Neuropsychological Functioning as a Moderator of the Relationship Between Psychosocial Functioning and the Subjective Experience of Self and Life in Schizophrenia

by John S. Brekke, Brandon Kohrt, and Michael F. Green

Abstract

Psychosocial interventions and models of quality of life in schizophrenia are based on the notion that increases in psychosocial functioning will be related to improvements in subjective experience outcomes such as self-esteem and satisfaction with life. However, studies have repeatedly failed to demonstrate a direct relationship between psychosocial functioning and subjective experience in schizophrenia. This study of 40 individuals diagnosed with schizophrenia examined whether neurocognitive measures of executive functioning moderated the relationship between psychosocial functioning and subjective experience. Subjective experience was represented by measures of satisfaction with life and self-esteem. The Global Assessment Scale measured psychosocial functioning, and the Wisconsin Card Sorting Test measured executive functioning. Multiple regression and correlation analyses indicated that executive functioning was a strong moderator. Specifically, individuals with schizophrenia with impaired executive functioning displayed a positive and statistically significant association between psychosocial functioning and both measures of subjective experience (r = 0.55 and 0.61). However, among schizophrenia patients with intact executive performance, psychosocial functioning was negatively associated with self-esteem and satisfaction with life (r = -0.24 and -0.46). And the findings were internally replicated using two other neuropsychological measures relevant to executive functioning. These findings indicate that executive functioning plays a major role in moderating the relationship between subjective experience and psychosocial functioning in schizophrenia. Implications for biosocial models, psychosocial interventions, and models of quality of life in schizophrenia are discussed.

Keywords: Schizophrenia, neuropsychological, psychosocial, subjective experience.


In literature on schizophrenia, more attention is being focused on subjective outcomes such as self-esteem and satisfaction with life (Strass and Estoff 1988; Attkisson et al. 1992; Brekke et al. 1993; Carling 1995; Bradshaw and Brekke 1999; Brekke and Long 2000). These variables have been called subjective experiences in schizophrenia (Brekke et al. 1993; Brekke and Long 2000), and are also referred to as humanitarian outcomes (Attkisson et al. 1992; Rosenblatt and Attkisson 1992). Although the number of studies on subjective experience in schizophrenia is still small, a set of findings across these studies has been perplexing. It appears that among individuals with schizophrenia there is a negligible relationship between their levels of psychosocial functioning and their self-esteem or satisfaction with life (Brekke et al. 1993; Arn and Linney 1996; Koivumaa-Honkanen et al. 1996; Awad et al. 1997; Kemmler et al. 1997; Mueser et al. 1997; Dickerson et al. 1998; Brekke and Long 2000). In other words, higher levels of functioning in work, social, or independent living domains are not generally accompanied by greater satisfaction with life or self-esteem for individuals with schizophrenia. Two recent outcome studies on community-based psychosocial intervention for individuals with severe and persistent mental illness found that there were increases in self-esteem during the intervention, but these gains were not clearly related to functional improvement, and they were not maintained over time (Mueser et al. 1997; Brekke and Long 2000).

These are challenging findings for our models of psychosocial intervention and quality of life in schizophrenia, because these models are generally based on the notion that psychosocial outcomes and subjective outcomes will be more closely linked (Stroul 1986; Carling 1995). The absence of an association between these variables could suggest that the relationship between them is nonexistent, or that it is moderated by another construct (Baron and...
Kenny 1986). In this article, we examine whether neurocognitive measures related to executive functioning moderated the relationship between psychosocial functioning and subjective experience in schizophrenia. Specifically, we investigate whether the level of executive functioning altered the relationship between psychosocial functioning and subjective experience variables of self-esteem and satisfaction with life.

Background

Schizophrenia is characterized by a loss of psychosocial functioning in major life domains such as work, social relationships, and independent living (American Psychiatric Association 1994). Although long-term studies on the course of the disorder find notable heterogeneity in functional outcomes across individuals (for reviews, see Harding 1988; McGlashan 1988; Moller and Von Zersen 1995; Harrow et al. 1997), studies on psychosocial interventions have found that some functional outcomes, particularly in work and social domains, are hard to achieve and maintain (Scott and Dixon 1995; Mueser et al. 1998). Neurocognitive variables have been associated with both the heterogeneity of psychosocial outcome (Green 1996; Brekke et al. 1997; Green and Nuechterlein 1999; Green et al. 2000) and with the difficulty in obtaining rehabilitative improvements (Hogarty 1988; Green 1996; Spaulding et al. 1999; Green et al. 2000).

