, then six months later at a stage of relative remission. Exploratory factor and reliability analytic techniques were used to identify items which factored together on a depression factor. These factor analyses are presented in Tables 1 and 2.

Reliability and validity study

The purpose of the second stage of development was to assess the reliability and validity of this new scale. First, a structured interview was developed for the scale. This interview was based on published structured interviews for the PSE (Wing *et al*, 1974) and HDRS (Williams, 1988). In the draft used for the study, each item was rated on a five-point scale, anchored by descriptors. The score '0' indicated absence of the item and '4' indicated presence in the highest form of severity.

The draft scale was assessed for reliability and validity and compared on these aspects with three established measures. These were the HDRS, the Beck Depression Inventory (BDI; Beck *et al*, 1961), and a depression measure derived from the expanded Brief Psychiatric Rating Scale (BPRS) (Green *et al*, 1990) by adding the scores for depression, guilt and suicidality.

The draft CDS and the three established measures were administered to a new sample of 100 out-patients and 50 in-patients. All subjects met DSM-III-R criteria (American Psychiatric Association,

Table 1
Factor analyses for selected PSE and HDRS items at time 1 and time 2

Symptom	Factor 1	Factor 2	Factor 3
Unrotated factor matrix, time 1			
Depression mood[1,2]	0.57	−0.28	−0.13
Guilt[1,2]	0.75	0.05	0.06
Work and interest[1,2]	0.48	−0.10	0.09
Loss of weight[1]	0.44	−0.14	0.64
Delusions of guilt[2]	0.39	0.59	−0.17
Depressed mood[2]	0.68	−0.44	−0.33
Hopelessness[2]	0.71	−0.50	−0.11
Observed depression	0.55	−0.16	0.02
Self-depreciation[2]	0.68	0.19	−0.07
Guilty ideas of reference[2]	0.59	0.61	−0.08
Pathological guilt	0.55	0.46	−0.06
Morning depression	0.38	−0.25	−0.36
Weight loss/poor appetite	0.41	−0.14	0.63
Early awakening	0.47	0.34	0.14
Eigenvalue	4.39	1.77	1.15
Percentage of variance explained	60.00	24.20	15.80
Unrotated factor matrix, time 2			
Depression mood[1,2]	0.74	−0.34	–
Guilt[1,2]	0.79	−0.01	–
Suicide[1,2]	0.79	−0.40	–
Work and interest[1,2]	0.45	−0.18	–
Psychic anxiety[1]	0.58	−0.14	–
Delusions of guilt[2]	0.70	0.08	–
Depressed mood[2]	0.78	−0.28	–
Hopelessness[2]	0.57	0.22	–
Suicidal plans or acts	0.76	0.02	–
Self-depreciation[2]	0.56	0.14	–
Guilty ideas of reference[2]	0.67	0.48	–
Pathological guilt[2]	0.81	0.44	–
Eigenvalue	5.75	0.91	–
Percentage of variance explained	86.30	13.70	–

1. HDRS item.
2. Item common at both time 1 and time 2.

Table 2
Reliability analyses for selected PSE and HDRS items at time 1 and time 2

	Alpha if item deleted	
	Time 1	Time 2
HDRS items		
Depression mood	0.82	0.87
Guilt	0.80	0.86
Work and interest	0.83[1]	0.89[1]
Loss of weight	0.83	–
Suicide	–	0.87
Psychic anxiety	–	0.88
PSE items		
Delusions of guilt	0.83	0.88
Depressed mood	0.81	0.87
Hopelessness	0.81	0.88
Self-depreciation	0.81	0.88
Guilty ideas of reference	0.82	0.88
Pathological guilt	0.82	0.87
Observed depression	0.82	–
Morning depression	0.83	–
Weight loss/poor appetite	0.83	–
Early wakening	0.83	–
Suicidal plans or acts	–	0.87
Alpha	0.83	0.89

1. Item which reduces the reliability of the scale.

1987) for schizophrenia. In addition, in order to assess the presence of a major depressive episode, each subject was administered part of a modified form of the PSE.

