Does Self-perceived Mood Predict More Variance in Cognitive Performance Than Clinician-Rated Symptoms in Schizophrenia?

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Symptoms are known to account for a small variance in some cognitive functions in schizophrenia, but the influence of self-perceived mood remains largely unknown. The authors examined the influence of subjective mood states, psychopathology, and depressive symptoms in cognitive performance in a single investigation in schizophrenia. A group of 40 stable medicated patients with schizophrenia (20 men, 20 women) and 30 healthy comparison subjects (15 men, 15 women) were assessed on neurocognitive measures of verbal abilities, attention, executive functioning, language, memory, motor functioning, and information processing. All subjects provided self-ratings of mood prior to cognitive testing. Patients were also rated on psychopathology and depressive symptoms. Patients performed worse than comparison subjects on most cognitive domains. Within the patient group, subjective feelings of depression-dejection, fatigue-inertia, confusion, and tension-anxiety predicted (controlling for symptoms) poor performance on measures of attention, executive function, and verbal memory. In the same group of patients, clinician-rated symptoms of psychopathology and depression predicted significantly poor performance only on tests of motor function. In comparison subjects, vigor related to better, and fatigue and inertia to worse, spatial motor performance. Self-perceived negative mood state may be a better predictor of cognitive deficits than clinician-rated symptoms in chronic schizophrenia patients.

Key words: profile of mood states/schizophrenia/ depression/cognitive/humans/psychopathology

Introduction

Schizophrenia is characterized by the presentation of positive (e.g., delusions, hallucinations, disorganized behavior) and negative (e.g., avolition, anhedonia, amotivation, and alogia) symptoms; the latter often remains refractory to treatment with conventional antipsychotics and shows a limited response to the newer atypical antipsychotics.1 Depressive symptoms commonly occur alongside the negative symptoms of schizophrenia2 and are associated with a high relapse rate and increased mortality.3 Recent studies have shown that a distinction between negative symptoms and depressive symptoms can be reliably made in patients with schizophrenia.4,5 There is some evidence to suggest that symptoms of depression in schizophrenia may be secondary to the influence of medication or neuroleptic induced movement disorders,6 whereas other evidence demonstrates that depressive symptoms may be a core component of the illness in both first-episode and chronic schizophrenia.7–11

Patients with chronic schizophrenia have been reported to exhibit widespread cognitive impairment,12–14 with prominent deficits in the domains of executive functioning, language, memory, sustained attention, motor functioning, and information processing. In contrast to the abundant literature reporting impaired neurocognitive functioning in schizophrenia, the relationship between psychopathology and cognition have produced equivocal findings.15,16 Severity of negative symptoms at the time of assessment has previously been associated with deficits in memory, verbal fluency, psychomotor speed, and executive functioning in patients with first-episode schizophrenia17 and with motor impairment,18 verbal fluency, and memory19 in patients with chronic schizophrenia. One study reported associations between positive symptoms and verbal memory,20 whereas others have reported no relationships between positive symptoms and neurocognitive performance.21–23 Given the overlap between depressive and negative symptomatology, few investigators have also examined the relationship between depressive symptoms and cognitive performance in schizophrenia. Some studies have found relationships between depressive symptoms and poor selective attention,24 verbal memory,25 attention,
and psychomotor slowing,\textsuperscript{26} whereas others have reported no relationships.\textsuperscript{27,28}

Altered subjective mood states (eg, feeling depressed and dejected, fatigue and inertia, anger and hostility) are known to affect neurocognitive performance in healthy\textsuperscript{28} as well as psychiatric populations, such as in patients with depression.\textsuperscript{29} It is possible that subjective mood states relate more strongly to cognitive performance than clinical measures of depressive and psychotic symptomatology. Certainly, a better overall picture of a patient’s mental state can be acquired when both subjective and objective assessments are taken into consideration. To our knowledge, no study has examined the relationship of subjective mood ratings and symptoms to neurocognitive functioning in schizophrenia.

The present study therefore was undertaken to assess the relative influence of self-rated mood and clinician-rated symptoms in neuropsychological performance in stable patients with chronic schizophrenia in the same investigation. Based on the extant literature we hypothesized that (1) patients would report greater feelings of negative mood states compared with the comparison group, (2) subjective mood states would be a better predictor of performance on cognitive tasks than clinical symptoms, and (3) patients as a group would perform worse than the groups of healthy subjects on all cognitive tasks.