Concerning neurocognitive variables, individuals with schizophrenia have consistently shown deficits in executive functioning when compared with non–mentally ill samples (Goldberg et al. 1987; Gold and Harvey 1994; Abbruzzese et al. 1996; Morice and Delahunty 1996; Heslegrave et al. 1997), specifically processes that are presumed to be mediated by the dorsolateral prefrontal cortex (Haut et al. 1997; Pantelis et al. 1997). These executive functions encompass processes such as awareness of the environmental and situational context, comparison of stimuli, monitoring a sequence of selections, abstraction, goal selection, generating and implementing plans, set shifting, and response to feedback (Stuss and Benson 1986; Petrides 1994; Goldberg and Gold 1995; Lezak 1995; Morice and Delahunty 1996; Owen et al. 1996; Pantelis et al. 1997). Although as a group, individuals with schizophrenia perform poorly on neuropsychological tests of executive functioning, there is considerable heterogeneity among individuals (Orzack and Kornetsky 1966). Green (1993) estimates that only half of any subpopulation can be classified with a deficit on a specific measure. This heterogeneity in both psychosocial performance and in executive functioning provides the variation necessary for testing the presence of a moderator.

A study by Li et al. (1998) on a nonclinical community sample is relevant to the notion that executive functioning could moderate the relationship between psychosocial functioning and subjective experience in schizophrenia. First, Li et al. (1998) found that satisfaction with life was based on both objective functioning levels and subjective comparisons made against a reference standard. Second, although these investigators identified a normal distribution of satisfaction with life in their sample, they also found that objective status in health, social functioning, and living conditions corresponded with life satisfaction in the middle of the curve; however, individuals at either extreme of the distribution in objective life status had a negligible relationship between life status and subjective satisfaction. Because of impairments in psychosocial functioning, individuals with schizophrenia, as a group, would fall into the lower extreme and thus would not be expected to display an association between objective life status and the subjective experience of self and life. The absence of a relationship between these variables at either end of the distribution could be due to a moderating variable. In this regard, Li et al. (1998) implicated a subjective self-referencing or self-monitoring process in establishing a relationship between objective functional status and subjective experience. This process suggests that the subjective experience of self and life is based on assessing one's status and performance relative to a set of external referents and contexts.

In this article, we test the generic hypothesis that executive functioning moderates the relationship between psychosocial functioning and subjective experience in schizophrenia. We propose that the executive functions described previously—such as context awareness, comparison of stimuli, set shifting, monitoring sequences, and abstraction—are relevant to the self-referencing and self-monitoring implicated by Li et al. (1998) in examining the relationship between life status and subjective life satisfaction. Specifically, we predict that the presence or absence of deficits in executive functioning will influence the relationship between psychosocial functioning and the subjective experience variables of self-esteem and satisfaction with life for individuals diagnosed with schizophrenia.

Methods

A cross-sectional design was used to determine whether neuropsychological measures of executive functioning moderated the relationship between psychosocial functioning and subjective experience in schizophrenia. Psychosocial and subjective experience data were gathered on the same day or generally within 2 weeks of the neuropsychological testing date as part of an existing protocol. The psychosocial ratings were made by a trained
Subjects. Forty subjects were selected for neuropsychological testing from a total sample of 172 individuals diagnosed with schizophrenia or schizoaffective disorder. All of the subjects were living in community-based care and were participating in an ongoing longitudinal study (Brekke et al. 1997). Monitoring of subject characteristics during sample recruitment yielded 40 subjects who did not differ from the larger sample on psychosocial functioning or demographic characteristics ($p > 0.05$ on all variables). The sample was made up of 15 women and 25 men. The ethnic composition of the sample was 19 whites, 9 African-Americans, 7 Latinos, and 5 Asian or other. The mean age was 33.2 years ($SD = 7.4$ years); the mean years of education was 12.5 ($SD = 2.9$ years). The mean age of the first psychiatric admission was 21.4 years ($SD = 5.6$ years), and the average lifetime cumulative months of hospitalization was 10.5 months ($SD = 16.3$ months, range 0 to 73.2 months). After an initial clinical screening for schizophrenia, study diagnoses came from the Schedule for Affective Disorders and Schizophrenia (Endicott and Spitzer 1978) administered by a licensed Ph.D.-level clinician trained in the use of the instrument. Diagnoses were made using interview data and clinic records. Twenty-three subjects were diagnosed with schizophrenia, and 17 were diagnosed with schizoaffective disorder. All but four subjects were on maintenance doses of neuroleptic medication. The average dosage of neuroleptic medication (in chlorpromazine equivalents) was 400 mg.

