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Neuropsychological Deficits and Violent Behavior in Incarcerated Schizophrenics

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The authors studied 37 male schizophrenics in a county jail psychiatric unit. Subjects were classified as impaired or not according to Luria-Nebraska Neuropsychological Battery criteria. Twelve of the 37 patients were impaired. Violence ratings were made on inpatient behavior and adult criminal records. Impairment status was related to adult history of violence but not inpatient violence. The most violent patients (by criminal record) were from the impaired category.

Over the past 10 years, researchers have gathered an increasing body of evidence demonstrating neurological deficits in a subgroup of schizophrenics. Johnstone et al. (1976) used coaxial tomography to demonstrate dilated ventricles in some schizophrenics. Since Johnstone's work, numerous supporting (Andreasen et al., 1982a; Golden et al., 1980a; Losonczy et al., 1986; Weinberger et al., 1979) as well as some negative (Jernigan et al., 1982) studies have been published. Johnstone et al. (1976) and others (Donnelly et al., 1980; Golden et al., 1980a, 1980b, 1982) have demonstrated neuropsychological deficits that tend to reinforce the importance of the anatomical data.

The clinical significance of these neurological/neuropsychological findings is controversial. Crow (1982), Andreasen et al. (1982a), and others have asserted a relationship between "negative," "type II," or nonparanoid schizophrenia and increased ventricular/brain ratio. Other researchers (Losonczy et al., 1986; Nasrallah et al., 1983) have not found such relationships.

The present study is an attempt to explore relationships between neuropsychological indicators of brain dysfunction and violent behavior in schizophrenics. The study was motivated by the observation that much violent behavior (*i.e.*, socially disapproved aggression) is associated with central nervous system dysfunction, usually due to intoxication. The forensic literature contains numerous studies (Shupe, 1954; Wolfgang and Strohm, 1956) showing that murders and assaults are linked to alcohol and drug intoxication. Other reports link neuropsychological abnormalities (Bryant et al., 1984; Lewis et al., 1986; Scott et al., 1982), CT scan abnormalities, and histories of CNS injury and abnormality (Lewis et al., 1986) with violent behavior. Numerous neurological syndromes (Moyer, 1976; Rice and Gendelman, 1973), including normal pressure hydrocephalus, have also been associated with violent behavior. Given the strong association between CNS dysfunction and violence, the reports of a possible subgroup of schizophrenics with CNS dysfunction led to the present inquiry.

Methods

Subjects

The study was carried out in the Psychiatric Security Unit (PSU) of a large, urban county mental health program (Meloy, 1985). The PSU is unusual in that it is not, primarily, a forensic unit but rather is an acute inpatient unit operated and staffed by the County Mental Health Services but located within the main county detention facility. Patients in the unit are usually recently arrested. There is a large overlap between PSU patients and County Mental Health patients. In addition, the county jail itself operates a section in which persons identified as psychiatric patients are housed and followed as "outpatients." Accordingly, only the severely disturbed inmate is admitted to the PSU. When the acute episode has been treated, patients return to outpatient status and location.

The patients chosen were 37 consecutive male schizophrenics who met the criteria for the study and gave written informed consent to participate in the study. The following criteria were included: a) Age between 18 and 45 years; b) DSM-III (American Psychiatric Association, 1980) diagnosis of schizophrenia; c) absence of history of CNS or neuroendocrine disease or disorder; d) absence of recent (past 6 months) substance abuse or history of severe substance abuse; e) absence of a diagnosis of mental retardation or schizoaffective disorder; f) absence of significant systemic illness.

Patients who were unable to provide a valid MMPI were also excluded. This served as a mode of screening outpatients who were simply too disorganized to ef-

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fectively cooperate with assessment procedures. Finally, persons who were admitted to the PSU due to legal requirements alone (not guilty by reason of insanity) rather than clinical indications were excluded. Neuropsychological procedures were done only after patients had been on a stable pharmacological regimen for at least 5 days.

Rating Instruments

Golden et al. (1980a) generated a set of rules that allowed discrimination of schizophrenics with dilated ventricles from those without, by use of the Luria-Nebraska Neuropsychological Battery (Golden et al., 1980b). Their study used rules generated from the test sample to discriminate in the same sample. Golden et al. (1982) later replicated this study with a different population, obtaining a near 80% accuracy rate. The decision rules consist essentially of simple counts of elevated T-scores, weighing elevations in receptive speech, rhythm, memory, and intelligence scales less than the other eight scales. Three or four elevations between 60 and 70 T qualified a subject for the "brain damage" category. A T-score of 65 on the "pathognomonic" scale also qualified. These rules showed high sensitivity with lesser specificity in Golden's studies.

