Multivariate Experimental Clinical Research, Volume 10, No. 3, 1994, 145-156.

A FACTOR ANALYSIS OF THE BRIEF PSYCHIATRIC RATING SCALE IN AN OLDER PSYCHIATRIC POPULATION: EXPLORATORY AND CONFIRMATORY ANALYSES

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ABSTRACT

Although the factor structure of the Brief Psychiatric Rating Scale (BPRS) is well established with many populations, a study by Overall and Beller (1984) suggested that its factor structure may differ with older psychiatric patients. The present study investigated the factor structure of the BPRS with older chronic psychiatric patients in a state-sponsored facility. Exploratory factor analyses showed that the BPRS factor structure with this population was in some respects similar to that found by Overall and Beller and in other ways similar to that previously found in younger general psychiatric samples. When various factor structures were assessed with confirmatory factor analyses via LISREL, a hybrid model best fit the present data. This model shared features of the BPRS factor structure with young adult patients as well as with that found by Overall and Beller with geropsychiatric patients.

INTRODUCTION

The Brief Psychiatric Rating Scale (BPRS) is a symptom-construct rating scale widely used by clinicians in research with adult psychiatric patients. Developed by Overall and Gorham in 1962, the instrument was originally constructed as a rapid assessment technique to evaluate the effects of treatment in drug research. The BPRS is now often employed for scaling clinical observations of patients' emotional and behavioral characteristics in both in- and outpatient settings. Numerous factor analytic investigations have shown a stable factor structure for the instrument (for summaries, see Overall & Klett, 1972 and Hedlund & Vieweg, 1980).

Hedlund and Vieweg (1980) reviewed 25 factor analytic studies of the BPRS, 11 of which were reported by Overall and his associates. Data analyses in these studies were drawn from schizophrenic inpatients in Veterans Administration

hospitals and National Institute of Mental Health facilities, from heterogeneous samples of psychiatric patients in other facilities, and from ratings of imaginary "typical" schizophrenic, paranoid, and depressed patients by psychiatrists in four European countries. Analytic methods used in these studies included both principal components and principal factors solutions rotated to both varimax and several oblique criteria.

In spite of the variety of patient populations, treatment settings, and analytic methods used, findings have been consistent. A stable factor structure has been demonstrated which usually includes four dimensions of manifest disordered behavior. These have been labeled Thinking Disturbance, Withdrawal-Retardation, Anxious Depression, and Hostile Suspiciousness. The consistency of results has led Overall and his associates to standardize their use of these four factors, with inclusion of the three BPRS items that have the highest factor loadings on each in subsequent uses of the instrument.

Although the factor structure of the BPRS has been demonstrated with younger psychiatric patients, it has not been similarly investigated with older chronic patients. This is unfortunate, since the BPRS, based as it is on observation, may be useful in evaluating the characteristics of patients who cannot participate in other types of psychological assessment activities. This is often true of older chronic psychiatric inpatients. Overall and Beller (1984) report a factor analysis of the BPRS for a sample of geropsychiatric inpatients in a university hospital setting. Using powered vector analysis (Overall & Porterfield, 1963) and then obliquely rotating the factors to axes defined by the most salient variables for each factor, they arrived at a five factor solution, which they named Depression, Agitation, Cognitive Dysfunction, Psychotic Distortion, and Hostile Suspiciousness. Reported correlations among these factors ranged from -.07 to .31; a second order analysis is not presented.

Overall and Beller note that the factor structure they obtained for the BPRS with these geropsychiatric patients differed in several respects from that obtained in other populations. The BPRS item Depressive Mood, which usually loads on a factor with the items Anxiety and Somatic Concerns in adult psychiatric populations, loaded in their analysis with Emotional Withdrawal, Blunted Affect, and Motor retardation. The item Anxiety, which usually loads on a factor with Depression in younger populations, combined in their analysis with Tension and Excitement to delineate a factor which Overall and Beller name Agitation.

For several reasons the relevance of these results for older psychiatric patients in other settings, such as long-term psychiatric facilities, is unclear. First, Overall and Beller's sample of elderly patients was drawn from a primarily middle class population. Chronic psychiatric inpatients are rarely able to maintain a middle class socioeconomic status due to their interpersonal and vocational impairments. Their hospitalizations are often due to psychiatric disorders which develop early in life. Second, a majority of Overall and Beller's sample was diagnosed as having organic brain syndrome or depression. Although these disorders are likely to be represented among chronic psychiatric patients, other diagnoses, especially the various types of schizophrenia, are likely to be present as well. Since the BPRS is an instrument which is potentially useful in the assessment of the behavior of these patients, a more precise determination of its factor structure was judged desirable. The purpose of this study was thus to assess the factor structure of the BPRS in a group of older chronic psychiatric inpatients.