The mean age of the sample was 43 years; 59% were male; 59% had never been married. Half the sample completed high school. As a group they had a mean of 5.5 admissions. Criteria for a major depressive episode were met by 8.7% (11 in-patients and 2 out-patients).

Six steps were taken in the analysis of the reliability and validity of the draft scale:

(a) tests of inter-rater reliability
(b) univariate assessment of items in the scale
(c) comparative assessment of internal validity of all scales
(d) assessment of ability to predict presence of a major depressive episode
(e) correlation between scales
(f) confirmatory analysis of CDS items.

After the data had been reviewed, two items which contributed neither to the internal reliability of the scale nor to its predictive capacity were dropped. In addition, the original five-point scale was reduced to a four-point scale. An examination of the descriptive statistics revealed that in fact the full five points were rarely used. Furthermore, reducing the range of the scale did not reduce its ability to predict the presence of a major depressive episode. The results presented therefore relate to the final nine-item, four-point scale. The scale is presented in Appendix 1.

The CDS was found to have high inter-rater reliability with an intraclass correlation of 0.895 and a percentage agreement on specific items of 86%. Test ratings were performed by two trained raters in the same room: one interviewed the subject; the other observed the interview. Ten joint interviews were done: five on in-patients; five on out-patients.

Correlations between the CDS and the other measures of depression (Table 3) were all highly

https://doi.org/10.1192/S0007125000292581 Published online by Cambridge University Press

Table 3
Correlations between measures of depression (Pearson product-moment correlation)

	Calgary	Hamilton	Beck	BPRS	Diagnosis of major depression
Calgary	1.00	–	–	–	–
Hamilton	0.82	1.00	–	–	–
Beck	0.79	0.76	1.00	–	–
BPRS	0.87	0.85	0.73	1.00	–
Major depression	0.64	0.71	0.58	0.67	1.00

$P > 0.001$ for all correlations.

Table 4
Cronbach's alpha for four depression scales

	In-patients	Out-patients	All patients
Calgary	0.78	0.71	0.79
Hamilton	0.77	0.66	0.77
Beck	0.92	0.88	0.91
BPRS	0.74	0.35	0.67

significant. Table 4 presents the internal reliability of each scale as assessed by Cronbach's alpha. The ability of each scale to predict the presence of a major depressive episode is shown in Table 5.

On all scales, in-patients scored higher than out-patients. The BPRS had a small standard deviation, especially in the out-patient group. Although this scale is widely used as an outcome measure, large samples would be required to show meaningful differences between groups on this measure of depression in out-patient populations.

Data for a receiver–operator curve in which the CDS is used to predict the presence of a major depressive episode are shown in Table 6. The reliability of this receiver–operator curve is limited by the relatively small number of subjects meeting criteria for a major depressive episode. From this curve, the cut-off point to be selected would depend on the purpose of the study and the need for either greater reliability or greater specificity.

Specificity study

In a third study, still in progress at Foothills Hospital, the CDS was administered to 31 chronic schizophrenic in-patients experiencing an acute relapse. In addition, each subject was independently examined for negative symptoms using the Positive and Negative Symptom Scale (Kay *et al*, 1987) and for extrapyramidal symptoms using the Simpson Angus Scale (Simpson *et al*, 1966). No significant correlations were found between level of depression assessed by CDS and measures of negative and extrapyramidal symptoms (Table 7). This lack of correlation is suggestive of, but not conclusive evidence for, a discrimination between depression and negative symptoms.

Conclusion

The CDS has been empirically derived for use in individuals with schizophrenia. It has high inter-rater reliability and appears to be a valid measure of depression. In addition, it distinguishes depression from negative and extrapyramidal symptoms.