Other neuropsychological measures. To provide potential internal replication of findings from the WCST, we used two other neuropsychological measures relevant to executive functioning: the Stroop Task and the Trail Making Task-B. Stroop (1935) developed a task to measure the executive processes of attention and interference. It consists of three stimuli categories: congruent, in which words are printed in the color they name (e.g., red in red ink); incongruent, in which words are printed in colors other than the corresponding tone (e.g., blue in red ink); and neutral, in which noncolor words are printed in color ink (e.g., monkey in red ink). This executive task requires focusing attention while inhibiting interference stimuli (Shiffrin and Scheneider 1984; Posner and Peterson 1990). It is considered a test of concentration effectiveness and selective processing. In the Trails B task, letters and numbers scattered throughout a page are traced in alternating sequence 1-A-2-B-3-C-4. This test was administered according to the standard procedure established by Reitan (1986). The Trails task assesses executive functioning including sequencing, mental flexibility, dual conceptual tracking, and sustained attention (Stuss and Benson 1986). Both neuropsychiatric assessment and neuroimaging studies have revealed a correlation between the WCST and Trails B scores (Spaulding et al. 1989; Lyons et al. 1991; DeVegvara et al. 1993; Siever et al. 1993).

Psychosocial functioning and subjective experience measures. The indicator of psychosocial functioning was the Global Assessment Scale (GAS; Endicott et al. 1976), which was selected as one outcome scale of choice for this population by Green and Gracely (1987). The GAS is a measure of psychosocial adjustment that yields a single score ranging from 0 to 100. The GAS ratings were derived from a face-to-face interview instrument, the Community Adjustment Form (CAF; Test et al. 1991), according to procedures outlined in Brekke (1992). The CAF gathers behavioral event data in 17 domains of community adjustment such as living situation, vocational
and social functioning, activities of daily living, family involvement, and medication usage. Interrater reliability on the CAF and the GAS using the intraclass correlation (ICC) was established during intensive rater training and during booster rating assessments throughout the study period (see Brekke et al. 1993). The ICC for the GAS ratings was 0.88.

The two indicators of subjective experience were self-esteem and satisfaction with life. Self-esteem was measured using the Index of Self-esteem (ISE; Hudson 1982). The ISE is a 25-item self-report measure that taps the subjective evaluation of self. Cronbach's α in this study was 0.87. Satisfaction with life was measured with the Satisfaction with Life Scale (SWL; Stein and Test 1980). The SWL is a 21-item self-report measure that targets subjective satisfaction with one's living situation, work, social contacts, and psychological state. The alpha in this study was 0.89.

Several other variables used to describe the sample in this study were gathered from other data sources. These variables were symptom levels, medication usage, and demographic characteristics. These data came from various instruments including the Brief Psychiatric Rating Scale (Lukoff et al. 1986), the Community Adjustment Form, and the Demographic Interview Form (Test et al. 1991). The reliability of these data is addressed in other sources (Brekke et al. 1993, 1997).

Statistical analyses. The following analyses were done to assess whether neuropsychological measures of executive functioning moderated the relationship between psychosocial functioning and subjective experience. First, the sample was divided into two groups based on their WCST perseverative error scores using a clinical cutoff score from Heaton (1981). This yielded what we called a high executive group and a low executive group. The advantage of the Heaton cutoff score was that it is based on an empirical criterion relevant to the WCST. When using the Heaton cutoff, there are 24 subjects in the low executive group and 15 in the high executive group. To provide potential corroboration of these findings using a more conservative criterion, some of the analyses using the WCST were replicated using a median split to divide the sample into high executive and low executive groups.