**Materials and Methods**

**Subjects**

A group of 40 patients (20 men and 20 women) and 30 healthy comparison subjects (15 men and 15 women), aged between 18 and 61 years participated in the study. Patients were recruited from both inpatient and outpatient settings and received a diagnosis of DSM-IV schizophrenia, as assessed by the Structured Clinical Interview, Patient version.\textsuperscript{30} All patients who participated in the study were in a stable phase of the illness and were recruited from the community or long-stay/rehabilitation wards; none of the patients were considered acutely unwell. All patients were on stable doses of antipsychotics for 6 or more weeks. All participants were right handed as assessed by the Edinburgh Handedness Inventory.\textsuperscript{31} A qualified physician examined the current physical health of all participants. Subjects were not included in the study if they had any known endocrine abnormalities or neurological diseases or were using illicit drugs. Women were excluded if they were pregnant, lactating, or taking any synthetic steroids including the oral contraceptive pill (see Table 1 for demographic characteristics of patients and comparison subjects).

The study procedures were approved by the Institute of Psychiatry and Maudsley Hospital Ethical (Research) Committee. After comprehensive description of the study, written informed consent was obtained from all participants.

**Subjective Mood and Psychopathology Assessments**

Subjective mood states were assessed using the Profile of Mood States (POMS).\textsuperscript{32} The POMS is a measure of subjective feelings of mood and has reliably been used with a wide range of psychiatric disorders.\textsuperscript{33,34} The questionnaire consists of 72 mood-related adjectives, which form the basis of 6 mood states: tension-anxiety, fatigue-inertia, depressed-dejected, anger-hostility, vigor, and confusion. Subjects are instructed to rate these adjectives on a 5-point scale ranging from “not at all” (0) to “extremely” (4). The POMS was administered to all patients just after the clinical and prior to cognitive assessment. All patients were supervised by a doctoral-level researcher (Dr Halari) when they completed the POMS questionnaire. None of the patients reported difficulty in completing the self-report measure. The comparison group completed the POMS after being screened and prior to cognitive assessment.

Psychopathology in patients was assessed using the Positive and Negative Syndrome Scale (PANSS).\textsuperscript{35} The PANSS assessments were conducted by clinicians who were trained using a separate sample of 3 schizophrenia patients: they were required to achieve scoring of each symptom within one point and at least 80% agreement on the total score for the PANSS and on each of the 3

| Table 1. Demographic and Clinical Characteristics of Patients and Comparison Subjects |
|---------------------------------|-------------------------------|-------------------------------|
|                                 | Patients, Mean (SD)           | Comparison Subjects, Mean (SD) |
| Education                       | 11.73 (2.93)                  | 12.83 (2.06)                  |
| Age                             | 43.28 (10.34)                 | 39.93 (11.83)                 |
| Premorbid IQ                    | 100.03 (13.57)                | 114.73 (8.81)                 |
| Predicted full-scale IQ         | 81.05 (11.10)                 | 110.36 (14.10)                |
| Duration of illness             | 19.15 (10.12)                 |                               |
| Age at onset, y                 | 25.14 (9.01)                  |                               |
| Medication (chlorpromazine equivalent) | 218.62 (228.82)            |                               |
| Score on positive syndrome scale| 18.81 (6.96)                  |                               |
| Score on negative syndrome scale| 19.45 (6.52)                  |                               |
| Score on general psychopathology scale | 39.62 (11.47)             |                               |
| Total PANSS score               | 77.10 (23.10)                 |                               |
| Total score on the Calgary depression scale | 13.00 (2.33)              |                               |
| Total score on the Hamilton depression scale | 9.54 (5.76)                |                               |
subscales: positive, negative, and general psychopathology. Depressive symptoms were assessed using the Calgary and Hamilton depression scales.

Cognitive Assessments

A trained psychologist (Dr Halari) administered a comprehensive neuropsychological battery comprising measures of memory, executive function, attention, spatial motor ability, motor functioning, speed of information processing, and language ability (see table 2). All participants were tested between 10:00 AM and 12:00 PM, and the battery took an average of 1.5–2 hours to complete. Every participant received the same order of tests.