The results presented indicate that the CDS potentially has specific advantages over the other commonly used scales. It is much easier to administer to in-patients than the BDI. In out-patients its greater range and standard deviation make it more sensitive to small but significant differences than the BPRS. In addition, it has fewer non-significant

Table 5
Discriminant ability of four depression scales using major depressive episode as criterion

	% Patients correctly classified	Total number of items	Number of items giving significant discrimination	Number of items not giving significant discrimination
Calgary	93	9	9	0
Hamilton	95	17	14	3
Beck	88	21	11	10
BPRS	96	3	3	0

https://doi.org/10.1192/S0007125000292581 Published online by Cambridge University Press

Table 6
Receiver-operator curve for CDS in depression in schizophrenia (number of subjects meeting criteria for a major depressive episode, 13 out of 150 (11 in-patients, 2 out-patients))

Score[1]	Specificity: %	Sensitivity: %
5	74	100
6	77	92
7	82	85
8	91	85
9	94	69
10	97	69
11	98	62
12	99	54
13	100	54

1. Range 0–23.

predictors of a major depressive episode than the Hamilton. This feature should make it less liable to problems of overlap than the Hamilton.

The Calgary scale will have practical application in research as a quick, reliable, observer rating scale for assessing change in depression in both in-patient and out-patient schizophrenic populations. In clinical practice, with the use of cutpoints to determine clinical depression, it will be useful in identifying depressed subjects at elevated risk of attempted suicide, and those in need of specific treatment for their depression. It requires further validation in centres other than the one in which it has been developed.

Table 7
Relations between measures of depression, negative symptoms and extrapyramidal symptoms: Pearson product correlations

	CDS	Neg	SA
Calgary Depression Scale (CDS)	1	–	–
Negative Symptom Scale (Neg)	0.09	1	–
Simpson Angus Scale (SA)	0.16	0.16	1

Appendix 1. The Calgary Depression Scale

General instructions

The Calgary Depression Scale is specifically designed for assessment of level of depression in people with schizophrenia. It was originally derived from two widely used instruments, the Present State Examination and the Hamilton Depression Rating Scale, using factor and reliability analysis techniques. Its reliability and validity was further tested on a separate sample using confirmatory factor analyses and discriminatory analysis.

The scale is designed to reflect the presence of depression exclusive of other dimensions of psychopathology in schizophrenics at both the acute and residual stages of the disorder. It is sensitive to change, and can be used at a variety of intervals.

The rater should have experience with schizophrenics and should develop inter-rater reliability with another rater experienced in the use of structured assessment instruments. An experienced rater should develop adequate inter-rater reliability within 5–10 practice interviews.

The interview consists of eight structured questions followed by one observation item. This last item depends on the observation of the entire interview.

For further information contact: Dr D. Addington, Department of Psychiatry, Foothills Hospital, 1403-29 St NW Calgary, Alberta T2N 2T9, Canada.

Interview guide for Calgary Depression Scale for schizophrenics

Interviewer: ask the first question as written. Use follow-up probes of qualifiers at your discretion.

Time frame refers to last two weeks unless stipulated.

NB. The last item, number 9, is based on observations of the entire interview.

1. Depression

How would you describe your mood over the last two weeks?
Do you keep reasonably cheerful or have you been very depressed or low spirited recently?
In the last two weeks how often have you (own words) every day? All day?

0.	Absent	
1.	Mild	Expresses some sadness or discouragement on questioning.
2.	Moderate	Distinct depressed mood persisting up to half the time over last two weeks; present daily.
3.	Severe	Markedly depressed mood persisting daily over half the time interfering with normal motor and social functioning.

2. Hopelessness

How do you see the future for yourself?
Can you see any future, or has life seemed quite hopeless?
Have you given up or does there still seem some reason for trying?

