## RESEARCH PAPERS

# Substance Abuse and Cognitive Functioning in Schizophrenia

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**Individuals with schizophrenia have an increased vulnerability to abuse drugs or alcohol. This vulnerability can interfere with the course and treatment of the disorder and may also have a detrimental effect on already compromised cognitive functioning. This study has a matched, cross-sectional design and compares the social and cognitive functioning and the symptoms of 33 schizophrenia subjects who abuse substances with 33 nonabusing schizophrenia subjects. Subjects were matched on sex, age, and education variables and were all outpatients. Measures of social functioning and quality of life were used. Assessment of cognitive functioning included measures of verbal ability, attention, executive functioning, and verbal and visual memory. Substance-abusing subjects had significantly lower quality of life. There were no other differences between the 2 groups. Several explanations are offered for the lack of observed differences in cognitive functioning.**

*Key Words:* schizophrenia, substance abuse, cognitive functioning

## INTRODUCTION

Individuals with schizophrenia have an increased vulnerability to abuse drugs and alcohol, which in turn can interfere with the course and treatment of the disorder (Mueser and others 1992a). The literature suggests that schizophrenia patients who abuse substances tend to be less compliant and to have more admissions to hospital and more presentations to emergency services (Drake and others 1989; Cleghorn and others 1991; Bartels and others 1993). Substance abuse has also been associated with a more severe course of the disorder, including an earlier age of illness onset (Mueser and others 1990). It has also been suggested, however, that these patients may have a milder course of schizophrenia which is aggravated by their substance use. Dixon and others (1991) reported that, in their inpatient sample, the drug-abusing patients with schizophrenia had less overall psychopathology at discharge. This suggested a quicker or more complete response to hospital treatment. Less severe symptoms may also have been a result of patients' abstinence while hospitalized.

The literature on the cognitive functioning of those schizophrenia patients who abuse substances is inconclusive with respect to the potential detrimental effects of substances on cognitive functioning that is already compromised. The cognitive deficits associated with alcohol and drug use have been extensively reported (Grant and Reed 1985). Deficits in learning, memory, information processing, attention, abstract reasoning, and perceptual motor ability have been well documented (Grant 1987). There is much research to support the existence of cognitive impairment in schizophrenia, but very little is known about the cognitive status of patients suffering from the combined effects of both schizophrenia and substance abuse (Mueser and others 1992b; Tracy and others 1995).

Cleghorn and others (1991) compared the cognitive performance of 38 schizophrenia patients who reported prior

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substance abuse with subjects who reported no abuse. None of the neuropsychological tests discriminated between the groups, and the investigators concluded that prior substance abuse did not produce general or domain-specific cognitive impairment. Sevy and others (1990) examined the cognitive functioning of schizophrenia inpatients with and without a history of cocaine use. No significant group differences were found on the Wechsler Adult Intelligence Scale—Revised (WAIS-R), but cocaine users performed better on a visual attention task and worse on a memory task than nonusers. Cognitive deficits were associated more with chronic drug use rather than cocaine use per se.

Tracy and others (1995) hypothesized that since substance-abusing schizophrenia patients appear to differ in several aspects from the nonabusing patients, their cognitive status may also be unique. Thus there exists the possibility that a treatable source of cognitive decline such as substance abuse is being ignored.

The purpose of this study was to compare a group of outpatients with schizophrenia who abused drugs and alcohol with a matched, nonabusing group of schizophrenia outpatients. It was hypothesized that the substance-abusing schizophrenia subjects would have poorer social and cognitive functioning and increased positive symptoms compared with the nonabusing subjects.

## METHODS

### Subjects

Thirty-three outpatients with schizophrenia who met criteria for substance abuse or dependence were identified from an outpatient clinic in a general hospital department of psychiatry and a community mental health clinic and then recruited for the study. Thirty-three outpatients with schizophrenia and no current substance abuse or dependence were identified from the same clinics. Thirteen of these nonsubstance abusers met criteria for past substance abuse or past dependence on alcohol, cannabis, or hallucinogens. This information was collected retrospectively. None of the subjects in this group had any substance use within 6 years of cognitive testing and none had used for a period greater than 5 years.

The 2 groups were matched for age, sex, and education. Diagnoses of substance abuse and/or dependence and schizophrenia according to DSM-III-R criteria (American Psychiatric Association 1987) were made using the Structured Clinical Interview for DSM-III-R (SCID) (Spitzer and others 1990). Diagnoses were made by the principal investigators (DA and JA). Interrater reliability was determined in a separate sample of 10 subjects by 100% agreement on the diagnosis and at least 80% agreement for symptom presence. All subjects met criteria for schizophrenia.

