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Factor Structure of Self-Reported Depression: Clinic-Referred Children Versus Adolescents

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The literature on childhood depression has often treated children and adolescents as a homogeneous group. However, research on cognitive and affective development suggests that the nature of depression may be different for these two age groups. We explored this possibility, separately factor analyzing Children's Depression Inventory responses for 110 clinic-referred children (aged 8–11 years) and 139 adolescents (aged 12–16 years). Although both groups produced three-factor solutions, a number of developmental differences were noted. All of the adolescent factors were correlated with parent perceptions of externalizing behavior, but none of the child factors were. Furthermore, gender differences on the factors were found for the adolescents only. And inspection of communality estimates indicated that whereas all of the CDI items were relatively involved in depression for the adolescents, only 20 of 26 items were involved for the children. Theoretical interpretation of the results was deferred pending replication of the factor structure.

As a consequence of a sustained and intensive research effort spanning the past 20 years, a good deal is now known about depression in adults. However, relatively little is known about the childhood and adolescent counterparts, and even less about whether there are developmental differences in the patterning of depressive symptomatology. Results of the few available studies do suggest, though, that developmental changes may occur in depressive symptomatology (cf. Garber, 1984).

One category of associated features whose relation with depression may vary with developmental level is externalizing (e.g., aggressive or oppositional) behavior. The revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-III-R*; American Psychiatric Association, 1987) has proposed that depression in adolescents may co-occur with "negativistic or frankly antisocial behavior," whereas for children, somatic complaints may be an associated feature. This notion that externalizing, aggressive symptoms may be more frequent in depressed adolescents than children has received some support from recent research findings (cf. Geller, Chestnut, Miller, Price, & Yates, 1985).

In the present study, we compared child and adolescent factor structures on a widely used self-report measure of depression, testing for developmental differences. We also sought to determine whether (a) developmental level influenced the relation between externalizing behavior and depression, (b) gender differences might exist in the degree to which children manifested the various factors, and (c) the influence of gender might interact with developmental level.

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Method

Measures

Children's Depression Inventory. All children answered the Children's Depression Inventory (CDI; Kovacs, 1980). Besides being widely used and well validated, the CDI was particularly appropriate for the current study because (a) it was developed for use with a relatively wide age range, allowing comparison of broad age groups; (b) it places minimal time and effort demands on children, thus minimizing the likelihood of a self-selection bias (e.g., with highly depressed children declining to respond); and (c) the items span a broad array of behaviors, thoughts, and feelings.

A number of investigators (e.g., Leon, Kendall, & Garber, 1980) have deleted an item pertaining to suicide from the CDI. On the basis of our concerns about suggesting suicide to clinic-referred children who had not seriously considered it, we also excluded the item.

Child Behavior Checklist. The Externalizing Behavior (e.g., fighting, arguing) scale from the parent-report Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983) was used as a measure of oppositional, aggressive, undercontrolled behavior. We also included the CBCL scale for internalizing behavior (e.g., worrying, social withdrawal).

Subjects

A total of 249 children (aged 8–11 years) and adolescents (aged 12–16 years) seeking services at eight public outpatient mental health clinics in eight North Carolina counties served as subjects in this study. The dividing point between childhood and adolescence was chosen to be ages 11/12 because this is the approximate age boundary between concrete and formal operational thinking (Piaget, 1970) and because this is the age at

which changes associated with puberty begin for many children. The child sample consisted of 110 subjects (65% male, 80% white). The adolescent sample contained 139 subjects (49% male, 84% white). Among the 85% for whom parent occupation data were available, SES ratings spanned the nine levels of Hollingshead's (1975) scale, with a mean of 4.63.

The overall level of depressive symptoms was lower for the children (mean CDI score = 11.48) than for the adolescents (mean CDI = 13.54), $F(1, 248) = 4.08$, $p < .05$. Across the age groups, mean CDI scores for female (13.42) and male (12.01) subjects were not significantly different. At the time treatment began, the mean Total Problem T score on the Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983) was 71.46; this placed the average child at the 99th percentile for his or her Age × Sex group with regard to severity of problem behavior.

Procedure

Participation was solicited at the time the youngsters and their parents made their first visit to the clinic. Although exact figures are not available, clinic records indicate that over 80% agreed to participate. At the time of their clinic intake, prior to their first meeting with a clinician, parents filled in the CBCL while children answered the CDI; help was available from staff if the child (or parent) had any difficulty reading the questionnaires. A subsample of the youngsters ($n = 116$), whose parents were contacted by mail and if necessary by phone, answered the CDI 6 months after the initial intake.

Results

Reliability Check

As an estimate of test–retest reliability, we computed the correlation between total CDI score at initial intake and at 6 months after the intake. Despite the unusually lengthy test–retest interval, and despite the fact that the subjects had received therapy in the intervening period, the correlation was 0.54 ($p < 0.0001$).

Factor Analysis

We first performed two factor analyses, one on the child data and one on the adolescent data. Kaiser's Measure of Sampling Adequacy (MSA; Cerny & Kaiser, 1977) was well above the 0.50 minimally acceptable level for both the adolescents (MSA = 0.83) and children (MSA = 0.67). This suggests that for both groups, the data were adequate and appropriate for factor analysis (i.e., that the sample size and "density" of the correlation matrix were adequate).