METHOD

As part of a larger study examining patients' characteristics on several behavior rating instruments, all patients residing on the geriatric units of a 600-bed state psychiatric facility were rated on the 16-item version of the BPRS by the psychologist assigned to provide services to these units. Patient ratings were drawn from the group of all patients residing on the geriatric units on January 1, 1987, as well as all admissions to these units during the following 24 months. Two psychologists completed the standard rating format for the BPRS, which consists of item names, a brief description of criteria for each item, and boxes to check on a seven-point Likert-type scale. The points on the scale were anchored with descriptions by which the rater was to indicate the degree to which the symptom was present, ranging from "not at all" to "very severe."

The intercorrelations of the ratings thus obtained were used as input for the principal components procedure available in the Statistical Package for the Social Sciences, Tenth Edition (SPSS-X, 1986). The number of factors to be retained for rotation was determined by the criterion of eigenvalue greater than one supplemented by the scree test (Cattell, 1966). The principal components procedure using these criteria was used initially to determine the number of factors to retain for rotation; subsequently a principal factors solution was obtained and rotated both to varimax and oblimin criteria. The factor intercorrelation matrix obtained from the oblimin rotation was examined to determine whether second-order factors should be extracted in order to further understand the BPRS factor structure. Since Overall and his associates have reported the use of scales defined by their factor analyses of the BPRS, reliabilities for the scales defined by the present analysis were obtained; these also facilitated comparisons of our results with those of Overall and Beller (1984), who similarly report reliabilities for their factor-defined scales.

Finally, in order to facilitate comparisons of the fit of several factor models to our data, confirmatory factor analyses comparing several models were completed, using LISREL VII (Joreskog & Sorbom, 1989; Long, 1983a). Three models were tested: one based on the findings typical with adult psychiatric patients (Overall & Klett, 1972); one based on Overall and Beller's (1984) sample of older psychiatric patients; and one based on the present study's finding with exploratory factor analysis. In this manner, it was hoped that it might be possible to determine which of the models best described the factor structure of these data.

RESULTS

Ratings for a total of 167 patients (72 men and 95 women) were obtained. The mean age of this group was 57.9 years, with a standard deviation of 10.0 years and a range of 40 to 89 years. Seventy-six percent of these patients were diagnosed as presenting one of the subtypes of schizophrenia, 15% as displaying an affective disorder (including schizoaffective disorder), and 16% as displaying an organic diagnosis (primarily mixed organic brain syndromes and dementias). These percentages sum to greater than 100 because some patients had been given more than one of these diagnoses.

TABLE 1
MEANS, STANDARD DEVIATIONS, AND RANGES FOR BPRS SCALES

Scale	Mean	Standard Deviation	Range
1. Somatic Concern	1.80	1.05	1-7
2. Anxiety	2.50	1.25	1-6
3. Emotional Withdrawal	2.98	1.36	1-7
4. Conceptual Disorganization	3.40	1.51	1-7
5. Guilt Feelings	1.68	1.12	1-6
6. Tension	2.17	0.98	1-5
7. Mannerisms and Posturing	1.44	0.81	1-5
8. Grandiosity	1.60	1.13	1-6
9. Depressive Mood	2.32	1.48	1-7
10. Hostility	2.02	1.22	1-7
11. Suspiciousness	2.13	1.35	1-7
12. Hallucinatory Behavior	1.85	1.36	1-5
13. Motor Retardation	1.67	1.04	1-6
14. Uncooperativeness	1.98	1.04	1-7
15. Unusual Thought Content	2.73	1.41	1-6
16. Blunted Affect	2.60	1.10	1-6

Interrater reliability was assessed for a subset of ten patients using the $\underline{Y}$ statistic proposed by Spitznagel and Helzer (1985) as an alternative to the kappa statistic, which may underestimate concordance because of its sensitivity to low base rates in the population considered. The $\underline{Y}$ statistic value in this analysis was .60; the corresponding kappa value was .51.

