Childhood Behavior Precursors of Schizotypal Personality Disorder

by Su-chin Serene Olin, Adrian Raine, Tyrone D. Cannon, Josef Parnas, Fini Schulsinger, and Sarnoff A. Mednick

Abstract

No study has yet reported specifically on the early behavior of individuals later diagnosed with schizotypal personality disorder (SPD). This study examines prospectively collected teacher reports on school behavior as a means of assessing childhood precursors of SPD. Thirty-six DSM-III-R diagnosed schizotypal subjects were compared with four other groups: 31 schizophrenia patients, 37 diagnosed as nonpsychotic mentally ill, 68 who were not mentally ill but had mothers with schizophrenia, and 60 who were not mentally ill and had normal parents. These individuals were compared on a teachers' school report questionnaire obtained when the subjects averaged 15.1 years old. Those who later developed SPD were found to be more passive and unengaged and more hypersensitive to criticisms compared with the nonschizophrenia groups. Similar results were found when males and females were examined separately, except that males who developed SPD were found to be less disruptive and hyperexcitable compared with males with schizophrenia; females with SPD did not differ from females with schizophrenia. A receiver operating characteristic analysis found these factors to predict 73.5 percent of future SPDs; the ability of these factors to predict future SPDs is comparable for males and females.

These findings suggest that preschizotypal traits may be identified in late childhood or adolescence.


Bleuler (1911/1950) recognized a mild form of schizophrenia in the relatives of his schizophrenia patients. Early studies (e.g., Kety et al. 1968, 1978) using Danish samples confirmed Bleuler’s observations in the biological relatives of adoptees with schizophrenia. Such individuals were described as having borderline or latent schizophrenia. The concept of borderline or latent schizophrenia was operationalized later by Spitzer et al. (1979) and termed schizotypal personality disorder (SPD) in DSM-III (American Psychiatric Association 1980). The association between SPD and schizophrenia has been demonstrated. Several studies have found SPD and schizotypal traits to be more prevalent in the families of schizophrenia subjects (e.g., Baron et al. 1983; Squires-Wheeler et al. 1992; Kendler et al. 1993, 1994; Parnas et al. 1993). Recent analyses of the Danish samples also reported SPD to be elevated in the biological families of adoptees with schizophrenia (Kety 1988; Kendler et al. 1994). The consistent association between SPD and schizophrenia in family and adoption studies implicates both a familial and a genetic relationship between SPD and schizophrenia.

Although some researchers consider schizophrenia to be the primary disorder and SPD to be the secondary form, an alternative perspective (e.g., Mednick et al. 1987) views SPD as the basic disorder. According to the latter perspective, which posits a diathesis-stress model, schizophrenia and SPD are “schizotypes” that share the same genetic liability (the diathesis) for schizophrenia. Interactions with the environment determine which of these schizotypes later decompensate to schizophrenia. Schizotypes who experience greater environmental stressors (e.g., perinatal complications, family instability) are more likely to develop overt schizophrenia symptoms (Mednick et al. 1987). Based on this perspective, SPD is considered a life-long disorder, suggesting that behavioral precursors of SPD could be identified. Many studies have investigated premorbid behavioral indicators of schizophrenia and schizophrenia-spectrum disorders, including some well-known, high-risk, longitudinal projects such as the Rochester Longitudinal Study (Sameroff et al. 1987), Emory University Project (Goodman 1987), Israeli
The present study set out to test these hypotheses in a longitudinal format using teacher reports of school behavior in the Copenhagen high-risk sample of offspring of psychiatric parents. The childhood behaviors of diagnosed schizotypals may be characterized by passivity and withdrawal, which may have analogs with internalizing childhood behavior. Patterns such as passivity and withdrawal may be characteristic of preschizotypals. If SPD truly is a life-long personality disorder, then analogs to adult SPD symptoms should be found in adolescence. In fact, one study assessing schizotypal traits in nondiagnosed offspring of psychiatric parents found stability of schizotypal features across time, supporting the idea that adult-diagnosed schizotypal individuals may have early indicators of their potential for SPD in adulthood. (Squires-Wheeler et al. 1992). If behaviors differentiating preschizotypals from other children and adolescents can be identified, they can be used to target such individuals for early intervention.

In contrast, fewer studies have focused on precursors of SPD, and no longitudinal study has yet looked systematically at the childhood behaviors of diagnosed schizotypals.

1. Internalizing behaviors:
   a. SPD versus nonschizophrenia outcomes: Preschizotypals are expected to be more withdrawn and quiet than children with nonschizophrenia outcomes. Relative to these children, preschizotypals are not expected to be different from children with nonschizophrenia outcomes with regard to externalizing behaviors.
   b. SPD versus schizophrenia: Preschizotypals are hypothesized to exhibit less externalizing behavior problems, compared with preschizophrenia subjects.

Because males and females have been found to exhibit different precursor behaviors in schizophrenia (Watt 1972, 1978; Watt and Lubensky 1976; Schwartzman et al. 1985; Asarnow et al. 1991; Olin et al. 1995), the question of sex differences in preschizotypal behaviors also was examined in this study.