The second step in the analyses was to use the procedures advocated by Baron and Kenney (1986) to test for the presence of moderator effects. Using this method, a regression equation for the entire sample was constructed with two blocks of independent variables to predict subjective experience scores. The first block consisted of the independent variable and the moderator, which in this case was psychosocial functioning and executive functioning. The second block's variable was the interaction between psychosocial and executive functioning. The critical statistical result was whether the interaction term was significant in the multiple regression equation. If the interaction term is significant, it suggests the presence of a moderator effect in the total sample (Baron and Kenney 1986). In the third step of the analyses, the correlation between psychosocial functioning and the subjective experience variables was calculated separately for the high executive and low executive groups.

Results

Before examining the test of the moderator hypothesis, we compared the high executive and low executive groups on numerous variables to assess for sample characteristics that might confound any moderating effect (table 1). In terms of age, sex, race, diagnosis (schizophrenia or schizoaffective), years of education, age of first psychiatric admission, medication dosage (in chlorpromazine equivalents), overall symptom levels (BPRS scores), positive symptoms, negative symptoms, and disorganized symptoms, there were no statistically significant differences between the high executive and low executive groups when using the Heaton cutoff score or when split at the median (p > 0.10 in all cases).

Table 1 presents the scores of the high and low executive groups on the critical study variables. Both the high executive and low executive groups had equally low GAS scores, with the mean value for both groups in the range that indicates major impairment in several psychosocial areas. There were no statistically significant differences between the groups on self-esteem or satisfaction with life. In addition, table 1 shows that there was no statistically significant correlation between WCST scores and the psychosocial functioning or subjective experience variables in the full sample. This provides an optimal condition for interpreting the presence of a moderator effect (Baron and Kenney 1986). It should also be noted that in the entire sample the correlations between GAS and both SWL and ISE scores were not statistically significant (see table 2). This is similar to other studies cited previously and reflects the central issue addressed by this study.

Multiple regression analysis was used to provide the first test of the moderator hypothesis. The interaction terms in the regression equations predicting both satisfaction with life and self-esteem were significant. The beta for the interaction term in the self-esteem equation was $-2.1 \ (t = -2.5, p < 0.02, df = 3,33; \text{partial } r = -0.42)$. The beta for the interaction term in the satisfaction with life equation was $-2.7 \ (t = -3.1, p < 0.005, df = 3,33; \text{partial } r = -0.49)$. These results indicate the presence of a moderator effect in the entire sample.
Table 1. Comparison of High and Low Executive Functioning Groups