Table 1 records the item names, means, standard deviations, and ranges for item ratings. Mean ratings for items tend to be near one or two (anchored by the descriptors "not at all" or "very mild,") although the ranges show that at least some patients were rated as "severe" or "very severe" on all items. This distribution for individual items probably reflects the pattern of ratings overall: individual patients tended to have high ratings on just a few items reflecting the pattern of their disorder. When several patterns are averaged together, the mean values for individual items are low even though the ranges encompass most values possible. For example, a depressed patient might have high ratings on the items Depression and Motor Retardation but low ratings on Grandiosity and Unusual Thought Content, while precisely the opposite might be true for a patient diagnosed as a paranoid schizophrenic.

Eigenvalues derived during the principal components procedure and used for determining number of factors to retain during the subsequent principal factors extraction and rotations are presented in Table 2. This table also presents the percentages of variance accounted for by each factor and the cumulative percentage of variance accounted for by the principal components solution. Figure 1

TABLE 2

EIGENVALUES, PERCENTAGES OF VARIANCE ACCOUNTED FOR BY FACTORS, AND CUMULATIVE PERCENTAGES OF VARIANCE FOR THE PRINCIPAL COMPONENTS SOLUTION

Factor	Eigenvalue	Percentage of Variance	Cumulative
1	4.77	29.8	29.8
2	2.57	16.1	45.9
3	1.74	10.9	56.8
4	1.49	9.3	66.1
5	1.00	6.2	72.3
6	.76	4.8	77.1
7	.70	4.4	81.5
8	.59	3.7	85.2
9	.50	3.1	88.3
10	.38	2.4	90.6
11	.33	2.1	92.7
12	.29	1.8	94.6
13	.27	1.7	96.2
14	.25	1.5	97.7
15	.19	1.2	99.0
16	.17	1.0	100.0

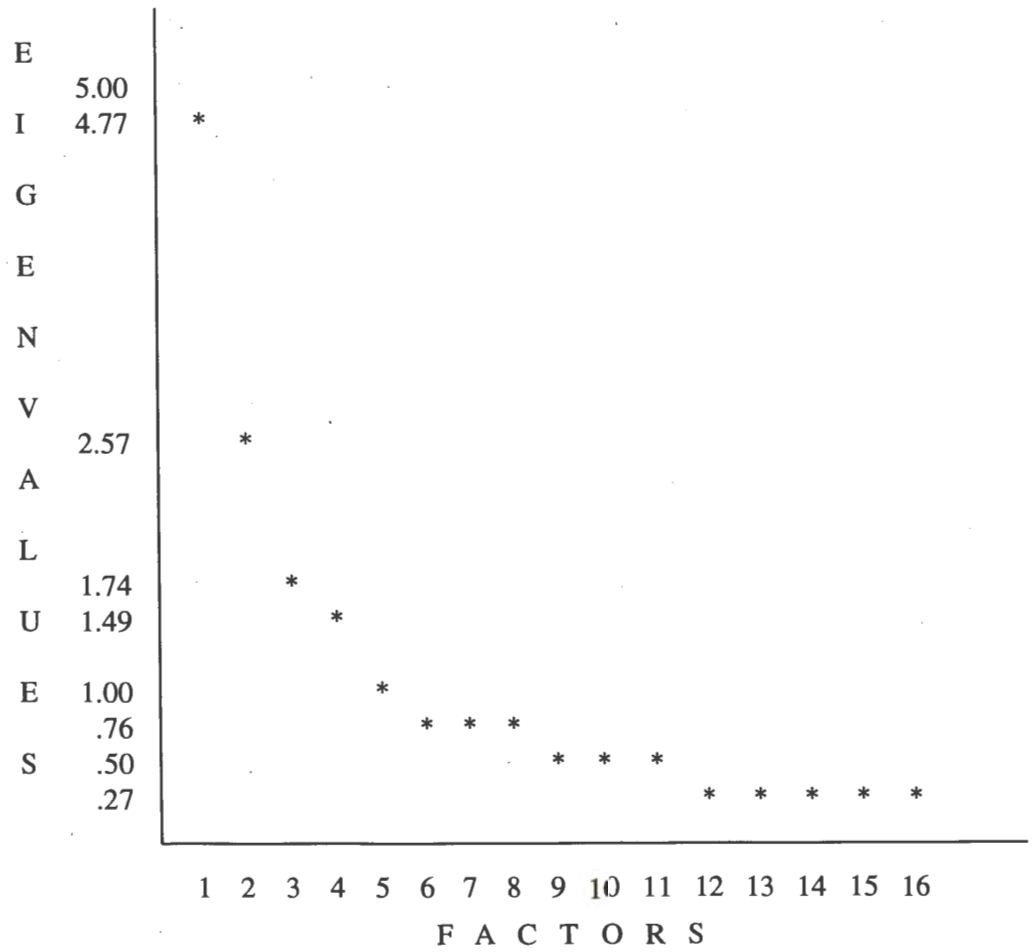
graphically presents the eigenvalues used in the scree test. It can be seen from inspection of Table 2 and Figure 1 that the slope of the eigenvalue plot changes substantially after extraction of the fifth factor, whose eigenvalue is only slightly less than one (with rounding, it becomes one, as reported in Table 2). Based on these two criteria (eigenvalue greater than one and inspection of the scree plot) a five-factor solution was judged most appropriate for these data. Final item communalities derived during the principal factors solutions are reported in Table 3.