Methods

Subjects. The sample comprises 162 high-risk subjects and 60 low-risk subjects from the Danish high-risk study of 311 individuals followed since 1962. The original Danish high-risk prospective study included 207 high-risk subjects who had a mother with severe schizophrenia. They were matched to 104 low-risk subjects on variables that included age, sex, father’s occupation, rural-urban residence, and institutional upbringing versus family life (Mednick and Schulsinger 1968). At the time of the 1962 study, the subjects were between the ages of 9 and 20, with a mean age of 15.1 years. None of the subjects included in the project had a psychiatric diagnosis in 1962. Two major diagnostic followup studies have been conducted since 1962. The first diagnostic followup was in 1972 when subjects averaged 25 years old. The second followup took place when these subjects averaged 39 to 42 years old and were largely past the risk period for developing schizophrenia. The lifetime diagnoses used in the present study are based on DSM-III-R.

Only four SPDs in the low-risk group had complete school reports of individuals later diagnosed as having schizophrenia, being nonpsychotic but mentally ill, or normal. Based on a knowledge of preschizophrenia behavior and the similarities between SPD and schizophrenia features, some tentative hypotheses were made.

1. Internalizing behaviors:
   a. SPD versus nonschizophrenia outcomes: Preschizotypals are expected to be more withdrawn and passive than children with nonschizophrenic psychiatric and normal outcomes. Relative to these children, preschizotypals also are expected to be more socially anxious.
   b. SPD versus schizophrenia: No hypothesis was made on this relationship because preschizotypal individuals are expected to be similar to those with preschizophrenia with regard to internalizing behaviors.

2. Externalizing behaviors:
   a. SPD versus nonschizophrenia outcomes: No hypothesis was made on this relationship because preschizotypals are not expected to be different from children with nonschizophrenia outcomes with regard to externalizing behaviors.
   b. SPD versus schizophrenia: Preschizotypals are hypothesized to exhibit less externalizing behavior problems, compared with preschizophrenia subjects.
school reports. Consequently, these subjects were not included in the analyses.

**DSM-III-R Diagnoses.** Between 1972 and 1974, the first major diagnostic followup was conducted by Hanne Schulsinger (1976) and consisted of the Present State Examination (PSE), PSE Etiology Scale, PSE syndrome checklist (Wing et al. 1974), Current and Past Psychopathology Scales (Endicott and Spitzer 1972), and other items assessing schizophrenia characteristics. In addition, hospital records were screened and relevant hospital charts were reviewed and scored for symptoms. Schulsinger completed a summary of the interview and hospital records, including social, occupational, and other psychiatric information. This information recently was converted to *DSM-III-R* diagnoses through careful review of the interview summaries.

Between 1986 and 1989, Bjorn Jacobsen conducted the second diagnostic followup. The subjects were evaluated using three structured psychiatric interviews: the Schedule for Affective Disorders and Schizophrenia—Lifetime Version (Spitzer and Endicott 1978), the PSE, and the Personality Disorders Examination (Loranger et al. 1985). Again, the hospital records of all subjects were screened for relevant information. Jacobsen completed a summary on each subject, including social, occupational, and psychiatric information. Based on this assessment, each subject was assigned diagnoses using *DSM-III-R* criteria.

Blind, independent reviews of the interview summaries from each assessment were conducted. This review indicated a high degree of diagnostic reliability (mean $\kappa$ coefficient $= 0.965$) (Parnas et al. 1993). More recently, the interview summaries of the SPD subjects were reviewed. All SPD subjects in the high-risk group evidenced at least five of the nine features of SPD described in *DSM-IV* (American Psychiatric Association 1994).

Subjects were assigned a primary lifetime diagnosis representing the most severe Axis I or II diagnosis at either assessment. The diagnostic outcomes of all the subjects in the Copenhagen high-risk sample have been discussed in a separate article (Parnas et al. 1993). For the present study, the high-risk group included 36 schizotypal subjects; SPD was considered primary to all disorders except schizophrenia. The SPD group was compared with three groups of children from the high-risk group: (1) 31 children who later developed schizophrenia; (2) 37 non-psychotics including individuals diagnosed with non-psychotic depression, substance abuse, and other Axis I and II disorders; and (3) 68 not mentally ill (NMI) individuals. They were also compared with 60 NMI individuals from the low-risk sample. Ten of the high-risk subjects did not receive complete school reports (2 SPD, 1 schizophrenia, 5 nonpsychotic, 2 NMI). Several psychotic disorders in the high-risk group were not included in these analyses because they occurred at low rates (1 delusional disorder, 1 schizophreniform disorder, 7 atypical psychosis, 6 organic brain syndrome, 5 paranoid personality disorder); 15 high-risk subjects were excluded because of missing diagnoses.

