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Does the Schizotypal Personality Questionnaire reflect the biological–genetic vulnerability to schizophrenia?

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Abstract

We investigated whether the Schizotypal Personality Questionnaire (SPQ) [Schizophr. Bull. 17 (1991) 555.] could be an indicator of the biological–genetic vulnerability to schizophrenia. We hypothesized that the mean scores on three dimensions of the SPQ of different groups of relatives of patients with schizophrenia would parallel their risk for developing schizophrenia. The SPQ was administered to 51 first-episode schizophrenia patients, 63 parents of schizophrenia patients, 42 siblings of schizophrenia patients and 12 children of schizophrenia patients. Patients differed from the relatives on all three dimensions. Siblings and children scored significantly higher than parents on Positive Schizotypy, and the insignificant difference between the siblings and children was in the expected direction. The results could not be explained by the differences in age, sex, IQ or substance abuse. No differences were found for Disorganization Schizotypy between the relatives. Children scored higher than parents on Negative Schizotypy. The current study offers support to the hypothesis that the positive dimension of SPQ reflects the genetic vulnerability to schizophrenia. © 2002 Elsevier Science B.V. All rights reserved.

Keywords: Schizotypal Personality Questionnaire; Biological–genetic vulnerability; Schizophrenia

1. Introduction

Recently, Tsuang et al. (1999) showed that schizotypal personality traits are found to a much higher degree in first-degree relatives of schizophrenia patients than in normal controls. They concluded that the prevalence rate for the schizotypal personality disorder in first-degree relatives was about 15% and that even a higher rate of subclinical schizotypal traits is to be expected in these relatives. Studies by Kety et al. (1994), Tsuang et al. (1991) and Kendler et al. (1995) consistently found these high rates of schizotypal traits among the biological relatives of schizophrenia patients. These studies mainly using interviews predominantly reported negative symptom-like features among relatives. Tsuang et al. (1999) argued that higher rates of schizotypal traits in relatives reflect the biological–genetic vulnerability to schizophrenia. The construct of (questionnaire) schizotypy is comprised of three dimensions (Venables, 1995). Recent factor analytical studies showed that questionnaire items of schizotypal traits can be reduced to three latent variables, viz. the positive, negative and disorganization dimensions of schizotypy (Raine et al., 1994; Vollema and Hoijtink, 2000) (see Table 1). These findings qualify the Schizotypal Personality Question-
naire (SPQ) as a sound psychometric and multidimensional questionnaire for assessing schizotypal traits, and therefore, as a promising indicator of the genetic vulnerability to schizophrenia. Although many studies investigated the occurrence of schizotypal traits in relatives, a small minority used the questionnaire approach. Kendler et al. (1996) used interviews and questionnaires in a family study and concluded that interviews discriminate relatives from controls better than questionnaires. Kremen et al. (1998) compared SPQ scores of normal controls to the scores of the biological relatives of schizophrenia patients. Relatives scored higher on Positive Schizotypy than the controls. No differences were found for the Negative and Disorganization Schizotypy dimensions. Since previous studies showed that negative symptom-like features occurred more frequently among relatives, the findings of Kremen et al. (1998) on Positive Schizotypy were unexpected. However, Yaralian et al. (2000) replicated the findings of Kremen, viz. Positive Schizotypy scores were elevated in relatives as compared to controls. These findings offer support for the hypothesis that the SPQ, as far as the positive dimension is concerned, reflects the genetic vulnerability to schizophrenia.

The discrepancy in the results between the recent and older studies may be due to instrument variation (Yaralian et al., 2000). For instance, Kendler et al. (1996) used the Magical Ideation Scale (MIS; Eckblad and Chapman, 1983) to assess Positive Schizotypy and the Social Anhedonia Scale (SAS; Chapman et al., 1976) to assess Negative Schizotypy. The SAS identified the relatives of the schizophrenia patients but the MIS did not. The Perceptual Aberration Scale (PAS; Chapman et al., 1978) and the MIS as well have overt psychotic-like items and contrasts with the SPQ on this point. Due to their overt psychotic-like contents, the PAS and MIS may be more vulnerable to a defensive response set of the relatives as compared to the SPQ.

Further evidence for the hypothesis that Positive Schizotypy, as assessed with the SPQ, reflects the genetic vulnerability to schizophrenia may come from studies investigating SPQ scores of various kinds of relatives. Gottesman (1991) presented the lifetime risks of developing schizophrenia for various kinds of relatives. He compiled these risks from many family studies and concluded, with respect to first-degree relatives, that the risk for parents is 6%, for siblings 9% and for children 13%.

