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Cognitive Dysfunction in Schizophrenia, Affective Disorder and Organic Brain Disease

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Summary: We used the Wechsler Adult Itelligence Scale (WAIS) to study a sample of patients with affective disorder (N = 52), schizophrenia (N = 17) and organic brain disease (N = 8). Schizophrenic patients had lower verbal, performance and full-scale IQs than patients with affective disorder, but were no different from those with organic brain disease. An individual WAIS subscale analysis showed that, compared with affectives, schizophrenics had relatively poorer performance on language than non-language tasks.

These differences were independent of age, sex, handedness, educational level or drug administration and are consistent with a variety of studies demonstrating significant cerebral dysfunction in carefully diagnosed schizophrenic patients.

In prior neuropsychological studies of patients with schizophrenia and affective disorder (Taylor *et al*, 1975; Taylor *et al*, 1979) we used an aphasia screening test to differentiate the two groups. More schizophrenics exhibited abnormal overall performance and dominant temporal/temporoparietal errors.

The present report employs the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1955) to study a sample of schizophrenics and patients with affective disorder and includes a small group of patients with organic brain disease for comparison. Based on our own data and that of other investigators (DeWolfe *et al*, 1971; Klonoff *et al*, 1970; Watson *et al*, 1968; Watson, 1965) we predicted that schizophrenics would show more total and verbal impairment than patients with affective disorder but would be indistinguishable from patients with diffuse organic brain disease.

Method

The study was done on an acute university psychiatric unit serving a suburban-rural population in New York State. All patients who satisfied our research criteria were included in the study, which took place during an eight month period ending May, 1976.

Research Criteria

For schizophrenia (1 to 4 required)

1. At least one of *a*, *b* or *c*:
   (a) Formal thought disorder (drivelling, tangentiality, neologisms, verbigeration, paraphasias, nonsequiturs, private words, stock words).
   (b) First rank symptoms (at least one).
   (c) Emotional blunting (a constricted, inappropriate, unrelated affect of decreased intensity, with indifference/unconcern for loved ones, lack of emotional responsivity, and a loss of social graces).
2. Clear consciousness.
3. No diagnosable affective disorder.
4. No diagnosable organic brain disease, no past hallucinogenic or psychostimulant drug abuse, no medical condition known to cause schizophrenic symptoms.

For mania (1 to 4 required)

1. Hyperactivity.
2. Rapid pressured speech.
3. Euphoric/expansive/irritable mood, with a broad affect.
4. No diagnosable organic brain disease, no psychostimulant drug abuse in past month, no medical illness known to cause manic symptoms.

For endogenous depression (1 to 3 required)

1. Sad, dysphoric or anxious mood.
2. At least three of *a* to *f*:
   (a) Early morning waking.
   (b) Diurnal mood swing (worse in am).
   (c) >2.2 kg weight loss in 3 weeks.
   (d) Retardation or agitation.

(e) Suicidal thoughts/behaviour.
(f) Feelings of guilt/hopelessness/worthlessness.

3. No diagnosable coarse brain disease, no use of steroids or reserpine in past month, no medical illness known to cause depressive symptoms.

For organic brain disease (1 to 3 required)

1. Personality change manifested by emotional coarsening, lability, irritability, emotional incontinence, or self-neglect.
2. Amnesia or disorientation.
3. At least one of *a* to *d*:
   (a) Aphasia/apraxia.
   (b) Incontinence of urine.
   (c) Seizures.
   (d) Focal neurological signs.

Testing Procedure

All patients were tested as soon after admission as their clinical state permitted, and every attempt was made to withhold psychotropic drugs until testing was completed. The WAIS was administered by an experienced neuropsychologist who was 'blind' to the research diagnosis.

Statistical Analyses

The data were examined by hierarchical multiple regression analyses in order to examine differences in test performance among diagnostic groups while controlling for the effects of sex, age, handedness, educational level, and drug treatment (neuroleptic dosage or serum lithium level). In the present study, the effects of these five variables were co-varied out of the WAIS before the variable of research diagnosis was entered. Pair-wise differences between diagnostic groups on the various measures were evaluated by *t* tests among the groups' regression weights only if there was a significant increment in multiple-R^2 when diagnosis was entered. Separate regression analyses were done on the WAIS Full Scale, Performance, and Verbal IQs.