Statistical Analysis

Based on the method of analyzing a large battery of neuropsychological tests adopted by previous studies, a priori cognitive scales were constructed based on what each individual test measured. Internally consistent summary scales were constructed with coefficient alphas ranging from 0.6788 to −0.8087 (the negative values apply to tests that were scored in the opposite direction). The cognitive scales were created by converting raw scores into z scores, derived from the means and standard deviations from the healthy control group (n = 30). Nine scales (see table 2) were constructed to represent domains of cognitive performance: verbal abilities, verbal memory, motor functioning, spatial motor, spatial memory, executive functioning, attention, speed of information processing, and verbal working memory. Individual z scores were used to assess speed of information processing using the Speed and Capacity of Language Processing Test and verbal working memory (letter number). The use of summary scales enhances the reliability of measurement and reduces type I error by reducing the number of statistical tests needed. The National Adult Reading Test was administered to measure premorbid IQ, and the vocabulary subtest of the Weschler Adult Intelligence Scale-III (WAIS-III) was used to estimate current verbal IQ.

First, a series of one-way analyses of variance were conducted to examine any differences between the patients and comparison group in each of the 9 cognitive domains and 6 dimensions of mood. Four sets of multiple regression analyses (enter method; probability to enter set at \( P < .05 \)) were then conducted to examine the relative contribution of (1) subjective mood to cognitive performance in all patients and comparison subjects, (2) symptoms (Calgary and Hamilton depression scales; PANSS—positive, negative, general, and total scores) as predictors of cognitive performance in patients, (3) relationship of subjective mood to cognitive performance controlling for symptoms and of symptoms to cognitive performance controlling for subjective mood ratings in patients, and (4) relationship of subjective mood to symptomatology in patients. Prior to conducting the above described analysis procedures, the data were examined to ensure that all statistical assumptions required for these analyses were met in this data set.

Results

There were no significant differences in age \((F_{1.68} = 1.581; P = .213)\), IQ \((F_{1.68} = 3.183; P = .079)\), and years of education \((F_{1.68} = 3.112; P = .082)\) between patients and healthy controls.
**Group Differences in Mood and Cognitive Domains**

Overall, patients reported feeling more depressed-dejected, tense and anxious, angry, hostile, fatigued, lack of vigor, and more confused compared with the comparison group. Patients performed worse than the comparison group on tests of verbal abilities, verbal memory, motor functioning, spatial motor, spatial memory, executive functioning, attention, and verbal working memory domains. The 2 groups performed similarly on the speed of information-processing domain (see table 3).

**Mood and Symptoms in Patients**

Scores on the Calgary depression scale ($R^2 = 0.280$, adjusted $R^2 = 0.136$, $P < .05$) and the Hamilton depression scale ($R^2 = 0.218$, adjusted $R^2 = 0.120$, $P < .05$) were related to feeling depressed and dejected on the POMS. Scores on the Hamilton depression scale were also related to fatigue and inertia ($R^2 = 0.111$, adjusted $R^2 = 0.085$, $P < .05$).

**Subjective Mood and Cognitive Performance**

In the patient group, feeling depressed and dejected related to poor performance on measures of attention ($R^2 = 0.17$, adjusted $R^2 = 0.140$, $P < .05$), whereas feelings of depression and dejection ($\beta = -0.50$, $P < .05$), fatigue and inertia ($\beta = -0.57$, $P < .05$), and confusion ($\beta = -0.66$, $P < .05$, $R^2 = 0.366$, adjusted $R^2 = 0.239$) all related to poor performance on the executive functioning domain. Feelings of fatigue and inertia ($\beta = -0.50$, $R^2 = 0.281$, adjusted $R^2 = 0.111$, $P < .05$) also related to poor performance on the motor functioning domain. Feeling depressed and dejected ($\beta = -0.47$, $P < .05$), tense and anxious ($\beta = -0.73$, $P < .05$), fatigue and inertia ($\beta = -0.56$, $P < .05$), and confused ($\beta = -0.64$, $P < .05$) predicted poor verbal memory performance ($R^2 = 0.37$, adjusted $R^2 = 0.24$, $P < .05$). These relationships remained significant after controlling for symptoms.

Within the comparison group, feelings of vigor related to better ($\beta = 0.33$, $P < .05$) and fatigue and inertia related to poor ($\beta = -0.66$, $P < .05$) spatial motor performance ($R^2 = 0.36$, adjusted $R^2 = 0.19$).