0.	Absent	
1.	Mild	Has at times felt hopeless over the last week but still has some degree of hope for the future.
2.	Moderate	Persistent, moderate sense of hopelessness over last week. Can be persuaded to acknowledge possibility of things being better.
3.	Severe	Persisting and distressing sense of hopelessness.

3. Self-depreciation

What is your opinion of yourself compared to other people?
Do you feel better or not as good or about the same as most?
Do you feel inferior or even worthless?

0.	Absent	
1.	Mild	Some inferiority; not amounting to feeling of worthlessness.
2.	Moderate	Subject feels worthless, but less than 50% of the time.
3.	Severe	Subject feels worthless more than 50% of the time. May be challenged to acknowledge otherwise.

4. Guilty ideas of reference

Do you have the feeling that you are being blamed for something or even wrongly accused? What about? (Do not include justifiable blame or accusation; exclude delusions of guilt.)

0.	Absent	
1.	Mild	Subject feels blamed but not accused less than 50% of the time.
2.	Moderate	Persisting sense of being blamed, and/or occasional sense of being accused.
3.	Severe	Persistent sense of being accused. When challenged acknowledges that it is *not* so.

5. Pathological guilt

Do you tend to blame yourself for little things you may have done in the past?
Do you think you deserve to be so concerned about this?

0.	Absent	
1.	Mild	Subject sometimes feels over guilty about some minor peccadillo, but less than 50% of time.
2.	Moderate	Subject usually (over 50% of time) feels guilty about past actions, the significance of which he/she exaggerates.
3.	Severe	Subject usually feels he/she is to blame for everything that has gone wrong, even when not his/her fault.

6. Morning depression

When you have felt depressed over the last two weeks; have you noticed the depression being worse at any particular time of day?

0.	Absent	No depression
1.	Mild	Depression present but no diurnal variation.
2.	Moderate	Depression spontaneously mentioned to be worse in morning.
3.	Severe	Depression markedly worse in morning, with impaired functioning which improves in afternoon.

7. Early wakening

Do you wake earlier in the morning than is normal for you?
How many times a week does this happen?

0.	Absent	No early wakening.
1.	Mild	Occasionally wakes (up to twice weekly) one hour or more before normal time to wake or alarm time.
2.	Moderate	Often wakes early (up to five times weekly) one hour or more before normal time to wake or alarm.
3.	Severe	Daily wakes one hour or more before normal time.

8. Suicide

Have you felt that life wasn't worth living?
Did you ever feel like ending it all?
What did you think you might do?
Did you actually try?

0.	Absent	
1.	Mild	Frequent thoughts of being better off dead, or occasional thoughts of suicide.
2.	Moderate	Deliberately considered suicide with a plan, but made no attempt.
3.	Severe	Suicidal attempt apparently designed to end in death (i.e. accidental discovery or inefficient means).

9. Observed depression

Based on interviewer's observations during the entire interview

The question "Do you feel like crying?" used at appropriate points in the interview, may elicit information useful to this observation.

0.	Absent	
1.	Mild	Subject appears sad and mournful even during parts of the interview involving affectively neutral discussion.
2.	Moderate	Subject appears sad and mournful throughout the interview, with gloomy monotonous voice and is tearful or close to tears at times.

https://doi.org/10.1192/S0007125000292581 Published online by Cambridge University Press

3. Severe — Subject chokes on distressing topics, frequently sighs deeply and cries openly, or is persistently in a state of frozen misery.

Calgary Depression Scale

Subject identification:

Interviewer:

Date:

		Absent	Mild	Moderate	Severe
1.	Depressed mood	0	1	2	3
2.	Hopelessness	0	1	2	3
3.	Self-depreciation	0	1	2	3
4.	Guilty ideas of reference	0	1	2	3
5.	Pathological guilt	0	1	2	3
6.	Morning depression	0	1	2	3
7.	Early wakening	0	1	2	3
8.	Suicide	0	1	2	3
9.	Observed depression	0	1	2	3

References

ADDINGTON, D., ADDINGTON, J. & SCHISSEL, B. (1990) A depression rating scale for schizophrenics. *Schizophrenia Research*, **3**, 247–251.