Results

Seventy-seven patients were studied: 52 with affective disorder (mean age = 39.7 years), 17 with schizophrenia (mean age = 37.8 years), and 8 with organic brain disease (OBD) (mean age = 50.8 years). The affective disorder group included 43 manics and 9 depressives; all of the schizophrenic patients had a chronic illness course; and the OBD group included 5 patients with presenile or senile dementia, 2 with alcoholic deterioration, and one with chronic dementia secondary to encephalitis.

Table I displays the verbal, performance and full-scale IQ scores for the four patient groups.

Table II shows the results of the multiple regression analyses to test differences in WAIS performance among the diagnostic groups, controlling for sex, age, handedness, educational level, and drug administration.

Full scale IQ

Sex, age, and handedness were entered and found not to be significant predictors of IQ. Educational level was entered next, resulting in a significant increment in R^2 (more years of education were correlated with a higher IQ), followed by drug treatment at the time of testing (recorded as neuroleptic dosage or serum lithium level), which also resulted in a significant increment in R^2 and effect on IQ. Here, lithium and neuroleptics had equally significant but *opposite* effects, with lithium associated with higher scores, and neuroleptics lower ones. Finally, diagnosis was entered as the cricitcal variable of interest, yielding a significant increment in R^2. Thus, there is a significant difference in WAIS Full Scale IQ among the diagnostic

TABLE I
Mean WAIS IQ scores

Scores	Mania (N = 43)	Depression (N = 9)	Schizophrenia (N = 17)	Organic brain disease (N = 8)
Verbal				
Raw	59.04	61.55	45.65	38.51
Scaled	101.75	102.50	86.40	81.30
Performance				
Raw	35.40	41.89	33.82	27.40
Scaled	88.50	95.30	84.53	83.16
Full Scale	94.63	99.73	84.55	81.60

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TABLE II
Multiple regression analysis of WAIS performance

Independent variables	Dependent variables: Verbal IQ MR	Performance IQ MR	Full scale IQ MR
Sex	.044	.127	.095
Age	.045	.130	.097
Handedness	.121	.152	.145
Education (yr)	.697**	.450**	.642**
Drug treatment	.725**	.480	.671*
Diagnosis	.776**	.600**	.744**

* P < .05
** P < .01

groups which remains after the effects of each of the other variables has been partialled out.

Pair-wise comparisons of group differences for the four diagnostic groups show that schizophrenics perform significantly worse than manics (P <0.01) or depressives (P <0.01), but not differently from patients with OBD and that manics and depressives perform significantly better than patients with OBD (P <0.01, and P <0.05, respectively), but not differently from each other.

Verbal IQ

Sex, age, and handedness did not predict verbal IQ, but educational level and drug administration did, as for Full Scale IQ. Diagnosis was again significantly related to Verbal IQ (P <0.01) after the effects of the other variables were removed. Pair-wise test between diagnostic groups again showed that schizophrenics had a lower verbal IQ than manics (P <0.01) or depressives (P <0.01), but were not different from patients with OBD, and that manics and depressives had higher verbal IQs than patients with OBD (P <0.05 and P <0.05, respectively), but did not differ from each other.

Performance IQ

Sex, age, and handedness did not predict performance IQ; educational level did, but this time there was no significant effects of drugs. Again, diagnosis was a significant predictor of performance IQ (P <0.01) after other variables were accounted for, and the pair-wise tests between diagnostic groups showed exactly the patterns described for the WAIS Full Scale and Verbal IQ above.

WAIS subscales

To further identify characteristics of differential WAIS performance, differences in individual subscale means among diagnostic groups were examined. Fig 1 shows the mean scores achieved by the four diagnostic groups on each of the 11 WAIS subscales. Differences among groups were tested by a separate analysis of variance for each subscale, with three planned comparisons being evaluated for all analyses: manics and depressives vs schizophrenics, schizophrenics vs OBD patients, and manics vs depressives.