<table>
<thead>
<tr>
<th>Client characteristics</th>
<th>High Executive (n = 15)</th>
<th>Low Executive (n = 24)</th>
<th>Test statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>33.7 (7.5)</td>
<td>32.5 (66.8)</td>
<td>t = -0.510, df = 1,37</td>
</tr>
<tr>
<td>Gender, male/female</td>
<td>11/4</td>
<td>13/4</td>
<td>x² = 1.43, df = 1</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td>x² = 1.65, df = 3</td>
</tr>
<tr>
<td>Caucasian</td>
<td>9</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Latino</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Years of education, mean (SD)</td>
<td>13.1 (1.8)</td>
<td>12.1 (.3)</td>
<td>t = -1.03, df = 1,37</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
<td>x² = 0.60, df = 1</td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>10</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Schizoaffective</td>
<td>5</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Age at first hospital admission, mean (SD)</td>
<td>21.6 (5.7)</td>
<td>22.3 (5.8)</td>
<td>t = -0.103, df = 1,36</td>
</tr>
<tr>
<td>Neuroleptic daily dose (CPZ equivalents), mean (SD)</td>
<td>390 (307)</td>
<td>399 (369)</td>
<td>t = 0.078, df = 1,37</td>
</tr>
<tr>
<td>Antiparkinsonian medications</td>
<td></td>
<td></td>
<td>x² = 0.008, df = 2</td>
</tr>
<tr>
<td>Yes</td>
<td>10</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Functional Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BPRS,¹ mean (SD)</td>
<td>45 (12.5)</td>
<td>47 (14.8)</td>
<td>t = 0.416, df = 1,37</td>
</tr>
<tr>
<td>Disorganized symptoms,¹ mean (SD)</td>
<td>11.8 (3.6)</td>
<td>13.5 (5.1)</td>
<td>t = 1.11, df = 1,37</td>
</tr>
<tr>
<td>Positive symptoms,¹ mean (SD)</td>
<td>7.2 (3.6)</td>
<td>6.8 (3.0)</td>
<td>t = -0.345, df = 1,37</td>
</tr>
<tr>
<td>Negative symptoms,¹ mean (SD)</td>
<td>4.7 (1.2)</td>
<td>4.5 (1.2)</td>
<td>t = -0.510, df = 1,37</td>
</tr>
<tr>
<td>Global Assessment Scale,² mean (SD)</td>
<td>38 (8.4)</td>
<td>37 (10.7)</td>
<td>t = -0.442, df = 1,37</td>
</tr>
<tr>
<td>Index of Self-Esteem,³ mean (SD)</td>
<td>78 (20.0)</td>
<td>90 (18.5)</td>
<td>t = 1.81, df = 1,35</td>
</tr>
<tr>
<td>Satisfaction with Life,⁴ mean (SD)</td>
<td>40 (16.3)</td>
<td>43 (15.4)</td>
<td>t = 0.620, df = 1,35</td>
</tr>
</tbody>
</table>

Note.—BPRS = Brief Psychiatric Rating Scale; CPZ = chlorpromazine.
¹Lukoff et al. 1986.
²Endicott and Spitzer 1976.
³Hudson 1982.
⁴Stein and Test 1980.

Table 2 presents the correlations between psychosocial functioning and subjective experience in the high and low executive groups. In the low executive group the correlation between psychosocial functioning and both subjective experience variables was positive and statistically significant. According to Cohen (1988), the effect sizes of the correlations in the low executive groups can be characterized as large (i.e., r > 0.5). In contrast to this, in the high executive group the correlations between psychosocial functioning and both subjective experience variables were negative and not statistically significant. The correlations when splitting the groups based on the median perseverative errors score were very similar to those when using the Heaton cutoff score. Specifically, both correlations in the low executive group were above 0.5 and statistically significant.
Table 2. Correlations Between Psychosocial Functioning and Subjective Experience

<table>
<thead>
<tr>
<th>Complete Sample (n = 40)</th>
<th>GAS</th>
<th>ISE</th>
<th>SWL</th>
<th>WCST</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISE</td>
<td>0.24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SWL</td>
<td>0.10</td>
<td>0.54**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WCST</td>
<td>-0.17</td>
<td>0.32</td>
<td>0.16</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High Executive (Heaton cutoff; n = 15)</th>
<th>GAS</th>
<th>ISE</th>
<th>SWL</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISE</td>
<td>-0.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SWL</td>
<td>-0.46</td>
<td>0.55</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low Executive (Heaton cutoff; n = 24)</th>
<th>GAS</th>
<th>ISE</th>
<th>SWL</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISE</td>
<td>0.61**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SWL</td>
<td>0.55*</td>
<td>0.57**</td>
<td></td>
</tr>
</tbody>
</table>

Note.— GAS = Global Assessment Scale; ISE = Index of Self-Esteem; SWL = Satisfaction with Life Scale; WCST = Wisconsin Card Sorting Test.

1Significant using Bonferroni-corrected value of 0.025.

The correlations in the high executive group were negative or near zero.

As stated earlier, to provide an internal replication we also examined the correlations between psychosocial functioning and the two subjective experience variables in the high and low executive groups when using the median of the Stroop scores and the Trails (B-A) scores to define the groups. Using the Trails scores, the correlations between psychosocial functioning and the subjective experience variables in the low executive group were 0.46 for self-esteem ($p < 0.07$, 1-tailed) and 0.51 for satisfaction with life ($p < 0.05$, 1-tailed). In the high executive group the correlations were -0.08, and 0.07 respectively. For the Stroop, the correlations in the low executive group were 0.62 for self-esteem ($p < 0.001$, 1-tailed), and 0.34 for satisfaction with life ($p < 0.10$, 1-tailed). In the high executive group the correlations were 0.11 and -0.36.