In the present study, patients were categorized into impaired (IMP) and not impaired (NIMP) groups using the decision rules noted above. The validity of any study of neuropsychological performance in schizophrenia tends to be clouded by issues of attention and cooperation due simply to psychosis. The authors chose these decision rules because the prior cross-validation with neuroanatomical data enhanced the meaningfulness of the categories.

Sellin and Wolfgang (1964) have made an impressive contribution to the measure of deviance. They presented raters with brief descriptions of criminal — including violent — acts. They determined the relative subjective severity of these acts in a fashion similar to that of the early psychophysiologists. This work represents the most careful present effort to devise a scaling method for severity in antisocial acts. In the present study, Wolfgang's scalings were applied to police and district attorney's reports of violent episodes. These ratings excluded behaviors in which there was no aggression directed at a person or no potential victim of violence. In this way, scores for individual acts, rather than simply behavioral counts, could be made with some validity (Schlesinger, 1984; Walker, 1978). Ratings were made blindly and summed to form an outpatient violence (OPV) score.

Patients were administered an MMPI, Luria-Nebraska Neuropsychological Battery (LNNB; Golden et al., 1980b), and Brief Psychiatric Rating Scale (BPRS; Overall and Gorham, 1962). The first 7 days of nursing notes were rated according to the Violent Behavior Rating Scale (VBRS). This is a behavioral counting checklist scaled in the manner of Lagos et al. (1977). This scale was developed by M. Rossi at the San Francisco General Hospital (personal communication) and is available from the authors. VBRS ratings were performed in a fashion blind to BPRS, MMPI, and LNNB results.

The research diagnostic interview included categorization of patients into Winokur paranoid and nonparanoid diagnostic categories (Tsuang and Winokur, 1974).

TABLE 1
Outpatient Violence (OPV) Categories with OPV Raw Score Ranges and Illustrative Histories

Category	Range	History and Raw Score on OPV
I. None	0	None
I. Mild	0–20	Strong-arm robbery (score 9)
III. Moderate	20–45	Assault with a deadly weapon (twice); forceful sodomy; arson causing a person to be hospitalized (score 31.9)
IV. Severe	45–95.5	Strong arm robbery; pushed a person down a flight of stairs; battery (three times); held a knife to the throat of a robbery victim and threatened to kill her; burglary of a residence with a knife (score 52)

Results

Demographics

The mean age of the 37 patients was 28.6 ± 5.1 years. Fourteen patients (38%) met the Winokur criteria for paranoid schizophrenia. Arrest records showed an average of 8.4 arrests over a average span of 5.3 years. Of the 37 patients, only four had never been arrested before the current arrest. One patient had averaged over one arrest per month in a 3-year period.

There was no significant relationship between age and number of arrests (r = .078, df = 37, NS).

LNNB Results

The mean number of subscales exceeding critical level was 4.8. The mean number of subscales exceeding 70 T was 1.89. Twelve of 37 patients were classified as IMP by the decision rules (Golden et al., 1980a). The mean age of the IMP group was 28.17 years, *vs.* 28.84 years for the NIMP group. The IMP group averaged a total of 7.92 arrests, *vs.* a total of 8.68 arrests for the NIMP group. There was a nonsignificant trend for a greater proportion of Winokur paranoid schizophrenics in the NIMP than in the IMP group (12 of 25 *vs.* 2 of 12; χ^2 = 3.38, df = 1, $p < .066$).

TABLE 2
Contingency Table and χ^2 Analysis of Outpatient Violence (OPV) Category vs. Impairment Category

OPV Category	Totals		Not Impaired			Impaired		
Group	Observed	Contribution to χ^2	Observed	Expected	Contribution to χ^2	Observed	Expected	Contribution to χ^2
None	5	2.4	5	3	.8	0	2	1.6
Mild	14	.7	8	9	.2	6	5	.5
Moderate	13	3.6	12	9	1.2	1	4	3.6
Severe	5	10.4	0	3	3.4	5	2	7.0

$\chi^2 = 17.14$, $df = 3$, $p < .001$.

Violence Data

Outpatient violence. The Wolfgang scores for each arrest report were summed for all arrests. Arrests for nonviolent activities such as defrauding an innkeeper or shoplifting were excluded. The distribution of the resultant scores was found to be heavily skewed and multimodal. A transformation was applied (1 = no violence, 2 = 0 to 20, 3 = 20 to 45, 4 = greater than 45). These groups were selected *a priori* with an aim toward generating a minimum of five observations per category, keeping the "no violence" patients distinct from others, while approximating a symmetrical unimodal distribution. These four groups (no violence, low, moderate, severe) were used as grouping variables in the subsequent analysis. Only five of 37 patients (14%) had no ratable history of outpatient violence. The relative severity of these categories is illustrated in Table 1.

