

# Psychotic Domestic Murder: Neuropsychological Differences Between Homicidal and Nonhomicidal Schizophrenic Men

Robert E. Hanlon · Joseph J. Coda · Derin Cobia · Leah H. Rubin

Published online: 13 January 2012  
© Springer Science+Business Media, LLC 2012

**Abstract** There is substantial evidence that individuals with schizophrenia are at increased risk for violent criminal behavior and an even higher risk for committing murder, relative to the general population. Neuropsychological features of seven schizophrenic men who murdered family members were compared to neuropsychological features of seven schizophrenic men with no history of violence, criminal offenses or antisocial behavior. The two groups were matched for age, education, race, gender, handedness, and diagnosis, and had similar psychotic symptom profiles and substance abuse histories. The schizophrenic murderers demonstrated significantly worse neuropsychological impairment, involving executive dysfunction and memory dysfunction, relative to nonviolent schizophrenic men. Implications include: (1) specific neuropsychological deficits may increase the likelihood of some schizophrenic men to murder family members due to an impaired capacity to inhibit impulsive violent aggression; (2)

neuropsychological status of schizophrenic defendants who commit domestic homicide should be considered by the trier-of-fact when they are tried for murder.

**Keywords** Schizophrenia · Homicide · Parricide · Murder · Neuropsychological testing

## Schizophrenic Violence

Studies of violence and schizophrenia have widely documented an increased risk for violent criminal acts among individuals with schizophrenia when compared to the general population (e.g., Brennan et al. 2000; Fazel et al. 2009a; Swanson et al. 2006; Swanson et al. 1990) and an increased risk for homicide, specifically (e.g., Erb et al. 2001; Fazel and Grann 2004; Wallace et al. 2004). However, there continues to be a general lack of consensus regarding the origins of violent behavior among individuals with schizophrenia (Hodgins 2008; Naudts and Hodgins 2006).

Psychiatric comorbidity, specifically personality disorders and substance abuse disorders, increases aggressive tendencies among individuals with schizophrenia (Cuffel et al. 1994; Fazel et al. 2009b; Hanlon and Mayfield 2005; Liettu et al. 2009; Swanson et al. 1990; Tiihonen et al. 1997; Wallace et al. 2004). Additionally, a history of antisocial behavior during childhood has been shown to significantly increase the likelihood of violent behavior in adults with schizophrenia, with the likelihood of violence increasing as a function of the number of antisocial behaviors (Swanson et al. 2008).

Numerous studies have implicated substance abuse as a primary risk factor for criminal violence among the mentally ill (e.g., Steadman et al. 1998; Fazel et al. 2009a,b; Vaughn et al. 2010). The potential for abused substances to induce aggression and paranoia may result in impulsivity, lack of

---

R. E. Hanlon  
Department of Psychiatry and Behavioral Sciences, Northwestern University Feinberg School of Medicine and Neuropsychological Associates of Chicago,  
Chicago, IL, USA

J. J. Coda · D. Cobia  
Department of Psychiatry and Behavioral Sciences, Northwestern University Feinberg School of Medicine,  
Chicago, IL, USA

L. H. Rubin  
Department of Psychiatry, University of Illinois at Chicago,  
Chicago, IL, USA

R. E. Hanlon (✉)  
Neuropsychological Associates of Chicago,  
645 N. Michigan Ave., Suite 803,  
Chicago, IL 60611, USA  
e-mail: r-hanlon@northwestern.edu

insight, and diminished awareness of the legal implications of criminal acts (Buckley et al. 2004; Krakowski et al. 1986). Additionally, lower socioeconomic status, criminal victimization (Vaughn et al. 2010), traumatic brain injury (Grafman et al. 1996; Wick et al. 2008), acute psychosis (Bourget et al. 2007; Humphreys et al. 1992; Liettto et al. 2009; Walsh et al. 2002), and undiagnosed/untreated schizophrenia (Swartz et al. 1998), have been associated with increased violent tendencies.

Paranoid delusions, a common feature of schizophrenia, have been implicated as a key factor in acts of violence towards someone believed to be a persecutor, often a relative or friend (Krakowski et al. 1986). Delusions involving threat and control override (TCO), characterized by the belief that a persecutor is threatening or controlling one's thoughts (Bjorkly 2002a; Link et al. 1998), are associated with violent acts directed toward the source of the delusional persecution.