**School Report.** In 1962, subjects were assessed extensively on several measures, including a teacher report of school behavior. Subjects were asked for their permission to send the questionnaire to the teachers. All subjects gave their oral agreement to the full day of assessment and teacher ratings. Teachers who knew the students best completed a school report questionnaire. School reports for older subjects were done retrospectively. For every subject, the teacher who completed the questionnaire had known the subject for at least 3 years. The school report was not completed for 12 (10 high-risk, 2 low-risk) subjects. The rest received complete or nearly complete school reports. Missing items on the questionnaire were nonsystematically distributed across all items.

Table 1 presents the school report questionnaire. Only behavioral items were included in the analyses; thus, items 1 through 6 were excluded. These items required teachers to make a true-false response about the subject’s classroom behavior. For all items, teachers were allowed a “don’t-know” response.

**Analyses.** An exploratory factor analysis was the method of choice for the following reasons: (1) The literature related to precursors of SPD is sparse. This article is intended to explore and identify possible precursors of adult SPD. Given that little is known about early SPD behaviors, exploratory factor analysis is appropriate (Bollen 1989). (2) The school report questionnaire had not been factor analyzed before, and consequently, an exploratory factor analysis is useful in suggesting underlying patterns in the teacher school report questionnaire (Bollen 1989). Principal axis factoring with VARIMAX rotation was employed using Statistical Package for the Social Sciences (SPSS-X; Norusis 1988). Factor scores were summed using the regression method (Norusis 1988). All individuals ($n = 297$) of the Copenhagen High-Risk Study with school data were used. Missing data for a specific item (ranging from 5.1% to 10.6%) were replaced with the group mean to maximize sample size.

Of concern was the question of the probable bias in using an ascertained sample in factor analysis. Factor analyses were conducted separately using the high-risk group ($n = 197$) and the low-risk group ($n = 102$). Congruence reliability (Harman 1976) for corresponding factors was very high for the first three factors (0.93, 0.88, and 0.80) and moderate for the last two (0.56 and 0.42).
Table 1. School report questionnaire: Factor loadings (criterion 0.30 or greater) for principal factors extraction and VARIMAX rotation of four factors

<table>
<thead>
<tr>
<th>Items</th>
<th>Mean (SD) (n = 299)</th>
<th>Factor 1: Socially anxious or withdrawn</th>
<th>Factor 2: Disruptive and hyper-excitable</th>
<th>Factor 3: Passive and unengaged</th>
<th>Factor 4: Hypersensitive to criticism</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Repeated a grade</td>
<td>0.90 (0.58)</td>
<td>0.89</td>
<td>0.11</td>
<td>0.06</td>
<td>-0.01</td>
</tr>
<tr>
<td>2. Tested by psychologist</td>
<td>0.98 (0.51)</td>
<td>0.92</td>
<td>0.00</td>
<td>-0.05</td>
<td>-0.12</td>
</tr>
<tr>
<td>3. High intelligence</td>
<td>0.95 (0.54)</td>
<td>0.93</td>
<td>-0.02</td>
<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>4. Performance poorer than abilities</td>
<td>0.91 (0.57)</td>
<td>0.88</td>
<td>0.07</td>
<td>0.10</td>
<td>0.07</td>
</tr>
<tr>
<td>5. Future psychotic or emotional problem</td>
<td>0.87 (0.34)</td>
<td>0.04</td>
<td>0.81</td>
<td>-0.03</td>
<td>-0.02</td>
</tr>
<tr>
<td>6. Remedial instruction</td>
<td>0.93 (0.28)</td>
<td>0.04</td>
<td>0.77</td>
<td>-0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>7. Lonely and rejected by others</td>
<td>0.93 (0.38)</td>
<td>0.09</td>
<td>0.72</td>
<td>-0.05</td>
<td>0.29</td>
</tr>
<tr>
<td>8. Content with isolation</td>
<td>0.93 (0.26)</td>
<td>0.05</td>
<td>0.65</td>
<td>-0.10</td>
<td>0.20</td>
</tr>
<tr>
<td>9. Anxious and restrained with classmates</td>
<td>0.84 (0.37)</td>
<td>-0.05</td>
<td>0.56</td>
<td>0.03</td>
<td>0.27</td>
</tr>
<tr>
<td>10. Anxious and restrained with teacher</td>
<td>0.82 (0.50)</td>
<td>0.02</td>
<td>-0.15</td>
<td>0.85</td>
<td>0.06</td>
</tr>
<tr>
<td>11. Disturbs class with inappropriate behavior</td>
<td>0.57 (0.50)</td>
<td>0.04</td>
<td>-0.01</td>
<td>0.84</td>
<td>0.07</td>
</tr>
<tr>
<td>12. Disciplinary problem</td>
<td>0.53 (0.50)</td>
<td>0.00</td>
<td>-0.05</td>
<td>0.58</td>
<td>-0.03</td>
</tr>
<tr>
<td>13. Easily excited or irritated</td>
<td>0.90 (0.55)</td>
<td>0.00</td>
<td>-0.05</td>
<td>0.54</td>
<td>0.14</td>
</tr>
<tr>
<td>14. Easily excited or irritated</td>
<td>0.73 (0.45)</td>
<td>0.04</td>
<td>-0.05</td>
<td>0.54</td>
<td>0.14</td>
</tr>
<tr>
<td>15. Quiet and unengaged</td>
<td>0.84 (0.37)</td>
<td>0.07</td>
<td>0.17</td>
<td>0.44</td>
<td>-0.14</td>
</tr>
<tr>
<td>16. Quiet and unengaged</td>
<td>0.84 (0.37)</td>
<td>0.02</td>
<td>-0.11</td>
<td>0.44</td>
<td>0.18</td>
</tr>
<tr>
<td>17. Rarely takes initiative</td>
<td>0.87 (0.34)</td>
<td>0.00</td>
<td>0.03</td>
<td>0.33</td>
<td>-0.00</td>
</tr>
<tr>
<td>18. Activity level: passive</td>
<td>0.77 (0.42)</td>
<td>-0.01</td>
<td>0.25</td>
<td>0.08</td>
<td>0.51</td>
</tr>
<tr>
<td>19. Rarely participates in spontaneous activity</td>
<td>0.90 (0.50)</td>
<td>-0.06</td>
<td>0.14</td>
<td>-0.19</td>
<td>0.47</td>
</tr>
<tr>
<td>20. Does not react when praised or encouraged</td>
<td>0.75 (0.66)</td>
<td>0.04</td>
<td>0.11</td>
<td>0.16</td>
<td>0.38</td>
</tr>
<tr>
<td>21. Shy, reserved, and silent</td>
<td>0.84 (0.37)</td>
<td>0.07</td>
<td>0.17</td>
<td>0.44</td>
<td>-0.14</td>
</tr>
<tr>
<td>22. Seldom laughs or smiles with others</td>
<td>0.84 (0.37)</td>
<td>0.02</td>
<td>-0.11</td>
<td>0.44</td>
<td>0.18</td>
</tr>
<tr>
<td>23. Uneasy about criticism</td>
<td>0.87 (0.34)</td>
<td>0.00</td>
<td>0.03</td>
<td>0.33</td>
<td>-0.00</td>
</tr>
<tr>
<td>24. Reacts insensitively</td>
<td>0.77 (0.42)</td>
<td>-0.01</td>
<td>0.25</td>
<td>0.08</td>
<td>0.51</td>
</tr>
<tr>
<td>25. Nervous</td>
<td>0.90 (0.50)</td>
<td>-0.06</td>
<td>0.14</td>
<td>-0.19</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Note.—Only behavioral items were used in the analyses; items 1 through 6 thus were excluded.