**Symptomatology and Cognitive Performance**

In the patient group, total scores on the positive ($\beta = -0.42$, $P < .05$) and negative ($\beta = -0.44$, $P < .05$) symptoms scales of the PANSS as well as scores on the Calgary depression scale ($\beta = -0.46$, $P < .05$) related to poor performance on motor functioning ($R^2 = 0.264$, adjusted $R^2 = 0.172$, $P < .05$). These effects remained significant after controlling for mood ratings. There were no significant associations between the symptoms and the domains of verbal abilities ($R^2 = 0.215$), verbal memory ($R^2 = 0.123$), spatial motor ($R^2 = 0.179$), spatial memory ($R^2 = 0.032$), executive function ($R^2 = 0.046$), attention ($R^2 = 0.070$), verbal working memory ($R^2 = 0.213$), and speed of information processing ($R^2 = 0.094$). All $P$ values are >.05.

**Discussion**

The main findings of this study were the following: (1) overall, patients reported feeling more depressed-dejected, tense-anxious, fatigued-inertia, angry and hostile, confused, and lack of vigor and performed worse on all cognitive measures compared with the comparison group; (2) in the patient group, (i) feeling depressed and dejected related to poor performance on executive functioning, attention, and verbal memory tasks, (ii) fatigue and inertia related to executive functioning, motor functioning, and verbal memory performance, (iii) feeling confused was associated with poor executive functioning and verbal memory performance, and (iv) feeling tense and anxious was related to poor verbal memory performance; and (3) in the comparison group, vigor was associated with better and fatigue and inertia with worse spatial memory performance.

Poor cognitive performance of patients compared with the healthy comparison group was expected and is consistent with a substantial number of previous neuropsychological studies. Also consistent with our
hypothesis were the following: greater subjective feelings of negative mood states were reported by patients compared with the healthy comparison group and variance was explained on a wide range of cognitive tests compared with that explained by clinician-rated symptoms of schizophrenia or depression.

The relationship between subjective mood states and neurocognitive performance found in our study is, to our knowledge, the first to be examined and demonstrated in a group of patients with chronic schizophrenia. Although studies of schizophrenia patients so far have not incorporated subjective mood states at the time of testing when conducting clinical and cognitive assessments, there are data in depressed patients indicating improvements in self-reported measures of mood to be associated with reduced complaints of memory problems. With regard to the relationship between symptoms and neurocognitive performance, our data showed a significant relationship between positive, negative, and depressive scores and motor functioning impairment. This finding is consistent with those of Zakzanis, who found a relationship between positive symptoms and neurocognitive domains. Our study, unlike some other studies, did not find significant associations between negative symptoms and memory, executive functioning, or verbal fluency or domains. However, there are also a large number of published studies that did not find a statistically significant association between negative symptoms and these neurocognitive domains. We are not aware of a systematic review of the relationship between negative symptoms and neurocognitive domains and speculate that the noted discrepancy relates to patient characteristics and varying methodologies of different studies. Nonetheless, it would be extremely valuable to further examine the effects of subjective mood states in patient samples where the effects of negative symptoms in cognitive performance are also evident to confirm whether subjective mood states indeed are more strongly associated than clinician-rated negative symptoms with cognitive performance in schizophrenia.

Furthermore, although cognitive performance in schizophrenia is generally deficient, state-related changes of small effects, eg, with atypical antipsychotics have been reported. Thus, performance may not be 100% static and may change with mood and thus motivation.

Although subjective feelings of depression and dejection were found to be related to scores on the Calgary and Hamilton depression scales and feelings of fatigue and inertia to be related to scores on the Hamilton depression scale, the depression scores rated by the clinicians predicted significant variance only on the motor functioning domain. It is possible that clinical ratings do not appropriately accommodate subjective feelings of patients, eg, tension and anxiety or feeling confused, which clearly have an impact on their cognitive performance. Furthermore, mood states as measured with the POMS may not be in the range of the clinical scales.

In conclusion, the present study showed that subjective feelings of mood were a better predictor of cognitive functioning relative to clinician-rated measures of psychopathology and depressive symptoms in patients with schizophrenia. It would be important for future cognition studies in schizophrenia to include self-reports of mood in addition to clinician-rated measures of psychopathology.

References