The matrix of factor loadings derived from the principal factors solution and subjected to rotation to varimax criteria is included in Table 4. The five factor solution obtained accounted for 62% of the common variance. Loadings greater than an absolute value of .30 were deemed substantial and included in the following interpretations. These items are underlined in Table 4. Items with substantial loadings on the first factor included Somatic Concerns, Anxiety, Guilt Feelings, Tension, and Depressive Mood. Given the high loadings of such items as Anxiety, Guilt, and Depressive Mood, this factor has been named Anxious Depression.

Scale items with positive loadings on the second factor were Conceptual Disorganization, Grandiosity, Hostility, Suspiciousness, Uncooperativeness, and Unusual Thought Content. In light of the high loadings of the items Grandiosity, Hostility, and Suspiciousness, this factor has been named Paranoid Symptoms. The third factor is defined by items such as Emotional Withdrawal, Conceptual

FIGURE 1

PLOT OF EIGENVALUES USED IN SCREE TEST



Disorganization, Depressive Mood, Motor Retardation, and Blunted Affect, and has been named Negative Symptoms. By contrast, the fourth factor is defined by items Conceptual Disorganization, Hallucinatory Behavior, and Unusual Thought Content, and is thus named Positive Symptoms. The last factor extracted is defined by the items Tension, Mannerisms and Posturing, and Hallucinatory Behavior. Because of the high loadings of the item Mannerisms and Posturing, this factor has been named Motor Symptoms.

An oblique rotation to oblimin criteria was obtained for the five-factor principal factors solution. Inspection of the pattern and structure matrixes for this solution showed that although as might be expected the magnitude of individual item loadings varied between the varimax and oblimin rotations, the overall interpretation of each factor would not be substantially different from that reported above for the varimax rotation. The factor intercorrelation matrix for the five factors rotated to oblimin criteria is presented in Table 5. It can be seen that with the exception of the negative correlation between Factor 2, Paranoid Symptoms, and Factor 5, Motor Symptoms, and the positive correlation between Factor 1 (Anxious Depression) and Factor 3 (Negative Symptoms), the correlations among

TABLE 3
COMMUNALITIES FOR BPRS SCALES IN PRINCIPAL FACTORS SOLUTION

Scale	Communality
1. Somatic Concern	.31
2. Anxiety	.73
3. Emotional Withdrawal	.60
4. Conceptual Disorganization	.62
5. Guilt Feelings	.70
6. Tension	.38
7. Mannerisms and Posturing	.59
8. Grandiosity	.38
9. Depressive Mood	.79
10. Hostility	.76
11. Suspiciousness	.74
12. Hallucinatory Behavior	.41
13. Motor Retardation	.35
14. Uncooperativeness	.77
15. Unusual Thought Content	.98
16. Blunted Affect	.65

these factors are not substantial. In light of the limited number of substantial intercorrelations among the factors, this matrix was judged unsuitable for higher-order factoring.

Reliabilities (Cronbach's alpha) for factor-based scales composed of items with the most clearly salient loadings were calculated. These are used as a way of measuring the extent to which extracted factors represent a homogeneous entity, and are reported in Table 6. It may be seen that the reliabilities for the first four factor-based scales range from .75 to .89, all in the acceptable range. The value for factor 5, .42, merits comment.