In summary, these findings indicated that executive functioning as measured by the WCST strongly moderated the relationship between psychosocial functioning and subjective experience in schizophrenia. For subjects with low executive functioning, there was a large and positive relationship between psychosocial functioning and two indicators of subjective experience. As psychosocial functioning improved in this group, the individuals experienced higher levels of self-esteem and satisfaction with life. By contrast, in the high executive functioning group the relationships between psychosocial functioning and subjective experience were not only statistically nonsignificant, but they were in the opposite direction to that in the low cognitive group. We also found no indication that client demographic and clinical characteristics were confounding this moderating effect. These findings were also replicated when using two other neuropsychological measures relevant to executive functioning.

Other Issues. Before discussing these results, there are several other issues that deserve attention. First, the measures of executive functioning that were used are generally thought to reflect frontal/executive functions, although the specific abilities that they assess are fairly diverse. The Pearson correlations between the measures...
are all in the expected directions: \( r = 0.44 \) (Stroop-Trails), 0.32 (WCST-Trails), and 0.02 (WCST-Stroop). These correlations reflect the diversity of the executive measures, yet the consistency of the moderation effect across the measures suggests the robustness of the moderation.

Second, given the distribution of gender and diagnosis in the high and low executive groups, we did several additional analyses using these variables. We found no relationship in this sample between gender or diagnosis (schizophrenia or schizoaffective disorder) and satisfaction with life, self-esteem, or GAS scores. In addition, neither gender nor diagnosis was a significant moderator of the relationship between psychosocial functioning and subjective experience. Third, GAS scores have been shown to reflect both symptom and functional status (Brekke 1992). Therefore, it is possible that symptom levels could contaminate the GAS as a measure of functional status. To address this concern, we used BPRS scores as a covariate in a re-analysis of the moderator effect using multiple regression analysis. There was only a very slight attenuation in the statistical significance of the interaction term. On this basis, we are confident in concluding that clinical status as measured by the BPRS did not confound our findings on the moderator.

Fourth, two other correlations from table 2 need comment. First, there is a trend for the statistical significance of the correlation between the WCST (perseverative errors) and self-esteem (\( r = 0.32 \)). This suggests that as executive functioning declines across subjects, self-esteem levels increase. This is not contrary to our proposed model; in fact, it lends support to the notion that poorer executive functioning can be facilitative of self-esteem for individuals with schizophrenia. It is also not surprising given that the relationship between psychosocial functioning and self-esteem is strong and positive in the low executive group. Second, the correlation between WCST and psychosocial functioning is not statistically significant (\( r = -0.17 \)), although it is in the expected direction. In a recent review, Green et al. (2000) found that in about one-half of the studies the WSCT was significantly correlated with functional outcomes. Therefore, our study is not an outlier in this regard. On the other hand, the GAS was correlated 0.34 with Trails and 0.31 with the Stroop.

Discussion

This study found that performance on a measure of executive functioning strongly moderated the relationship between psychosocial functioning and the subjective experience of self and life for individuals with schizophrenia. This provides a possible explanation for a consistent finding in previous studies. In several studies, including this one, there has been a negligible association between levels of psychosocial functioning and either satisfaction with life or self-esteem for individuals with schizophrenia (Brekke et al. 1993; Arn and Linney 1996; Koivumaa–Honkanen et al. 1996; Awad et al. 1997; Kemmler et al. 1997; Mueser et al. 1997; Dickerson et al. 1998; Brekke and Long 2000). In this study, however, after splitting the sample according to executive performance, a notable pattern emerged. Individuals with schizophrenia and impaired executive abilities displayed a large, positive, and statistically significant association between psychosocial functioning and two measures of subjective experience: satisfaction with life and self-esteem. In contrast, the correlation between subjective experience and psychosocial functioning among schizophrenia patients with intact executive functioning was negative, although not statistically significant.