1Items 7 and 8 belong with anxiety items 9 and 10 probably because of an adaptive response (i.e., isolation) to social anxiety. SD = standard deviation.

Given the lack of stability in using a small normal sample (in this case the 102 low-risk controls) for this factor analysis, as well as the general similarity between the two samples, the high-risk and low-risk groups were combined to attain greater reliability in the factor structure.

Similarly, factor analyses also were conducted separately for males (n = 172) and females (n = 127) to examine possible differences in factor structure. The results of these factor analyses were once again generally similar. Congruence reliability for corresponding factors was very high for the first two factors (0.97 and 0.95), high for the third (0.70), and moderate for the last two (0.63 and 0.50). Because of power considerations, and the general similarity of the above factor analyses, the results of this study are based on the factor structure derived from the entire sample.

The five groups (SPD, schizophrenia, nonpsychotic, high-risk NMI, low-risk NMI) were then compared on the factors derived, using one-way analysis of variance (ANOVA) with factor scores as the dependent variables. Males and females also were examined separately to explore gender differences. However, because of the reduction in power anticipated with smaller total sample sizes, these analyses are exploratory.

After the multivariate tests, factors that significantly discriminated the groups at the 0.05 level were examined to compare the SPDs with the other groups using the Tukey-honestly significant difference (HSD) procedure (Hochberg and Tamhane 1987). The school behavior factors that significantly distinguished SPD outcome were then combined in a single index to determine how well this total SPD score predicted adult SPD status. A receiver operating characteristic (ROC) analysis was conducted to assess the predictive validity of these factors.

Results

Factor Analysis of School Behavior. Principal factors extracted with VARIMAX rotation yielded five factors based on Kaiser's criterion of an eigenvalue greater than 1
(Kaiser 1958). The criterion for significant loadings was set at 0.30 or greater; these factor loadings are shown in table 1. Factor 1 accounted for 19.8 percent of the variance: this factor included items 7 through 10 and was labeled "socially anxious or withdrawn." Factor 2 accounted for an additional 18.6 percent of the variance: this factor included items 11 through 15 and was labeled "disruptive and hyperexcitable." Factor 3 accounted for 16 percent of the variance: this factor, consisting of items 16 through 22, was labeled "passive and unengaged." Factor 4 accounted for an additional 6.8 percent of the variance: this factor, consisting of items 23 through 25, was labeled "hypersensitive to criticism." The fifth factor consisted of items 19 and 22 and was dropped from further analyses for four reasons: (1) Factor 5 meets only the minimal criterion of an eigenvalue greater than 1 (eigenvalue = 1.011) and only accounts for an additional 5.3 percent of the variance. (2) Only two items loaded on this factor. (3) Both items were already accounted for in factor 3. (4) Removing the fifth factor resulted in simple structure as outlined by Thurstone (1947). Thus, further analyses were based on a four-factor solution. The regression method was used to create factor scores for all four factors.