This factor is defined primarily by one item, Mannerisms and Posturing. It was included for rotation because of its associated eigenvalue and the eigenvalue's position in the scree. It was subsequently discovered that scores on this factor, when factors scores for all patients were subjected to K-means cluster analysis, defined a small but highly distinctive group of patients with motor symptomatology (Ownby & Seibel, 1990). Most of these patients had previously been diagnosed as catatonic schizophrenics, a diagnostic group known to often have prominent motor symptomatology. The low reliability of the factor thus probably reflects the very high specificity of the item Mannerisms and Posturing, with a subsequent very small contributions from the other item, Hallucinatory Behavior, included in calculating the reliability.

Finally, results of confirmatory analyses are presented in Table 7. An extensive discussion of the techniques of confirmatory analyses are provided elsewhere

TABLE 4
BPRS ITEM FACTOR LOADINGS — VARIMAX ROTATION

Item	Factor 1	2	3	4	5
1. Somatic Concern	.56	.01	.04	.00	.00
2. Anxiety	.81	.13	.13	.20	.01
3. Emotional Withdrawal	.07	.13	.74	.17	-.03
4. Conceptual Disorganization	.17	.31	.35	.55	.25
5. Guilt Feelings	.82	.05	.10	.11	-.06
6. Tension	.50	.03	.06	.07	.34
7. Mannerisms and Posturing	-.08	.05	.05	.14	.75
8. Grandiosity	-.03	.50	-.29	.22	.01
9. Depressive Mood	.73	.09	.44	.02	-.22
10. Hostility	.10	.85	.07	.18	.08
11. Suspiciousness	.12	.81	.16	.19	-.10
12. Hallucinatory Behavior	.13	.12	.11	.50	.34
13. Motor Retardation	.20	.03	.54	-.04	.08
14. Uncooperativeness	.06	.84	.20	.05	.15
15. Unusual Thought Content	.11	.33	.08	.92	-.02
16. Blunted Affect	.11	.03	.77	.18	.07

(Cole, 1987; Long, 1983a, 1983b). The LISREL program (Joreskog & Sorbom, 1989) provides several goodness of fit measures in order to assess the extent to which factor models represent empirical data. LISREL reports a chi-square value, a goodness of fit index, the derivation of which is complex (see Joreskog & Sorbom, 1989, for an explanation) and an adjusted goodness of fit index which varies according to both the fit of the factor model and its associated degrees of freedom. These measures are reported in Table 7. It may be seen that Model III, based on results of the current exploratory factor analyses, provides the best fit of model to data.

The chi-square statistic reported by LISREL is rarely nonsignificant (i.e., indicating that the model fits the underlying data without significant error) due to issues such as violations of the assumption of multivariate normality and the number of persons upon whom the data are based (Joreskog & Sorbom, 1989). The authors of the program recommend using this value as only a relative measure of fit. As Long (1983a) notes, though, it is possible to test the significance of the difference between chi-square values associated with nested models in order to assess whether one model fits significantly better than another. Comparisons of the chi-square values for each model are also provided in Table 7. It may be seen that Model I, based on Overall and Beller's study, fits the data derived in this study relatively poorly; the chi-square value is large and the goodness of fit indexes are substantially less than the value of .90 suggested by Cole (1987) as indicating acceptable fit of a model to data. Model II, based on Overall and

TABLE 5

CORRELATIONS AMONG FACTORS ROTATED TO OBLIMIN CRITERIA

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1.00				
Factor 2	.12	1.00			
Factor 3	.29	.14	1.00		
Factor 4	.04	.05	.06	1.00	
Factor 5	-.16	-.46	-.16	-.20	1.00

Klett's previously reported data, fits the data significantly better, and Model III, based on the present exploratory results, significantly improves fit still further (all *ps* < .01).

It should be noted that even the best fitting model's goodness of fit index is still less than .90, suggesting that additional improvements in model fit may be possible. It should also be noted that Overall and Beller used the 18-item version of the BPRS, while the studies reported by Overall and Klett and the current study used its 16-item version. This made modifications to the Overall and Beller factor model necessary to test with the data in this study. This places an important limitation on the test of their model, since factor structures may vary widely depending on item composition of the measures analyzed.