The presence of a moderator is supported by several lines of evidence. First, several groups, including healthy individuals (Li et al. 1998), the severely mentally ill (Koivumaa–Honkanen et al. 1996), and patients with brain damage (Hutter and Gilsbach 1995), do not always exhibit a direct relationship between subjective experience and objective life measures. As stated earlier, Li et al. (1998) identified a normal distribution of satisfaction with life in a community sample. Objective status in psychological health, social function status, and living conditions corresponded with life satisfaction in the middle of the curve, but individuals at either extreme of the distribution of objective life status displayed marked deviance between objective and subjective status. Because of impairments in psychosocial functioning, individuals with schizophrenia would fall into the lower extreme and thus would not be expected to display an association between objective and subjective status. Importantly, Li et al. (1998) also found that individuals with the lowest objective life status showed the strongest effects of comparative referencing on their life satisfaction.

The mechanism by which this moderation occurs has yet to be specified. We would speculate that central executive functions such as the awareness of environmental contexts, self-analysis, and the comparison of complex stimuli (Benson and Stuss 1990; Petrides 1994; Lezak 1995) are good candidates because they are employed to establish standards of reference—a significant contributor to the subjective evaluation of experience (Li et al. 1998). More specifically, we would propose that individuals with schizophrenia who have intact executive functioning establish their subjective experience according to a reference standard rather than to a direct evaluation of objective performance. This will be particularly problematic for individuals who have intact executive functioning, but who have low levels of current psychosocial functioning.
This is exactly the pattern found in the present data. Both the high executive and low executive groups had equally low levels of psychosocial functioning, which reflected major functional impairment. Therefore, in the high executive group, increasing levels of psychosocial functioning across subjects were not associated with higher levels of subjective experience because the range in psychosocial functioning was still very low compared to a variety of potential reference groups. In essence, the executive functioning of this group provides the capacity for the complex self-referencing that suppresses the relationship between improvements in psychosocial functioning and higher levels of self-esteem or satisfaction with life, especially when functional levels are very low. This dynamic is even more likely as these individuals are integrated into the wider community to greater and greater degrees, which is the goal of most contemporary psychosocial interventions and community care models.

On the other hand, individuals with schizophrenia and impaired executive functioning, lacking the capacity for complex self-referential judgments, can more directly translate improvements in their objective psychosocial status into enhanced subjective experience unhindered by external or premorbid self-referencing. Therefore, even though their levels of psychosocial functioning are low, increases in functional levels across individuals will be associated with higher scores in subjective experience indicators such as self-esteem and satisfaction with life. These findings have implications for emerging biosocial models, for our understanding of quality of life in schizophrenia, and for psychosocial interventions in this field.

There are emerging biosocial models in schizophrenia that address the etiology of the disorder (Olin and Mednick 1996), as well as its clinical course (Nuechterlein et al. 1992). There are also attempts to link biologically related variables with psychosocial outcomes for individuals with schizophrenia (Hogarty 1988; Spaulding 1994; Brekke et al. 1997; Green et al. 1999). The findings presented here suggest that the relationships between these biological and social variables might be intervening as well as direct. This expands the complexity of the biosocial models that can be proposed or that might be needed to explain a range of phenomena in schizophrenia.

These findings also have relevance for quality of life and humanitarian outcomes in schizophrenia. Although there is no single accepted model of quality of life in schizophrenia, most attempts to conceptualize or measure the total life experience of individuals with schizophrenia propose some constellation of objective functional indicators with the individual's subjective experience of their lives (Rosenblatt and Attkisson 1992; Lehman 1996). Previous studies have found that certain neurocognitive and psychophysiological variables are directly related to psychosocial functioning (Green et al. 2000). Therefore, quality of life cannot be understood without considering the direct effect of psychobiological variables. The current findings suggest two other considerations. First, we might need different models of quality of life in schizophrenia based on executive capacity. Those with intact executive functioning might have greater capacity for improvements in psychosocial functioning, but they will have a more complex pathway to achieving subjective life quality. Schizophrenia patients with executive deficits, on the other hand, will more readily translate small gains in psychosocial functioning into improvements in their subjective experience of quality of life. Second, any model of quality of life in schizophrenia must consider executive capacity as a moderator of the relationships between functional and humanitarian outcomes. Such a model would contain direct effects between psychobiological variables and psychosocial functioning, with cognitive variables then moderating the relationship between psychosocial functioning and subjective experience. This yields a fully biopsychosocial model of quality of life in schizophrenia.