The five diagnostic groups were compared on the four factors. The means and standard deviations of the four factor scores are shown in table 2. The five groups were significantly different from one another on three factors (factors 2, 3, and 4).

1. Testing of Hypotheses—Internalizing Behaviors:

   a. SPD versus other nonschizophrenia outcomes: The one-way ANOVA indicated that factor 3 (passive and unengaged) significantly differentiated among the five groups ($F = 3.67; df = 4,216; p = 0.007$). Pairwise comparisons using the Tukey HSD procedure supported the hypothesis that preschizotypals would be more passive and unengaged than other children. Specifically, preschizotypals were significantly more passive and unengaged compared with the low-risk NMI ($p < 0.05$). None of the other pairwise comparisons was significant. The hypothesis that preschizotypals would exhibit greater social anxiety (factor 1) was not supported.

   b. SPD versus schizophrenia: Preschizotypals were not significantly different from preschizophrenia subjects on factor 1 (socially anxious or withdrawn) or factor 3 (passive and unengaged).

<p>| Table 2. Means (standard deviations) of factor scores on the four factors derived from the school report questionnaire |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|</p>
<table>
<thead>
<tr>
<th>Groups (n)</th>
<th>Factor 1: Socially anxious or withdrawn</th>
<th>Factor 2: Disruptive and hyperexcitable</th>
<th>Factor 3: Passive and unengaged</th>
<th>Factor 4: Hypersensitive to criticism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males and females combined</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPD (34)</td>
<td>0.09 (0.40)</td>
<td>-0.02 (0.65)</td>
<td>0.29 (0.93)</td>
<td>0.46 (1.1)</td>
</tr>
<tr>
<td>SZ (30)</td>
<td>0.16 (0.44)</td>
<td>0.63 (1.4)</td>
<td>0.20 (1.0)</td>
<td>0.05 (0.88)</td>
</tr>
<tr>
<td>NPD (32)</td>
<td>-0.002 (0.31)</td>
<td>0.20 (1.2)</td>
<td>-0.29 (0.79)</td>
<td>0.10 (0.62)</td>
</tr>
<tr>
<td>HR-NMI (66)</td>
<td>0.11 (0.40)</td>
<td>-0.12 (0.76)</td>
<td>0.14 (0.92)</td>
<td>-0.09 (0.53)</td>
</tr>
<tr>
<td>LR-NMI (60)</td>
<td>0.01 (0.35)</td>
<td>-0.22 (0.64)</td>
<td>-0.24 (0.81)</td>
<td>-0.09 (0.58)</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPD (24)</td>
<td>0.04 (0.24)</td>
<td>0.05 (0.71)</td>
<td>0.25 (0.90)</td>
<td>0.40 (1.1)</td>
</tr>
<tr>
<td>SZ (18)</td>
<td>0.18 (0.46)</td>
<td>1.0 (1.5)</td>
<td>0.16 (1.0)</td>
<td>-0.07 (0.81)</td>
</tr>
<tr>
<td>NPD (18)</td>
<td>0.07 (0.39)</td>
<td>0.59 (1.5)</td>
<td>-0.34 (0.78)</td>
<td>0.18 (0.67)</td>
</tr>
<tr>
<td>HR-NMI (30)</td>
<td>0.12 (0.34)</td>
<td>-0.03 (0.82)</td>
<td>-0.08 (0.93)</td>
<td>-0.18 (0.49)</td>
</tr>
<tr>
<td>LR-NMI (34)</td>
<td>0.03 (0.38)</td>
<td>-0.11 (0.74)</td>
<td>-0.28 (0.84)</td>
<td>-0.09 (0.63)</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPD (10)</td>
<td>0.21 (0.64)</td>
<td>-0.19 (0.48)</td>
<td>0.39 (1.0)</td>
<td>0.62 (1.0)</td>
</tr>
<tr>
<td>SZ (12)</td>
<td>0.13 (0.43)</td>
<td>0.07 (1.0)</td>
<td>0.26 (1.0)</td>
<td>0.23 (0.98)</td>
</tr>
<tr>
<td>NPD (14)</td>
<td>-0.09 (0.02)</td>
<td>-0.32 (0.39)</td>
<td>-0.22 (0.84)</td>
<td>0.00 (0.57)</td>
</tr>
<tr>
<td>HR-NMI (36)</td>
<td>0.11 (0.45)</td>
<td>-0.21 (0.70)</td>
<td>0.33 (0.88)</td>
<td>-0.01 (0.57)</td>
</tr>
<tr>
<td>LR-NMI (26)</td>
<td>-0.02 (0.31)</td>
<td>-0.35 (0.44)</td>
<td>-0.18 (0.78)</td>
<td>-0.06 (0.51)</td>
</tr>
</tbody>
</table>

Note.—SPD = schizotypal personality disorder; SZ = schizophrenia; NPD = nonpsychotic disorder; HR-NMI = high-risk not mentally ill; LR-NMI = low-risk not mentally ill.