Subjects were excluded if they did not meet this criteria or if they had any of the following: 1) evidence of an organic central nervous system disorder, for example, epilepsy, traumatic brain injury, or infectious or toxic cerebrovascular disease; 2) mental retardation; or 3) age under 18 or over 65 y. The study was described verbally and in writing, and written informed consent was obtained from each subject.

Each group consisted of 29 males and 4 females. The average age of participants was 34 y, and the average educational level achieved was grade 12. The majority of the subjects were single, lived alone, and received government financial support. There were no differences between the groups in marital status or living and financial arrangements. The substance-abusing group met criteria for substance dependence for at least 1 substance. Twelve subjects met criteria for alcohol dependence, 5 met criteria for cannabis dependence, and 12 met criteria for alcohol dependence or abuse plus cannabis dependence or abuse. Four of the subjects used different combinations of drugs but also met criteria for inclusion: 1) alcohol dependence plus past crack dependence, 2) codeine dependence, 3) Benylin dependence, and 4) alcohol dependence and barbiturate dependence. All of the subjects in the substance abuse group had at one time or other been referred to a substance or dual-diagnosis program for treatment. In most cases, the subjects did not follow through with or would eventually leave treatment. The implication is that either caregivers or significant others had perceived these individuals to have a problem with substances.

### Measures

#### *Symptoms*

The Positive and Negative Syndrome Scale (PANSS) (Kay and others 1987) was used to obtain ratings for positive and negative symptoms. The PANSS was administered by JA and a clinical research nurse. Interrater reliability was established in a separate sample of 5 subjects to at least 85% reliability on the syndrome scores and no more than 1 point difference on any individual symptom items.

#### *Social functioning*

Two measures were used to assess social functioning: the Social Functioning Scale (SFS) (Birchwood and others 1990) and the Quality of Life Scale (QLS) (Heinrichs and others 1984). The SFS is a short scale designed to assess social functioning in schizophrenia. It provides measures of adjustment for the following 3 areas of functioning: independence to perform daily living skills, social engagement or withdrawal, and recreation. It has been shown to be a reliable, valid, and sensitive measure of social functioning (Birchwood and others 1990).

The QLS is a 21-item interviewer rating scale providing information on symptoms and functioning during the preceding 4 weeks. Each item is rated on a 7-point scale and in all but 2 cases requires a judgement by the clinician. It measures adjustment on 4 subscales: interpersonal relations,

instrumental role functioning, intrapsychic foundations (for example, motivation), and common objects and activities (for example, owning a car, reading a book).

*Cognitive functioning*

Verbal ability, visual–spatial ability, executive and frontal lobe functioning, visual and verbal memory, and visual attention were assessed. Verbal ability was assessed with the vocabulary subtest from the WAIS-R. Visual–spatial ability was assessed with the Block Design subtest from WAIS-R. The immediate and delayed recall of the verbal memory subtests from the Wechsler Memory Scale (revised) were used to assess verbal memory, and the Rey Osterrieth Complex Figure was used to assess visual memory (Rey 1942). The Wisconsin Card Sorting Test (WCST), the Chicago Word Fluency Test (Thurstone and Thurstone 1943), and the Jones-Gotman Design Fluency Test (Jones-Gotman and Milner 1977) were used to measure executive and frontal lobe functioning. The computerized version of the WCST (Heaton 1981) developed by Wang Laboratories was used. The computerized version of the WCST is comparable to the card version for this population (Hellman and others 1992).

Visual attention was assessed with the degraded stimulus version of the Continuous Performance Test (CPT) and the Forced-Choice Span of Apprehension task (SPAN). The CPT is a measure of visual sustained attention. It involves monitoring a quasirandom series of stimuli (numbers) as they are presented briefly and individually in a continuous sequence and pressing a response button each time that a predesignated stimulus occurs (Nuechterlein 1991). The SPAN task measures the efficiency of early iconic memory and readout stages of visual information processing that is relatively independent of active, short-term memory (Asarnow and others 1991). Subjects are required to detect a target letter from an array of 3 or 12 letters arranged in a 4 × 4 matrix.

### Procedures

Subjects were assessed on 3 separate occasions within a 10-d period 1) for the SCID and PANSS, 2) for the social functioning assessment, and 3) for cognitive assessment. Two different research assistants conducted the social functioning and the neurocognitive assessments.

## RESULTS

In the substance abuse group, 12 subjects met criteria for alcohol dependence, 5 met criteria for cannabis dependence, and 12 met criteria for alcohol dependence or abuse plus cannabis dependence or abuse. There were no differences among these 3 groups on any of the cognitive, social, or symptom variables. The individual cognitive, social, and symptom scores of the 4 subjects who met the following criteria—alcohol dependence plus past crack dependence, codeine dependence, Benylin dependence, or alcohol dependence and barbiturate dependence—were examined. Scores were not more than 2 standard deviations above or below the means for the substance-abusing group as a whole. There was 1 exception. The subject who had used crack had a positive symptom score of 30. Thus, in this sample, differences in substances affected only group differences in positive symptoms. Within the nonabusing group there were no differences in social or cognitive functioning or symptoms between those who had never abused substances and those who had abused for a short period in the past.