Inpatient violence. The total score on the combined VBRS scale ratings for two raters was used in the analysis. Interrater reliability for the VBRS was .86. The mean was 4.57 ± 9.54.

The distribution of VBRS ratings was markedly skewed, to the degree that this rating was transformed to a dichotomous variable, *i.e.*, violent or not violent, for the purpose of subsequent analysis. Nineteen of 37 patients showed ratable inpatient violence.

There was no relationship between inpatient violence and outpatient history of violence ($\chi^2 = .45$, $df = 3$; NS).

Relationship between Violence Data and Neuropsychological Data

There was no relationship between inpatient violence category and IMP/NIMP classification ($\chi^2 = .667$, $df = 1$; NS).

There was a strong relationship between outpatient violence history and IMP/NIMP classification (Table 2). The salient feature of the contingency table is the severe violence/IMP cell. This cell reflects the fact that, even though there were twice as many NIMP patients as there were IMP patients, the five most violent patients were all IMP patients. (It is important to be aware that the χ^2 procedure treats the violence groupings as a categorical rather than as an ordinal variable.)

The raw (nontransformed) outpatient violence scores for the 12 IMP patients were 30.8 while the 25 patients in the NIMP group averaged 17.8. The raw scores for the inpatient violence ratings (total of two raters) were 5.36 for the NIMP group and 2.92 for the IMP group.

A post hoc analysis of the most severely violent (group IV) patients revealed that the IMP/NIMP categorization alone provided an 81% accuracy rate in discriminating the severely violent from other patients (in terms of outpatient violence histories). The severely violent group was strongly associated with IMP status ($\chi^2 = 12.04$, $df = 1$; $p < .0005$). This severely violent and impaired group showed a mean age of 26.6 years *vs.* 28.94 for the others. They averaged a total number of arrests of 9.4 *vs.* 8.3 for the remainder. The raw scores for inpatient violence averaged 4.2 for this group *vs.* 4.6 for the others. The mean raw score for outpatient violence was 59.3 *vs.* 16.17 in the remainder. The most violent group averaged 4.8 T-scores greater than 70 on the LNNB subscales *vs.* 1.38 for the others.

Discussion

This is an initial study and requires replication. The population studied is not typical of schizophrenics generally but is a group of incarcerated schizophrenics preselected for demonstrable and important social deviance (if not violence). Although the selected nature of the group limits generalization to a broader schizophrenic group, the selection also makes the results more specific for violence rather than disordered behavior generally.

The lack of relationship between age and number of arrests underscores the truncated nature of the population studied. The criminal justice system acts to

remove persons with persistently high arrest rates, especially for serious offenses. The population studied was no doubt more deviant and violent than the total schizophrenic population, but it also failed to include persons imprisoned or subjected to long-term civil commitment in forensic hospitals. This selection problem plagues studies of violent behavior and reduces the likelihood of detecting relationships in the data.

The relationship, suggested by the data, between outpatient violence history and neuropsychological functioning is not a simple one. The most violent patients were in the IMP group; but the IMP group was not notably violent. In fact, there appeared to be a dichotomous distribution within the IMP group, with approximately equal numbers of subjects with severe and mild violence histories. The NIMP group appears to be more consistent.

In view of the small number of patients, the above-noted dichotomy is quite speculative. It does seem reasonable, however, to hypothesize that diffuse brain dysfunction does not always lead to violent behavior in this group. If it does, however, such behavior will tend to be recurrent or perseverative—an ongoing trait rather than an episodic behavioral extreme associated with acute decompensation. This would tend to explain the presence, in the IMP group, of the very highest "career violence" individuals. This hypothesis would also tend to explain the absence of a trend toward more inpatient violence in the high outpatient violence group (*i.e.*, "decompensated" patients will tend to show behavioral extremes in an acute hospitalization while the "trait" patients would not). Such a hypothesis carries obvious and serious prognostic implications and deserves exploration.

Conclusion

The most important aim of the study was to determine whether a clinically important behavioral characteristic, violence, was disproportionately distributed between schizophrenics with or without evidence of generalized brain dysfunction. The answer is a qualified yes. Outpatient histories of violence, especially severe histories, were associated with neuropsychological dysfunction. This finding tends to support the clinical relevance of the newly emerging brain-damaged/non-brain-damaged dichotomy in schizophrenia.

References

American Psychiatric Association (1980) *Diagnostic and statistical manual of mental disorders* (3rd ed). Washington, DC: Author.