The aim of the present study was to evaluate the SPQ as an indicator of the genetic vulnerability to schizophrenia. If the SPQ reflects this genetic vulnerability, then scores of various kinds of relatives should parallel the risk percentages as presented by Gottesman. SPQ scores should be highest for patients than for the children of patients, followed by the siblings and parents of schizophrenia patients, respectively.

2. Method

2.1. Subjects

The sample of our study consisted of 168 subjects (see Table 2). Fifty-one patients with first-episode schizophrenia or schizophreniform disorder, accord-
ing to DSM-IV, participated in the study. Diagnoses were based on the Comprehensive Assessment of Symptoms and History (CASH; Andreasen et al., 1992). Subjects were physically healthy, had no history of neurological or medical illness (based on medical checklist and medical records) and had no premorbid IQ below 85 (based on the Dutch National Reading Test; Schmand et al., 1992).

All relatives were screened on psychotic symptoms. Subjects, whose family members with schizophrenia were admitted in Veldwijk Psychiatric Hospital, were interviewed using the BPRS-E (Overall, 1988). Those relatives who were recruited by advertisements were interviewed using the CASH. Psychosis and substance abuse were exclusion criteria.

Sixty-three parents of DSM-IV schizophrenia patients participated in the study. They were physically healthy (based on a medical checklist) parents of schizophrenia patients admitted in Veldwijk Psychiatric Hospital, or they were recruited by advertisements in newspapers and newsletters of the Dutch society for family members of schizophrenia patients. They (except one) had an IQ of at least 85 (based on the Dutch National Reading Test) and had no history of a psychotic illness. The children of the parents met the DSM-IV criteria for schizophrenia as determined by CASH or by medical records.

Forty-two healthy siblings participated in the study. They were recruited in the same way as the parents (see above). They also had an IQ of at least 85 (32 of them were tested with the Dutch National Reading Test and 10 had sufficient levels of education) and had no history of a psychotic illness.

Finally, 12 children of DSM-IV schizophrenia patients participated. They were healthy children of schizophrenia patients admitted in Veldwijk Psychiatric Hospital. Their IQ was at least 80 (based on the Dutch National Reading Test), and they had no history of a psychotic illness.

Written informed consent was obtained from all subjects after full explanation of the study aims and procedures.

2.2. Questionnaire

The SPQ (Raine, 1991) is a 74-item questionnaire with a dichotomous response format (yes/no). The SPQ is developed to measure the DSM-III-R criteria for the Schizotypal Personality Disorder. It can be used as a screening instrument in the general population for the identification of individuals with schizotypal traits and may serve as a measure of individual differences in schizotypal personality. Whether it may qualify as a valid indicator of the genetic vulnerability to schizophrenia or not is unclear. Recent factor analytical studies showed that the items can be reduced to three latent variables, viz. the positive, negative and disorganization dimensions of schizotypy (Raine et al., 1994; Vollema and Hoijtink, 2000). We followed Vollema and Hoijtink (2000) in the allocation of the items to the dimensions (see Table 1). This allocation differs from the original allocation of the items. Firstly, Vollema and Hoijtink suggested to weigh the items differently (0–2) since some items are stronger indicators for a specific dimension than others. Secondly, they divided the items concerning referential thinking. Some of these items exclusively load on Positive Schizotypy and refer to the aspects of delusional atmosphere. Most items load on Positive Schizotypy and Negative Schizotypy as well, and they reflect the psychotic-like and social-interpersonal determinants of referential thinking.

All subjects filled out the SPQ. In the statistical analyses, the scores on three dimensions of each subject were used.

2.3. Statistics

Statistical analyses are performed using SPSS 10.0 (Statistical Package for the Social Sciences (SPSS), 1994). Groups are compared for sex differences by the chi-square test. Differences in mean age are compared by analysis of variance (ANOVA). Firstly, differences on mean SPQ dimensional scores between the groups are compared by ANOVA. Secondly, if sex and age differ significantly between the groups and if significant differences appear between the groups on mean SPQ scores, then the two-factor ANCOVA will be used for each dependent variable separately. The two factors will be the groups of subjects (patients, parents, siblings and children) and sex (male and female). Age will be the covariate. When significant differences appear between the groups, we will examine the mean SPQ dimensional scores between the groups of first-degree relatives only (parents, siblings and children) using one-way ANOVA and Bonferroni
post-hoc analysis. When necessary, ANOVA will be used on the sub-scale level to compare the differences between the groups on individual traits (e.g. magical ideation). All statistical tests are considered significant at the \( p < 0.05 \) level.