DISCUSSION

The first four factors obtained in this analysis are similar to those obtained in other analyses of the BPRS with adult psychiatric populations. The fifth factor, Motor Symptoms, represents a dimension of patient behavior not usually reported in factor analyses of the BPRS. The items loading on this factor in this analysis, Mannerisms and Posturing and Tension, usually load on other factors such as the withdrawal-retardation factor for Mannerisms and Posturing and the anxious depression factor for Tension, as reported by Overall and Klett (1972). Overall and Beller (1984) also do not report a motor symptoms factor for their geropsychiatric patients, suggesting that for the our group of older chronic psychiatric patients, the motor symptoms dimension may be unique. It can be speculated that it emerges in the our analysis due to the prominence of unusual motor behaviors among this group of older patients, many of whom have been hospitalized for long periods of time. It should be emphasized in making this comparison, however, that while the Overall and Beller sample was clearly geriatric (all patients were older than 60 years, and most were older than 70), the sample reported upon here is much younger, with a mean age of 52 years and all being older than 40 years.

Several other differences between the results of this study and others merit comment. First, while the BPRS item Anxiety loaded on a factor Overall and Beller named Agitation, in this analysis it loads with Depressive Mood on a factor

TABLE 6

RELIABILITIES FOR FACTOR-BASED SCALES

Factor 1:	
Anxiety	
Guilt Feelings	alpha = .85
Depressive Mood	
Factor 2:	
Hostility	
Suspiciousness	alpha = .89
Uncooperativeness	
Factor 3:	
Emotional Withdrawal	
Motor Retardation	alpha = .75
Blunted Affect	
Factor 4:	
Conceptual Disorganization	
Hallucinatory Behavior	alpha = .79
Unusual Thought Content	
Factor 5:	
Mannerisms and Posturing	
Hallucinatory Behavior	alpha = .42

here named Anxious Depression. The factor found in this analysis is thus similar to one reported by Overall and Klett (1972) in a sample of psychiatric patients.

Second, although many of the scale items associated with the negative symptoms of serious psychiatric disorder (e.g., Blunted Affect, Emotional Withdrawal) constituted a separate factor in this analysis as they had in a number of previous studies (Hedlund & Vieweg, 1980), in Overall and Beller's study these items loaded on the depression factor. This finding suggests the possibility that these scale items may have different meanings in different contexts. In Overall and Beller's geropsychiatric sample, these items refer to the symptoms of depression displayed by older persons, while in our study these items may refer to the negative symptoms displayed by patients with long-standing serious mental illness.

Finally, items suggesting thought disturbance have loadings on two separate factors in Overall and Beller's study but on only one in this study. Overall and Beller obtained both Cognitive Dysfunction and Psychotic Distortion factors, while only the Positive Symptoms factor was found in the our study.

Results of the confirmatory analyses are consistent with these observations. The confirmatory analyses show that the factor structure of the BPRS for older psychiatric patients is both similar to that found with young psychiatric patients and to that found with psychiatric patients in a university hospital geropsychiatric setting. It is apparent that several items (such as Blunted Affect and Emotional

TABLE 7

GOODNESS OF FIT INDEXES FOR THE MODELS TESTED

Model	GOF[a]	Adjusted GOF[b]	Chi-square
I. Overall & Beller, 1984	.80	.70	353.23
II. Overall & Klett, 1972	.85	.78	240.27[c]
III. Current data	.87	.80	209.37[c]

[a]Goodness of fit index from LISREL
[b]Adjusted goodness of fit index from LISREL
[c]Difference between this chi-square and that preceding it is significantly different ($p < .01$), representing better fit.

Withdrawal) are probably related to negative psychotic symptomatology in some settings and to depressive symptomatology in others. The present confirmatory analyses show that in our sample of older chronic patients these items are most probably rating negative symptomatology.

In a similar fashion, the item Anxiety related to the psychomotor symptom Tension in the Overall and Beller study while in the present analysis it appears most closely related to the group of affective symptoms labeled here Anxious Depression and similarly by Overall and Klett. Results of the LISREL analysis thus confirm what was suggested by the exploratory analysis: a hybrid of the two models best fits the present data.

These results thus demonstrate once again the substantial stability of the BPRS factor structure across populations and settings. Most of the same basic dimensions of disordered behavior are assessed by this instrument in most populations. It is noteworthy, however, that the precise composition of factor solutions and items loading on factors may vary across populations. Caution is indicated in generalizing data from younger psychiatric samples to groups of older adult psychiatric patients. The practice suggested by Overall and Klett (1972) of summing ratings on groups of scales to arrive at higher-level composite dimensions, in particular, should probably be avoided until additional data more clearly demonstrate the precise factor structure of the BPRS with older adults.

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Footnotes

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