Andreasen NC, Olsen SA, Dennert JW, et al (1982a) Ventricular enlargement in schizophenia: Relationship to positive and negative symptoms. *Am J Psychiatry* 139:297–302.

Andreasen NC, Smith MR, Jacoby CG, et al (1982b) Ventricular enlargement in schizophrenia: Definition and prevalence. *Am J Psychiatry* 139:292–296.

Bryant ET, Scott ML, Golden CJ, et al (1984) Neuropsychological deficits, learning disability, and violent behavior. *J Consult Clin Psychol* 52:323–324.

Crow TJ (1982) Two dimensions of pathology in schizophrenia: dopaminergic and non-dopaminergic. *Psychopharmacol Bull* 18:22–29.

Donnelly EF, Weinberger DR, Waldman IN, et al (1980) Cognitive impairment associated with morphological brain abnormalities on computed tomography in chronic schizophenic patients. *J Nerv Ment Dis* 168:305–308.

Golden CJ, Graber B, Moses JA Jr, et al (1980a) Differentiation of chronic schizophrenia with and without ventricular enlargement by the Luria-Nebraska Neuropsychological Battery. *Int J Neurosci* 11:131–138.

Golden CJ, Hammecke T, Purisch A, et al (1980b) *A manual for the Luria-Nebraska Neuropsychological Battery (revised)*. Los Angeles: Western Psychological Services.

Golden CJ, MacInnes WD, Ariel RN, et al (1982) Cross-validation of the ability of the Luria-Nebraska Neuropsychological Battery to differentiate chronic schizophrenics with and without ventricular enlargement. *J Consult Clin Psychol* 50:87–95.

Jernigan TL, Zatz LM, Moses JA Jr, et al (1982) Computed tomography in schizophrenics and normal volunteers. I. Fluid volume. *Arch Gen Psychiatry* 39:765–770.

Johnstone EC, Crow TJ, Frith CD, et al (1976) Cerebral ventricular size and cognitive impairment in chronic schizophrenia. *Lancet* 2:924–926.

Lagos JM, Perlmutter K, Saexinger H, et al (1977) Fear of the mentally ill: Empirical support for the common man's response. *Am J Psychiatry* 134:1134–1137.

Lewis DO, Pincus JH, Feldman M, et al (1986) Psychiatric, neurological, and psychoeducational characteristics of 15 death row inmates in the United States. *Am J Psychiatry* 143:838–845.

Losonczy MF, Song IS, Mohs RC, et al (1986) Correlates of lateral ventricular size in chronic schizophrenia. I. behavioral and treatment response measures. *Am J Psychiatry* 143:976–981.

Meloy JR (1985) Inpatient psychiatric treatment in a county jail. *J Psychiatry Law*, Fall-Winter, pp 377–396.

Moyer KE (1976) *The Psychobiology of aggression*. New York: Harper & Row.

Nasrallah HA, Kuperman S, Hamra BJ, et al (1983) Clinical differences between schizophrenic patients with and without large cerebral ventricles. *J Clin Psychiatry* 44:407–409.

Overall JE, Gorham DR (1962) The Brief Psychiatric Rating Scale. *Psychol Rep* 10:799–810.

Rice E, Gendelman S (1973) Psychiatric aspects of normal pressure hydrocephalus. *J Am Med Assoc* 223:409.

Schlesinger S (1984) *The severity of crime*. Bureau of Justice Statistics Bulletin NCJ-92326. Washington DC: Department of Justice.

Scott ML, Martin RL, Liggett KR (1982) Neuropsychological performance of persons with histories of assaultive behavior. In J Cole (Chair), *Psychological and neuropsychological concomitants of violent behavior*. Symposium conducted at the American Psychological Association annual convention, Washington, DC.

Sellin T, Wolfgang ME (1964) *The measurement of delinquency*. New York: Wiley.

Shupe LM (1954) Alcohol and crime: A study of the urine. *J Criminal Law Criminol Police Sci* 44:661–664.

Tsuang MT, Winokur G (1974) Criteria for subtyping schizophrenia: Clinical differentiation of hebephrenia and paranoid schizophrenia. *Arch Gen Psychiatry* 31:43–47.

Walker MA (1978) Measuring the seriousness of crimes. *Br J Criminol* 18:348–364.

Weinberger DR, Torrey EF, Neophytides AN, et al (1979) Lateral cerebral ventricular enlargement in chronic schizophrenia *Arch Gen Psychiatry* 36:735–739.

Wolfgang ME, Strohm RB (1956) The relationship between alcohol and criminal homicide. *Q J Studies Alcohol* 17:411–425.