### 2.4. Results

Table 2 shows that sex and age differed significantly between the groups. Regardless of these significant differences, subsequent two-factor ANCOVA showed that both sex and age did not affect the results. For sex, the significances in the two-factor ANCOVA were 0.399 for Positive, 0.710 for Disorganization and 0.797 for Negative Schizotypy. For age, these rates were 0.644, 0.817 and 0.183, respectively. Subject group effects were significant in the two-factor ANCOVA for Positive Schizotypy \( (F = 6.689; \text{df} = 3; p < 0.0001) \) and for Negative Schizotypy \( (F = 5.491; \text{df} = 3; p = 0.001) \) but not for Disorganization \( (p = 0.348) \). No significant interaction effects between group and sex were found.

In Table 3, the mean SPQ scores on the positive, negative and disorganization dimensions for each group are given. Schizophrenia patients scored significantly higher than all groups of relatives, viz. Positive Schizotypy \( (F = 25.187; p = 0.000) \), Negative Schizotypy \( (F = 13.383; p = 0.000) \) and Disorganization Schizotypy \( (F = 5.382; p = 0.001) \).

Because of these significant and large differences between patients and relatives, we analyzed the scores of the three groups of relatives separately. These results are given in Table 3. Significant differences appeared on Positive Schizotypy (siblings>parents, \( p = 0.033 \); children>parents, \( p = 0.003 \)) and on Negative Schizotypy (children>parents; \( p = 0.047 \)). Analyses on the sub-scale level revealed that almost all items with regard to Positive Schizotypy exerted influence on the differences. One-way ANOVAs (for relatives only) showed significant differences for, respectively, referential thinking \( (F = 6.122; p = 0.003) \), delusional atmosphere \( (F = 5.861; p = 0.004) \), magical ideation \( (F = 3.582; p = 0.031) \) and unusual perceptual experiences \( (F = 6.823; p = 0.002) \). Analysis on the sub-scale level for the negative dimension showed that referential thinking \( (F = 6.122; p = 0.003) \) and social anxiety \( (F = 6.199; p = 0.003) \) exerted the strongest influence on the difference between children and parents.

### 3. Discussion

We examined the validity of the SPQ as an indicator of the genetic vulnerability to schizophrenia. We hypothesized that the mean SPQ scores of different groups of relatives would parallel the risk of these groups for developing schizophrenia.

The main findings with respect to the three dimensions of the SPQ were as follows. Significant differences were found for Positive Schizotypy: (1) schizophrenia patients scored higher than all groups of relatives, (2) children of schizophrenia patients scored higher than parents, and (3) siblings of schizophrenia patients scored higher than parents. For Disorganization Schizotypy, significant differences were found between patients and (all groups of) relatives only. Significant differences were found for Negative Schizotypy: (1) schizophrenia patients scored higher than all groups of relatives, and (2) children scored higher than parents. The results could not be explained by the differences in age, sex, IQ or substance abuse.

The results with respect to the positive dimension reflect the risk percentages of relatives for developing schizophrenia. A higher genetic risk for developing schizophrenia tends to run in parallel with a higher score on the positive dimension of the SPQ. These results support the hypothesis that the biological—
genetic vulnerability to schizophrenia manifests itself on the positive dimension of the SPQ. Previous work by Kremen et al. (1998) and Yaralian et al. (2000) also showed elevated rates of Positive Schizotypy on the SPQ in relatives as compared to controls. However, these authors did not make a distinction between the various kinds of relatives. The PAS and MIS, alternative scales for Positive Schizotypy, were not elevated in the first-degree relatives as compared to the normal controls (e.g. Clementz et al., 1991). Therefore, the finding that Positive Schizotypy is elevated in relatives seems to be restricted to the SPQ. The fact that the PAS includes more overt psychotic-like items, as compared to the milder items of the SPQ, may lead to a defensive response style of the relatives and eventually to discrepancies between the studies.

Although we did find a difference between patients and relatives for Disorganization, no difference was found between the groups of relatives. These findings are in line with work by Kremen et al. (1998) and Yaralian et al. (2000). They both found no differences on Disorganization between relatives and controls. Therefore, the SPQ dimension of Disorganization probably does not reflect the biological–genetic vulnerability to schizophrenia. The phenomena captured under the umbrella of Disorganization (mild formal thought disorder, eccentric and odd behavior) are frequently found in relatives when assessed with observational and interview measures. For that reason, Kremen et al. (1998) raised the question whether Disorganization phenomena would be more amenable to interviews. Regardless of these negative findings concerning its validity, factor analytical studies consistently show that Disorganization, as assessed with the SPQ, is a separate factor of schizotypy (Raine et al., 1994; Vollema and Hoijtink, 2000).