———, ———, MATICKA-TYNDALE, E., *et al* (1992) Reliability and validity of a depression rating scale for schizophrenics. *Schizophrenia Research*, **5**, 51–59.

AMERICAN PSYCHIATRIC ASSOCIATION (1987) *Diagnostic and Statistical Manual of Mental Disorders* (3rd edn, revised) (DSM-III-R). Washington, DC: APA.

AWAD, G. (1992) Quality of life of schizophrenics on medications: implications for clinical trials of neuroleptics. *Hospital and Community Psychiatry*, **43**, 262–265.

BECK, A. T., WARD, C. I., MENDELSON, M., *et al* (1961) An inventory for measuring depression. *Archives of General Psychiatry*, **4**, 561–571.

GREEN, M. F., NUECHTERLEIN, K. H., VENTURA, J., *et al* (1990) The temporal relationship between depressive and psychotic symptoms in recent onset schizophrenia. *American Journal of Psychiatry*, **147**, 179–182.

HAMILTON, M. (1960) A rating scale for depression. *Journal of Neurology, Neurosurgery and Psychiatry*, **23**, 56–62.

HIRSCH, S. R. (1982) Depression revealed in schizophrenia. *British Journal of Psychiatry*, **140**, 421–424.

JOHNSON, D. A. W. (1986) Depressive symptoms in schizophrenia: some observations on the frequency, morbidity and possible causes. In *Contemporary Issues of Schizophrenia* (eds A. Kerr & P. Snaith). London: Gaskell.

KANE, J., HONIGFELD, G., SINGER, J., *et al* (1988) Clozapine for the treatment resistant schizophrenic: a double-blind comparison versus chlorpromazine/benztropine. *Archives of General Psychiatry*, **45**, 789–796.

KAY, S. R., FISZBEIN, A. & OPLER, L. A. (1987) The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophrenia Bulletin*, **13**, 261–276.

LAPIERRE, Y. D., NAIR, N. V. P., CHOUINARD, G., *et al* (1990) A controlled dose-ranging study of remoxipride versus haloperidol in a Canadian multicentre trial. *Acta Psychiatrica Scandinavica*, **82**, 72–76.

MELTZER, H. Y., SOMMERS, A. A. & LUCHINS, D. J. (1986) The effect of neuroleptics on negative symptoms in schizophrenia. *Journal of Clinical Psychopharmacology*, **6**, 329–338.

SCHOOLER, N. R. (1991) Maintenance medication for schizophrenia: strategies for dose reduction. *Schizophrenia Bulletin*, **17**, 311–324.

SIMPSON, G. M., AMUSE, D., BLAIR, J. P., *et al* (1966) Phenothiazine produced extrapyramidal system disturbance. *Archives of General Psychiatry*, **10**, 199–208.

SIRIS, S. G., ADAN, F., COHEN, M., *et al* (1988) Postpsychotic depression and negative symptoms: an investigation of syndromal overlap. *American Journal of Psychiatry*, **145**, 1532–1537.

WILLIAMS, J. B. (1988) A structured interview guide for the Hamilton Depression Rating Scale. *Archives of General Psychiatry*, **45**, 742–747.

WING, J. K., COOPER, J. E. & SARTORIOUS, N. (1974) *The Measurement and Classification of Psychiatric Symptoms*. London: Cambridge University Press.

*Donald Addington, MBBS, MRCPsych, FRCP(C), *Associate Professor*; Jean Addington, PhD, *Adjunct Assistant Professor*; Eleanor Maticka-Tyndale, PhD, *Assistant Professor, Department of Psychiatry, University of Calgary*

*Correspondence: *Foothills Hospital Department of Psychiatry, 1403-29th Street NW, Calgary, Alberta, T2N 2T9, Canada*