1 This group is significantly different from the group having the most deviant score for that factor.

2 This group had the most deviant score for that factor.
2. Testing of Hypotheses—Externalizing Behaviors: 
   
a. SPD versus other nonschizophrenia outcomes: 
   Factor 2 (disruptive and hyperexcitable) distinguished the five groups \((F = 5.26; df = 4.216; p = 0.0005)\). Pairwise comparison using Tukey’s procedure indicated, however, that the preschizotypals were not different from the non-preschizophrenia groups on this factor.

   b. SPD versus schizophrenia: Pairwise comparison indicated that preschizotypals were significantly \((p < 0.05)\) less disruptive and hyperexcitable (factor 2) than the preschizophrenia subjects. In fact, the preschizophrenia subjects were the most disruptive group (Olin et al. 1995). They were significantly more disruptive and hyperexcitable than the preschizotypals and the high-risk NMI and low-risk NMI groups \((p < 0.05)\).

Exploratory Hypotheses. No hypothesis was made for factor 4 (hypersensitive to criticism). This factor, however, distinguished the five groups \((F = 4.11; df = 4.216; p = 0.003)\). Preschizotypals were more hypersensitive to criticism than other children (table 2). Specifically, Tukey’s procedure showed that preschizotypals were significantly more hypersensitive to criticism compared with high-risk and low-risk children with NMI \((p < 0.05)\). The other pairwise comparisons were not significantly different.

Analyses by Sex. These analyses were replicated for males and females separately to explore gender differences. In general, except for changes in \(p\) values resulting from the reduced power associated with smaller sample sizes, the results for males and females were similar to those of the combined sample. Preschizotypal males and females were found to be more passive and unengaged and more hypersensitive to criticism. The results of the analyses for males and females are shown in table 2.

Factor 1 (socially anxious or withdrawn). This factor did not distinguish the males or the females.

Factor 2 (disruptive and hyperexcitable). Preschizotypal males were less disruptive and hyperexcitable than the preschizophrenia males \((F = 4.80; df = 4; p = 0.001)\). In fact, the preschizophrenia males also were found to be more disruptive and hyperexcitable than the high-risk NMI and low-risk NMI males. Preschizotypal females were not significantly different from their female preschizophrenia peers on this factor. Compared with their male nonschizophrenia peers, preschizotypal males did not differ on this factor; similarly, preschizotypal females did not differ from their female nonschizophrenia peers on this factor.

Factor 3 (passive and unengaged). The difference between preschizotypal males and the low-risk NMI males approached significance \((F = 1.98; df = 4; p = 0.10)\). Similarly, the difference between the preschizotypal females and the low-risk NMI females also approached significance \((F = 2.11; df = 4; p = 0.09)\). The lack of significant findings when the sexes were separated is probably caused by the decreased power associated with smaller sample sizes. As can been seen in table 2, the mean factor 3 scores for the SPDs and the low-risk NMI are comparable when the groups are combined or separated by sex.

Factor 4 (hypersensitive to criticism). Preschizotypal males were found to have significantly higher scores than high-risk NMI males \((F = 2.54; df = 4; p = 0.04)\), whereas preschizotypal females were found to have significantly higher scores than the low-risk NMI females \((F = 2.53; df = 4; p = 0.046)\).

Assessing the Predictive Value of the SPD Factors: An ROC Analysis. To assess the predictive value of the SPD factors, an index was developed by summing the significant differentiating factor scores derived from the entire sample to obtain a total SPD score for each subject (in this case, factors 3 and 4; factor 2 was not included in this index because it distinguished only the male SPD from the male schizophrenia subjects). An ROC analysis (Swets and Pickett 1982; Hsiao et al. 1989; Mossman and Somoza 1989) was used to evaluate the efficacy of the total SPD score for differentiating preschizotypals from normals. In the absence of a general population sample, the low-risk normal control (i.e., NMI) group is used to examine the positive and negative predictive power of this total SPD score. Figure 1 shows rates for true-positive and false-positive reports corresponding to various cutoffs in the total SPD score for the entire sample. The points for males and females are also plotted separately—including endpoints \((0,0)\) and \((1,1)\)—and are connected to produce two ROC curves (Egan 1975; Swets and Pickett 1982), one for each sex. The ROC curve shows the tradeoff between the probability of true-positive and false-positive reports as the decision criterion changes. A conservative criterion would result in low true- and false-positive rates, represented by a point near the lower left-hand corner of figure 1. In contrast, a lenient criterion would result in high true- and false-positive rates, represented by a point near the upper right-hand corner of the graph. The true-positive rate corresponds to the sensitivity of the total SPD score, whereas the false-positive rate corresponds to 1 minus the specificity of the total SPD score. As seen in figure 1, the ROC for both males and females is comparable to that of the entire sample.