With respect to the negative dimension, patients scored higher than relatives and children scored higher than parents. These findings somehow support the hypothesis for Negative Schizotypy (as measured with the SPQ) being a vulnerability indicator. However, they seem to diverge from the findings of Kremen and Yaralian, who found no differences between relatives and normal controls on the negative dimension of the SPQ. Analysis on the sub-scale level revealed that the difference between children and parents in our study is predominantly caused by the elevated scores on referential thinking and social anxiety. As shown in Table 1, referential thinking in our study is a component of the negative and the positive dimensions as well. In the original SPQ used by Kremen and Yaralian, referential thinking is only part of the positive dimension. Therefore, differences in item allocation between our study and the studies mentioned above may explain the different findings on Negative Schizotypy between the studies. Some studies reported that social anhedonia discriminates between relatives and normal controls (Kendler et al., 1996; Clementz et al., 1991). Venables and Rector (2000) argued that social anhedonia and Negative Schizotypy (in the way it was assessed by the SPQ) are only moderately associated. Therefore, the discrepancy of the findings with respect to Negative Schizotypy (in general) may be partly explained by instrument variation. To a certain extent, the SPQ assesses social anhedonia with the subscale ‘no close friends,’ but as one of the five sub-components of the negative dimension. Therefore, it is no surprise that different findings occur between studies using the SPQ or the SAS.

The positive dimension of the SPQ seems to reflect the biological–genetic vulnerability to schizophrenia. What other reasons can be given for the striking similarity between an ascending risk for developing schizophrenia in parents, siblings and children, respectively, and their corresponding ascending scores on Positive Schizotypy? Our finding cannot be explained by the effects of age, sex, IQ or substance abuse. Venables (1996) found elevated scores on Positive Schizotypy using a different questionnaire for normal subjects whose mothers have been exposed to the influenza virus in the second trimester of pregnancy. It is very unlikely that maternal exposure to the influenza virus caused higher rates of Positive Schizotypy in our subjects because one expects that all groups of relatives have equal chances to be exposed to the virus. However, the influence of an unknown environmental factor cannot be completely ruled out.

Our study has several limitations. Firstly, the group of children of schizophrenia patients was small (n = 12). Since the current differences were in the expected direction, a larger sample of children might reveal significant differences between children and siblings. Secondly, Clementz et al. (1991) argued that relatives of schizophrenia patients might be defensive in admitting psychotic-like symptoms on questionnaires. It is unlikely that this was the case in the
current study. One would expect the strongest influence of a defensive response set on the positive dimension, but it is precisely on this dimension that the groups of relatives differed and that differences were in accordance with levels of genetic risk.

Thirdly, the three groups of relatives in our study (parents, siblings and children) were biologically unrelated and they were also unrelated to the schizophrenia patients. This might have influenced the results. We selected biologically unrelated relatives because Gottesman’s risk percentages were based on cross-sectional samples of biologically unrelated relatives. Since the data from both studies compare very well (with respect to the positive dimension), the negative influence of our selection seems to be minor. Future research should include the biologically related groups of patients and relatives.

Fourthly, we cannot rule out completely the possibility that selection bias contributed to the lower scores of the parents. Since parents were able to marry and have children, they might constitute the healthiest group even though most of the siblings in our study were married, too. Finally, instrument and sample variation (e.g. first-episode versus chronic schizophrenia patients) might explain the divergent findings across the studies. We used a mixed schizophrenia sample (acute and chronic patients) without analyzing further variables like, for example, symptomatology and duration of illness.

Future studies, which are directed to the link between the genetic vulnerability and schizotypy, should search and control for the effects of instrument variation. Based on the current findings, we recommend the use of the positive dimension of the SPQ in studies on the genotype of schizophrenia. Furthermore, the characteristics of the sample of schizophrenia patients, whose relatives were recruited, should be described in detail.

In sum, the positive dimension of the SPQ discriminates between the various kinds of relatives of patients with schizophrenia. The higher the risk of schizophrenia for a group of relatives, the higher are the mean scores on the positive dimension of the SPQ. The results could not be explained by the differences in age, sex, IQ or substance abuse. The current study offers support to the hypothesis that the positive dimension of the SPQ reflects the genetic vulnerability to schizophrenia.

4. Uncited references

American Psychiatric Association, 1994

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