Student's *t* tests were conducted to compare the 2 study groups. There were no differences between the 2 groups on age at 1st admission, age at onset of the illness, number of previous admissions, or medication dose. There were no differences in the proportion of individuals in each group who were taking traditional antipsychotics or 1 of the newer antipsychotics such as clozapine or risperidone. There were no differences between the groups in negative symptoms or general psychopathology. The substance-abusing group, however, had significantly higher scores on positive symptoms. When the 1 subject with a score of 30 is removed, the difference is no longer significant. The 2 groups did not differ in social functioning, but the substance-abusing group had significantly lower scores on the QLS (all subscale scores and total overall score) than the nonabusing group. Since multiple *t* tests were conducted, a Bonferroni procedure was used to control for type I errors. As a result, the only significant difference between the groups was the score on the QLS. These results are presented in Table 1. There were no differences between the groups on any of the individual measures of cognitive functioning. These results are presented in Table 2.

## DISCUSSION

This study was conducted in a predominantly middle-class Canadian city. Both groups of subjects were drawn from a relatively stable outpatient sample of schizophrenia subjects. In such clinic settings, patients who abuse substances are seen as less compliant in terms of clinic attendance, medication, and other psychosocial treatments. The main substances of abuse were alcohol and marijuana. This finding is consistent with results from an earlier survey in the same clinic (el-Guebaly and Hodgins 1992). The similarity enhances the generalizability of our findings to clinic attenders. Other drugs, such as cocaine, were rare. The subjects identified as substance users in this study clearly had problems with substances; all met criteria for dependence on at least 1 substance, and all had at some time been referred or recommended for substance abuse treatment.

There were no differences in negative symptoms, and the apparent difference in positive symptoms was mainly due to the 1 subject who used crack, an effect that has been reported elsewhere (Lieberman and others 1989). Thus, in a sample in which the main drugs of abuse were alcohol and cannabis, there was no increase in positive symptoms.

**Table 1**

**Differences between the substance-abusing group and the nonabusing group for demographics, symptoms, and social functioning**

| Variables | Mean (SD) | | 2-tailed *t* test value |
|---|---|---|---|
| | Substance users | Nonusers | |
| Demographic variables | | | |
| Age | 34.3 (7.7) | 34.6 (7.6) | matched |
| Grade | 12.0 (2.7) | 12.2 (1.9) | matched |
| Age at onset of illness | 23.0 (7.0) | 22.2 (5.2) | −0.56 |
| Age at 1st admission | 24.2 (6.6) | 24.8 (6.4) | 0.35 |
| Previous admissions | 5.7 (6.0) | 4.5 (3.2) | −1.05 |
| CPZ equivalents | 404.3 (319.6) | 328.1 (238.1) | −1.10 |
| Symptoms | | | |
| PANSS-positive | 15.3 (5.5) | 12.7 (4.9) | −2.06[a] |
| PANSS-negative | 14.0 (3.9) | 15.1 (6.3) | 0.88 |
| PANSS-GPS | 28.0 (6.1) | 26.5 (6.1) | −1.05 |
| Social variables | | | |
| Social functioning | 122.2 (19.0) | 128.3 (22.3) | 1.20 |
| Quality of life | 59.8 (20.1) | 77.8 (20.6) | 3.73[b] |

[a] $P < 0.05$.
[b] $P < 0.001$; only this value was significant after Bonferroni procedure ($P < 0.01$).

The lack of differences between the groups on the SFS is not surprising. This scale measures fairly basic levels of social functioning (for example, washing dishes and doing laundry), and most of the subjects obtained average or low average scores on this scale. Generally, subjects in this study scored higher than those in Birchwood's original sample (Birchwood and others 1990), particularly on items that reflect socializing and recreational activities. Since there were no differences for items such as engagement, communication, and occupational functioning, sample differences may reflect the socioeconomic status of our subjects, who live in a mainly middle-class, nonindustrial city in Western Canada. Since the subjects in the study had reasonable scores on this test compared with published norms, their high scores may have led to a ceiling effect.

The substance-abusing group, however, had significantly lower scores on the QLS. This suggests that they are functioning at a lower level than their nonabusing peers in areas of interpersonal relationships, motivation, role functioning, activities, ownership of possessions, and overall quality of life.