Factor extraction. To determine the appropriate number of factors, we used the "parallel analysis technique" (Gorsuch, 1983; Humphreys & Ilgen, 1969). We first generated two sets of one hundred 26 × 26 correlation matrices from random (i.e., no correlations between columns) data, one based on a distribution similar to that of the child CDI data, the other based on a distribution similar to that of the adolescent CDI data. Then, separately for the two groups, the average roots (eigenvalues) were computed across the 100 reduced (i.e., with communality estimates on the diagonal) random correlation matrices. These roots were then compared with the roots from the children's and adolescents' CDI data. CDI roots larger than the corresponding root in the random data were considered to represent actual factors; those less than the corresponding roots were considered random factors. This approach (as well as interpretability of various solutions based on differing numbers of factors) suggested three factors for both groups. Factors were then extracted by using the unweighted least-squares method.

Factor rotation. As a first step towards determining the most appropriate method of rotation, the internal consistency of the CDI was assessed separately for the children and adolescents. Coefficient alpha (Cronbach, 1951) was high for both groups (0.81 for the children; 0.89 for the adolescents), suggesting the presence of a general factor; this indicated that the method used for rotation should be one that allowed for a general factor. This in turn suggested that an oblique rotation be used, making it possible for the general factor to be correlated with the other factors. A number of different methods of rotation, including various permutations of the orthomax (of which varimax and quartimax are special cases) and promax procedures, were considered and their results inspected. A promax rotation (Mulaik, 1972) using a target matrix generated by a quartimax prerotation was selected for both the child and adolescent data; Table 1 contains the resultant factor structures. This rotation was selected because it allowed both for general as well as correlated factors, and because it produced the most interpretable factors (an extended report containing factor interpretation is available from Bahr Weiss). Note, however, that with the partial exception of the orthogonal varimax rotations (which do not allow for a general factor), the solutions generated by the other methods of rotation were quite similar to those generated by the promax/quartimax rotation.

To assess relations between the factors and CBCL scales, we computed correlations between the scales, and factor scores derived from the CDI. The matrix containing these correlations (see Table 2) was significant at the 0.001 level (Feild & Armenakis, 1974).

Comparison of Child and Adolescent Data

Although it would have been desirable to perform a confirmatory factor analysis to compare the children's and adolescents' factor patterns, the scaling properties of the CDI items (i.e., only three response alternatives, resulting in a grossly nonnormal distribution) made this form of analysis inappropriate. Instead, we used two comparison strategies, described next, that were not distribution dependent.

Procrustes rotations. We rotated the child covariance matrix using a Procrustes rotation (Mulaik, 1972) with the adolescent structure as the target, and rotated the adolescent covariance matrix using the child structure as the target. To obtain an estimate of the degree of fit between the matrices, we computed residuals (i.e., loadings from the Procrustes rotation minus the loadings from the Procrustes target). Residual loadings ranged from −0.48 to 0.73, with an absolute value mean of 0.20, suggesting that there were considerable differences between the factor structures of the two groups. Because of the aforementioned distribution restrictions it was not possible to compute a probability value for these residuals.

Inspection of communality estimates. To determine which CDI items were *not* important components of the CDI factor structure for the children and adolescents, we inspected the communality estimates (i.e., the portion of variance of the CDI

Table 1
Factor Structure Matrix

Response	Children			Adolescents		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
1. I am sad all the time.	**0.534**	−0.087	0.274	**0.646**	0.069	0.175
2. Nothing will ever work out for me.	0.184	0.166	−0.218	**0.543**	0.336	0.248
3. I do everything wrong.	**0.406**	0.343	0.239	**0.475**	**0.511**	0.290
4. Nothing is fun at all.	0.272	0.180	0.025	**0.431**	0.159	0.113
5. I am bad all the time.	**0.528**	**0.413**	0.105	0.375	**0.685**	0.326
6. I am sure terrible things will happen to me.	**0.596**	0.117	0.125	**0.524**	0.321	0.009
7. I hate myself.	0.363	**0.586**	0.209	**0.547**	0.284	0.124
8. All bad things are my fault.	0.319	0.367	0.227	0.358	**0.511**	**0.415**
9. I feel like crying every day.	0.345	0.360	**0.887**	**0.659**	−0.000	0.279
10. Things bother me all the time.	0.331	**0.514**	0.329	**0.703**	0.261	0.307
11. I do not want to be with people at all.	0.303	0.147	0.129	0.397	0.225	0.008
12. I cannot make up my mind about things.	0.152	**0.471**	0.217	**0.410**	0.304	0.318
13. I look ugly.	**0.447**	0.316	0.150	0.392	0.342	0.217
14. I have to push myself all the time to do my schoolwork.	0.147	**0.483**	0.075	0.231	0.204	**0.734**
15. I have trouble sleeping at night.	0.029	0.245	0.049	**0.568**	0.181	0.004
16. I am tired all the time.	0.167	0.030	0.194	**0.545**	0.104	0.353
17. Most days I do not feel like eating.	0.226	0.358	−0.080	**0.442**	−0.003	0.116
18. I worry about aches & pains all the time.	**0.409**	0.134	0.116	**0.560**	0.111	0.106
19. I feel alone all the time.	**0.640**	0.317	0.139	**0.582**	0.057	0.220
20. I never have fun at school.	0.210	**0.516**	−0.077	**0.438**	0.265	0.372
21. I do not have any friends.	0.199	0.216	−0.179	**0.496**	0.159	0.117
22. I do badly in (school) subjects I used to be good in.	0.268	**0.530**	−0.011	0.338	**0.408**	**0.546**
23. I can never be as good as other kids.	0.294	**0.528**	0.121	0.328	0.235	**0.434**
24. Nobody really loves me.	**0.483**	0.310	**0.675**	**0.611**	0.255	0.142
25. I never do what I am told.	0.395	0.199	−0.001	0.334	**0.626**	0.208
26. I get into fights all the time.	**0.460**	0.258	0.108	**0.409**	**0.696**	0.178
Variance explained, eliminating other factors	4.519	1.615	1.091	2.108	2.003	1.365
Variance explained, ignoring other factors	6.217	3.012	2.281	3.496	3.208	1.892