Inspection of Fig 1 reveals that the verbal subtests are more efficient than the performance subtests in separating manics and depressives from schizophrenics (and OBD patients). Manics and depressives achieved significantly higher scores than schizophrenics on the subscales of Information (P <.05), Comprehension (P <.01), Similarities (P <.01), Vocabulary (P <.01) and Digit Symbol (P <.05); no differences were found for

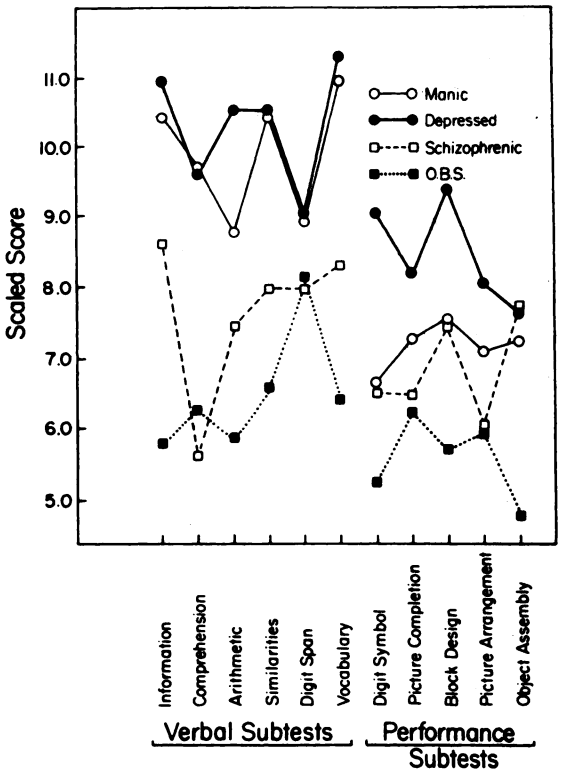

FIG 1.—Mean Wais subtest scores by diagnostic group.

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the Arithmetic, Digit Span, Picture Completion, Block Design, Object Assembly or Picture Arrangement subscales.

The verbal subtests of the WAIS do not precisely reflect the language functions of the dominant temporal lobe as the digit span subtest is a test of short-term holding memory and the arithmetic subtest taps dominant parietal lobe functioning. Excluding these two subtests, schizophrenics are seen to perform worse than affectives on all four language tasks but on only one of five non-language tasks (exact probability = 0.04).

Schizophrenics performed significantly better than OBD patients on only two of the 11 WAIS subscales, information ($P < .05$) and Object Assembly ($P < .05$). Only one subscale differentiated manics and depressives, with depressed patients scoring significantly higher than manics on the Digit Symbol Subscale ($P < .05$).

Discussion

The failure of the WAIS to distinguish schizophrenics from patients with organic brain disease is consistent with a number of previous reports (DeWolfe, 1971; Klonoff *et al*, 1970; Watson *et al*, 1965; Watson, 1968) and the WAIS profile for the schizophrenics is also similar to those reported by others (DeWolfe, 1971; Smith, 1964). DeWolfe (1971), however, had some degree of success in discriminating diffusely brain damaged patients from chronic or process schizophrenics. Another exception is a report (Goldstein and Halperin, 1977) in which neurologically impaired schizophrenics were differentiated from neurologically normal ones with 66 per cent accuracy using the WAIS subscales and the Halstead-Reitan subtests in a discriminant function analysis. However, this statistical technique may overestimate the true relationship under investigation, and needs confirmation in a prospective study.

Our study is unique in demonstrating significant differences between schizophrenics and patients with affective disorder on the WAIS, a finding which is consistent with our own data on aphasia screening test performance in a different sample (Taylor *et al*, 1975), as well as an overlapping one (Taylor *et al*, 1979), both for overall test performance and for dominant temporal lobe functioning. The opposite effects of lithium and neuroleptics on the WAIS scores can be explained by the fact the lithium was prescribed mainly for patients with mania or depression, and neuroleptics for patients with schizophrenia.

There is now increasing data from a variety of sources (Abrams and Taylor, 1979; Flor-Henry, 1976; Johnstone *et al*, 1976, 1978; Taylor *et al*, 1979; Weinberger *et al*, 1979a, b) demonstrating significant cerebral dysfunction in patients with rigorously diagnosed schizophrenia. This dysfunction is usually bilateral, but when schizophrenics are compared with patients with affective disorder, dominant hemisphere dysfunction is greater in the schizophrenic group (Abrams and Taylor, 1979; Flor-Henry, 1976; Taylor *et al*, 1979). The WAIS performance of our schizophrenics and patients with affective disease is consistent with this literature.

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