In essence, the ROC curve represents all possible discrimination rules that can be obtained by selecting different total SPD score cutoffs. Decision rules developed to
determine a cutoff presumably depend on the cost and benefit associated with correct predictions (i.e., hit and correct rejection) and false predictions (false alarms and misses). One simple strategy used to decide a cutoff is to maximize the proportion of correct predictions (Green and Swets 1966). This strategy essentially equates the hit rate to the correct rejection rate and the false alarm rate to the miss rate. The cutoff value then becomes the log prior odds in favor of SPD (Coombs et al. 1970; John et al. 1982). The smaller the base rate of SPD, the smaller the cutoff point.

For the entire SPD versus low-risk NMI comparison, subjects with scores of at least 0.25 are labeled SPD; those with scores higher than 0.25 are not. This strategy results in a hit rate of 73.5 percent and a false-alarm rate of 26.7 percent in this sample. For the SPD versus low-risk NMI comparison in males, subjects with scores of at least 0.15 are labeled SPD; those with scores greater than 0.15 are not labeled. This strategy results in a hit rate of 66.7 percent and a false-alarm rate of 20.6 percent in the sample. For the SPD versus low-risk NMI comparison for females, this strategy results in a hit rate of 80.0 percent and a false-alarm rate of 30.8 percent at an optimal cutoff of 0.42 (see figure 1).

Another strategy for selecting a cutoff total SPD score is to determine the desired tolerance for false alarms (false positives) or misses (false negatives). Fixing a miss probability is equivalent to setting a desired hit rate because both must total 1. Specifying a smaller false-alarm probability results in a smaller hit rate (lower left-hand corner of the ROC curves in figure 1). Likewise, the false-alarm rate is necessarily higher with an increased hit rate (upper right-hand corner of the ROC curves). Deciding on this cutoff, of course, depends on (1) the effectiveness and cost of the intervention program, (2) the cost incurred to someone who experiences the label/intervention that he or she does not need, and (3) the cost to those potential SPDs who do not undergo the treatment intervention.

Current Versus Retrospective Teacher Ratings. The teacher reports for some older subjects were completed from memory. To assess the possible effect of the retrospective ratings, the analyses were completed separately for the older and younger students. The results for these two groups were almost identical, suggesting that retrospective teacher ratings related to later diagnosis in the same manner as the concurrent ratings.

Discussion

As hypothesized, the results of this study suggest that analogs of adult SPD traits were evident as early as late childhood or early adolescence. Approximately, three-quarters of preschizotypal subjects exhibited classroom behaviors that distinguished them from other children. No clear sex differences were found for the preschizotypal students. Males with preschizophrenia were found to be more disruptive and hyperexcitable than their peers, but females with preschizophrenia were not. This sex difference is consistent with previous findings (Olin et al. 1995). Compared with children who became mentally healthy adults, preschizotypal students were more passive and more socially unengaged; they also were hypersensitive to criticism and reacted more nervously. Such behavior is consistent with DSM-III-R characteristics of SPD, specifically no close friends or confidants and constricted affect. The passivity and seriousness observed by teachers in preschizotypal children may be related to the constricted affect seen in schizotypal adults. Social disengagement as children and adolescents may result in the lack of close friends or confidants characteristic of schizotypal adults.

Although not specifically hypothesized, preschizotypal children were found to be more hypersensitive to criticism than children with normal outcomes. The authors speculate that hypersensitivity to criticism in preschizotypal children may develop into the symptom of excessive social anxiety experienced by adults with SPD.
In DSM-IV, the SPD feature of excessive social anxiety is associated with paranoid ideation, which may be expressed as hypersensitivity in childhood or adolescence.

In this context, it is interesting that preschizotypal children were not found to be more socially anxious (factor 1) compared with the other groups. The adult schizotypal trait of social anxiety may develop later, as a consequence of passivity and hypersensitivity. The inability of these children to initiate and participate in activities, compounded by their sensitivity to criticism and anxiety in other classroom situations, may result in a lack of socializing opportunities. This lack of socialization in childhood may later lead to social anxiety as adults and explain the lack of close friends and confidants characteristic of schizotypal adults. Alternatively, social anxiety may underlie many disorders and may not be specific to schizotypy.

The ROC analysis showed that the total SPD score had some predictive efficacy. When a total SPD score was chosen to maximize the proportion of SPD predictions, approximately three-quarters of future SPDs were targeted. Some nonschizotypals were falsely classified using these total SPD scores in childhood, however, which indicates that some behaviors identified by the school report may not be specific to schizotypy.