These findings also have implications for psychosocial interventions in schizophrenia. First, if interventions are concerned with humanitarian outcomes such as self-esteem or satisfaction with life, these findings are relevant to assessment and treatment planning. Individuals with schizophrenia and intact executive functioning in rehabilitation will have a far greater challenge in establishing and maintaining their self-esteem and satisfaction with life when compared with those who have executive deficits. Practitioners and consumers must be prepared for this challenge as they establish and begin to meet rehabilitative goals. Incorporating realistic goal setting and accurate self-appraisals for the patient with schizophrenia and intact executive functioning could be critical to helping the patient experience humanitarian outcomes from rehabilitation. As an example, a therapeutic environment that does not address executive functioning and subjective experience could contribute to the deterioration of subjective experience among frontally intact schizophrenia patients, which could then lead to treatment attrition or other forms of treatment noncompliance. A specific problem is the standard of reference. For example, if neuropsychological capacities are related to a schizophrenia patient's ability to function in an independent living or occupational environment (Green 1996; Brekke et al. 1997), then those individuals with the best ability to refer to their behavior will have increased exposure and interaction with the non-mentally ill. As the community of reference expands from those who are severely mentally ill to the general population, this increases the potential for obvious disparities between the schizophrenia patient and his or her comparative peers. A widening gap in functioning between the individual and the reference group will incur a detriment in self-esteem and could have
an impact on other humanitarian outcomes. Such an effect would certainly alter an individual's motivation for continuing rehabilitation. Clearly, without accounting for executive functioning, psychosocial interventions cannot be optimally designed for individuals with schizophrenia.

Another potentially critical issue in psychosocial intervention concerns treatment improvement and subjective experience. Green (1996) and Green et al. (2000) have found that better neurocognitive functioning among individuals with schizophrenia is related to functional improvement in some rehabilitative settings. Therefore, individuals with the greatest capacity for functional improvements might also have the greatest difficulty in realizing a relationship between their psychosocial performance and their self-esteem or satisfaction with life. This could be frustrating for both practitioners and clients, and could affect practitioner investment in client change and client investment in the intervention. Preparing for this phenomenon as part of the intervention could prevent a range of treatment casualties.

There are several caveats about this study that must be considered. First, although the role of executive functioning in moderating the dynamic between subjective experience and psychosocial functioning is strongly supported by these results, the specific process that accounts for this relationship has not been identified. A number of candidates have been suggested, but further research is necessary to determine the mechanism of action. Second, this study used a cross-sectional design. Longitudinal designs would allow for a more rigorous causal assessment of whether executive deficits influence the relationship between individual changes in psychosocial functioning and changes in subjective experience over time. Third, in addition to replicating these findings, future research should employ psychophysiological measures. Habituation to stimuli and electrodermal stress reactivity are potentially useful constructs to investigate (Brekke et al. 1997). Smooth-pursuit eye movement abnormalities and other eye tracking dysfunction can result from damage to the frontal lobe (Pantelis et al. 1997), and are therefore excellent candidates for moderator exploration. Employing a range of neuropsychological tests could also help to isolate the exact nature of the moderating mechanism. Fourth, the sample size in this study was relatively small. Replication on larger samples is necessary. Fifth, there are a variety of other factors, such as mood, that could influence the subjective experience of self and life. These factors need empirical and theoretical attention. Finally, there are other indicators of subjective experience such as self-concept, self-structure, and self-image. Investigating the relationship of these phenomena with neurocognitive variables could further our understanding about other important aspects of psychosocial experience in schizophrenia.

References


Brekke, J.; Raine, A.; and Thomson, C. Cognitive and psychophysiological correlates of positive, negative and


Kolb B., and Whishaw, I.Q. Performance of schizophrenic patients on tests sensitive to left or right frontal, temporal, or parietal function in neurological patients. Journal of Nervous and Mental Disease, 171(7):435–443, 1983.


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