Note. Loadings > 0.40 are boldfaced.

items accounted for by the factors); items with estimates lower than 0.15 were considered to be relatively uninvolved in the factor structure. Although there were six such items (Nos. 2, 4, 11, 15, 16, and 21) for the children, there were none for the adolescents.

Relation Between Externalizing Behavior and Depression

As shown in Table 2, the CBCL Externalizing Behavior scale was correlated with none of the child CDI factors but with all three CDI factors among the adolescents. To test whether externalizing behavior was related to CDI depression as a whole, correlations were computed between total CDI and Externalizing scores. However, because three CDI items (5, 25, 26) pertain directly to oppositional, aggressive behavior, such correlations might reflect little more than item overlap. Consequently, the correlations were also computed with these three items subtracted from total CDI score.

For the children, the correlation between total CDI score and CBCL Externalizing score was 0.13 (*ns*); when the three oppositional/aggressive items were removed from the CDI, the corre-

Table 2
Correlations Between Factors, and Between Factors and Child Behavior Checklist (CBCL) Scores

Factor	Children			Adolescents		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
1	1.00	0.41	0.30	1.00	0.31	0.31
2	0.41	1.00	0.21	0.31	1.00	0.26
3	0.30	0.21	1.00	0.31	0.26	1.00
CBCL Internalizing	0.09	0.09	−0.15	0.33***	0.20	0.14
CBCL Externalizing	0.15	0.08	0.01	0.29*	0.43****	0.31**

*$p < .004$ (minimum considered significant, based on Dunn-Sidak correction). **$p < .001$. ***$p < .0005$. ****$p < .0001$.

lation became 0.10 (*ns*). For the adolescents, however, total CDI and Externalizing scores were significantly correlated ($r = 0.38$; $p < 0.0001$), even when the three items were removed ($r = 0.35$, $p < 0.0002$).

Inspection of the factor structures suggested that Factor 2 in the adolescent data might be considered an externalizing behavior factor. It had a relatively high correlation ($r = 0.43$) with the CBCL Externalizing scale, and the three CDI items showing the highest loadings (5, 25, and 26) all involved externalizing behaviors. No such factor was found in the child data. Instead, these three items (5, 25, and 26) all loaded on child Factor 1, a general factor (see Table 1).

To test whether endorsement of these items varied as a function of age, we computed a multivariate analysis of variance (MANOVA), with these items as the dependent variables; age and sex (the latter variable was included so that the Age × Sex interaction could be tested) served as the independent variables. Multivariate results were nonsignificant: For age, $F(3, 243) = 0.3391$, $p > 0.50$; for Age × Sex, $F(3, 243) = 0.4436$, $p > 0.50$. All univariate tests were also nonsignificant. This suggests that it is the relation between depression and these externalizing behaviors (or at least the child's perception of the behaviors) that changes with age, not the frequency of their occurrence.

Gender Differences

One-way ANOVAs revealed no significant differences between the young boys and the young girls on any of the three factors. Adolescent males and females, on the other hand, differed significantly on Factor 1 ($p < 0.005$) and marginally on Factor 2, ($p < 0.10$); girls scored higher on Factor 1, boys on Factor 2.

Discussion

Our findings suggest that although there may be parallels between childhood and adolescent depression, there also may be important differences. For instance, the communality analysis indicated that six CDI items in the child data were uninvolved in the factor structure but that all items were relatively involved for the adolescents; this suggests depression in children may involve fewer symptoms. The children and adolescents also differed in the extent to which aggressive, oppositional behavior appeared to be an integral part of the symptom pattern. Sex differences on the factors emerged only in the older group, which suggests that gender differences in the patterning of depressive symptoms may originate at some point between childhood and adolescence.

Each of these developmental differences suggests intriguing hypotheses about their origin and significance. However, development of such hypotheses, prior to replication of the factor structure, would be premature.

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