Of particular interest in this study were behaviors that distinguished preschizophrenia sufferers and preschizotypals, and these may elucidate differences in the etiologies of the two disorders. In this study, children with preschizophrenia were found to be more hyperexcitable and disruptive than those who were preschizotypal. This etiological difference may be explained by Meehl’s diathesis-stress model of schizophrenia. According to Meehl (1962, 1989, 1990), schizotypals and persons with schizophrenia are “schizotypes” who share a common genetic diathesis. Schizophrenia is postulated to develop as a result of the interactions of these schizotypes with the environment. In particular, schizotypes who suffer stressful experiences may develop overt schizophrenia, whereas those who do not suffer stressful experiences develop SPD. The children with preschizophrenia in the sample studied experienced delivery complications and poor rearing environments, such as family instability, early institutionalization, and parental separations (Mednick et al. 1987; more recent unpublished analyses of schizophrenia replicate earlier findings). Such early stressful experiences also have been associated with later antisocial behavior (Raine 1993). Consequently, the poor impulse control and disruptive behaviors exhibited by children with preschizophrenia may be related to their more stressful environments.

Of note is the somewhat higher rate of SPD in the study sample than that reported in other studies. In the current study, 17.4 percent of the children of parents with schizophrenia developed SPD. In the Roscommon Family Study, Kendler et al. (1993) reported a lifetime prevalence of 13.9 percent SPD in parents of children with schizophrenia. Among the first-degree relatives, the parent-child concordance rate was twice that of sibling-sibling concordance. In the provincial and national samples of the Danish Adoption Study of Schizophrenia (Kendler et al. 1993), SPD was reported in 10.7 percent of first-degree relatives of those with schizophrenia. Concordance rates for parent-child versus sibling-sibling concordance were not distinguished. The concordance between schizophrenia and SPD in the Copenhagen High-Risk Study is somewhat higher than that in other studies. Several differences between the current sample and other studies may explain this difference in prevalence rates. First, the sample is characterized by offspring of mothers with severe schizophrenia. Only mothers who qualified as having severe or typical schizophrenia in Europe and the United States were selected. In 1962, these mothers had been hospitalized for at least 5 years or had three separate hospitalizations of at least 3 months’ duration with no sign of improvement at discharge (Mednick and Schulsinger 1968). Second, the concordance rate of SPD is based on parent-child concordance rather than sibling-sibling concordance. The latter concordance rates have been shown to be lower (Kendler et al. 1993). Third, there is a significant amount of assortive mating in the sample (Parnas 1985). The high-risk subjects were more likely than the low-risk (control) subjects to have a father with a schizophrenia-spectrum diagnosis. This factor increases genetic liability and the chance of developing schizophrenia-spectrum disorders. Fourth, most of the subjects in this study had significant contact with their mothers with schizophrenia, unlike the adoptees in the Danish adoption study. Many of the children in the current study were reared in public institutions when the mother broke down. The stress and instability in the environments of the offspring of parents with schizophrenia might account for the greater prevalence of both schizophrenia and SPD in the sample, compared with adoption studies.

Advantages and Limitations. This study is potentially important for several reasons. First, this study is the first, to our knowledge, to examine behavior precursors of SPD based on a sizable number of DSM-III-R diagnosed SPDs. Second, teacher ratings were made prospectively, before any of the subjects received a psychiatric diagnosis. Although teachers might have been aware of parental illnesses—an awareness that could potentially lead to increased SPD scores in the high-risk group, the study results indicate that the SPD group scored at a higher level than even the high-risk NMI group. These findings
suggest that teacher ratings were fairly accurate, despite possible biases. Third, the student characteristics were rated more than 30 years before the diagnosis, indicating a continuity in the disorder.

There are some inherent limitations, however. First, the findings were constrained by items in the school report questionnaire. Because the questionnaire did not collect information relating to the more positive traits of SPD (e.g., odd beliefs or magical thinking, odd behavior, odd speech, unusual perceptual experiences, and paranoia), this study could not determine if precursors of these traits are detectable before overt onset of the disorder. The predictive power of the school report ratings may be limited if such traits have detectable early precursors. This limitation points to the need for further research that investigates early (preschool) analogs of the positive traits of SPD in future longitudinal research. The development of a childhood measure tapping positive schizotypal traits would be essential. Second, some nonschizotypal children had total SPD scores that would classify them as potential SPDs. This lack of specificity indicates the need to delineate further the early behaviors that may be more specific to preschizotypy, such as the more positive traits of SPD. Third, the SPD sample in this study is a high-risk group, a factor that may limit the ability to generalize from the findings. Fourth, the use of an ascertained sample in the factor analysis may bias the total SPD score distribution. Future studies ideally should use an unselected general population. Finally, the lack of theoretical background in this area necessitated a more exploratory approach. The findings reported in this study thus should be considered preliminary and call for replication, preferably in a general population.

Conclusions

Precursors of schizotypy that are analogs of some of the adult symptomatology are identifiable in late childhood or early adolescence. This finding could have potentially important implications: (1) Diagnostically, the existence of childhood precursors of SPD suggests that such precursors might be considered in future DSM criteria for SPD. (2) Childhood analogs of adult schizotypal symptoms indicate that SPD does not develop suddenly in adulthood but rather has its roots in late childhood, or even earlier. The early signs of SPD suggest that genetic and/or environmental factors existing before school age play an important role in the development of this life-long disorder.

References


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