Finally, there were no differences in cognitive functioning between the groups. These results fit with other studies that have not reported additional cognitive impairment in samples of substance-abusing schizophrenia patients (Cleghorn and others 1991). Nevertheless, such results are surprising because the literature suggests that extensive use of substances will lead to cognitive impairment as well as neuroanatomical abnormalities. It is a reasonable expectation that individuals with schizophrenia would be particularly vulnerable to the cognitive and neuropathological effects of substance abuse since their cognitive functioning and neuroanatomical structures may already be compromised (Mueser and others 1992a).

There are 3 possible explanations for the lack of observed cognitive impairment in the substance-abusing group. First, the cognitive impairment associated with alcohol and drug use usually occurs after many years of prolonged and excessive use (Eckhardt and others 1995). It may be that the amount and frequency of substance use had not yet caused any cognitive impairment in this relatively young sample. One of the difficulties in assessing substance abuse is the differences among subjects with respect to the quantities and the frequency with which substances are used. In this study, we were unable to determine accurately how often and how much substances were being used. Another difficulty is that self-report of such data tends to be unreliable.

A 2nd explanation for the failure to demonstrate differences in cognitive impairment is that the substances are affecting patients' symptoms, social functioning, and performance on cognitive tests. In this case, the lack of observed differences could be attributed to the relatively mild impairment of the individuals with schizophrenia who abuse substances. It is the effects of the substances that make these patients look similar as a group to the nonabusers (Dixon and others 1991). As Dixon and colleagues (1991) suggested, those individuals who have the necessary skills and motivation to obtain drugs or to use drugs and alcohol in a social

**Table 2**

**Differences between the substance-abusing group and the nonabusing group for cognitive functioning**

| Measures | Mean (SD) | | 2-tailed *t* test value | Confidence intervals |
|---|---|---|---|---|
| | Substance users | Nonusers | | |
| Visual–spatial blocks | 26.5 (10.5) | 31.1 (9.1) | 1.86 | –0.34, 9.40 |
| Vocabulary | 42.7 (15.2) | 45.8 (13.5) | 0.87 | –4.03, 10.27 |
| Memory | | | | |
| Verbal memory | 20.0 (8.6) | 16.9 (7.8) | –1.53 | –7.19, 0.95 |
| Visual memory | 17.7 (7.8) | 17.1 (7.0) | –0.32 | –4.28, 3.08 |
| Fluency | | | | |
| Design fluency | 29.2 (15.8) | 29.0 (14.2) | –0.03 | –7.56, 7.31 |
| Verbal fluency | 39.8 (15.8) | 41.7 (15.0) | 0.05 | –5.72, 9.60 |
| Executive functioning | | | | |
| Perseverative errors | 22.8 (16.4) | 24.4 (13.0) | 0.45 | –5.68, 8.96 |
| Attention | | | | |
| CPT | 82.6 (17.6) | 88.1 (8.1) | 1.63 | –1.23, 12.29 |
| SPAN-12 | 49.0 (6.2) | 48.7 (6.5) | –0.17 | –3.42, 2.88 |
| SPAN-3 | 59.3 (5.8) | 59.9 (4.2) | 0.50 | –1.87, 3.12 |

setting may have a better prognosis in terms of their schizophrenia. When they abstain from substance use and are compliant with appropriate treatments, they may be less symptomatic and exhibit improved functioning. Other studies have reported higher functioning in schizophrenia subjects who abused substances, particularly among those who used alcohol and cannabis (Arndt and others 1992).

Finally, the lack of significant results may be due to sample size. Type II error is always a concern in the interpretation of negative results. When sample sizes are limited, studies may lack the precision to identify small or moderate effects. We have addressed this issue by calculating confidence intervals for each comparison. The confidence intervals in Table 2 indicate that the data are not inconsistent with small cognitive differences. These results could be interpreted as a failure to find evidence of cognitive differences rather than as strong evidence against the existence of such differences.

Thus we cannot determine which of these explanations is more appropriate or what are the cognitive effects of concomitant substance abuse in schizophrenia. Regardless, these substance-abusing patients, because of their noncompliance, are not necessarily receiving optimal treatments. In addition, as shown in this study, their already compromised quality of life is being affected.

There are clear implications for interventions with this particular group of substance abusers. If the substance abuse can be addressed, there may be a concomitant improvement in quality of life and general well-being. There could also possibly be an improvement in patients' symptoms and cognitive and social functioning if, as Dixon and others (1991) suggested, substance-abusing schizophrenia patients comprise a generally better prognostic group. There does not seem to be evidence for a direct relationship between amount of drug consumption and impairment except at extremes, where it appears that chronic users of many substances are more impaired than less frequent users (Tracy and others 1995). We therefore want to prevent chronic, long-term use where cognitive impairment may be inevitable.

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