With regard to hallucinations, studies of community-based samples of psychiatric patients have found no significant relationship between auditory hallucinations and violent behavior (e.g., Monahan et al. 2000; Swanson et al. 1996). However, Bjorkly's (2002b) review of studies on hallucinations and violence revealed evidence that *command* hallucinations were associated with a propensity to execute violent acts based on the commands.

## Parricide

Parricide is the act of murdering one's parent (i.e., matricide or patricide) or both parents. While not exclusive to schizophrenia, parricide is considered to be an act closely associated with schizophrenia (Green 1981; Singhal and Dutta 1992). In their review of documented cases of parricide, Hillbrand et al. (1999) found that offenders were typically single males with major psychopathology, including schizophrenia, mood disorders, and personality disorders. C. Green (1981) and Liettto et al. (2009) found paranoia and persecutory delusions to be common features of male parricidal offenders, and that matricide, in particular, is commonly committed by sons with schizophrenia.

Additionally, the psychological effects stemming from verbal and physical abuse by either parent may have deleterious and long-standing effects on individuals who are repeatedly victimized. These circumstances have been identified as a forecaster for individuals who murder their parent (s) (Marleau et al. 2006).

## Neuropsychological Abnormalities in Schizophrenia

Schizophrenia is a chronic debilitating psychiatric disorder that affects the development and formation of brain structure

(Keshavan et al. 2008) and consequently disrupts neurocognitive functioning (Palmer et al. 2009), in addition to producing the psychotic symptoms and negative symptoms classically associated with the disorder. This has led to the hypothesis that compromised neuropsychological functioning is a core feature of the disorder (Elvevag and Goldberg 2000).

Evidence from several avenues of research supports this hypothesis. Neuropsychological impairments emerge years before expression of psychotic symptoms (Hoff et al. 1999; Reichenbert et al. 2002), are considerably developed upon first psychiatric contact (Bilder et al. 2000; Saykin et al. 1994), persist upon remission of psychotic symptoms, and remain relatively stable over time (Barbarotto et al. 2001; Friedman et al. 2001; Martinez-Aran et al. 2002), are evident to a similar, yet mild, degree in non-psychotic siblings (Cannon et al. 1994; Goldberg et al. 1990; Goldberg et al. 1994), do not respond markedly to typical or atypical antipsychotic medication (Mishara and Goldberg 2004), and are related to functional outcome (Green 1996).

In general, the neurocognitive deficits associated with schizophrenia are commonly manifested in the following domains: attention and vigilance, working memory, language, learning and memory, perceptuomotor processing, and executive functions. The neuropsychological profile of schizophrenia is best characterized as broad impairments across the majority of cognitive domains. On average, cognitive deficits in schizophrenia fall approximately one standard deviation below the mean for healthy subjects (Bilder et al. 1995; Dickinson et al. 2007), with some falling below three standard deviations (Saykin et al. 1991; Saykin et al. 1994). Measures of memory and learning, processing speed, and executive control appear to have the strongest effect sizes. Neuropsychological studies of violent offenders with schizophrenia have found that violent schizophrenic individuals manifest significantly worse neurocognitive deficits (i.e., intellectual functions and memory) relative to nonviolent schizophrenic individuals and antisocial individuals without schizophrenia (e.g., Schug and Raine 2009).

The neurocognitive deficits described above are considered to be the result of structural and functional abnormalities of the schizophrenic brain. The most common findings are enlarged ventricles and reduction in whole brain volumes. Regarding the neocortex, the most consistent findings are volume loss in prefrontal and temporal regions, particularly left dorsolateral prefrontal cortices, as well as the left superior temporal gyrus (Honea et al. 2005). Cortical thinning in prefrontal and temporal regions has also been a consistent finding (Kuperberg et al. 2003; Narr et al. 2005). For subcortical structures, changes in the hippocampus (Csernansky et al. 1998), thalamus (Harms et al. 2007), and basal ganglia (Mamah et al. 2007) are also evident.

Neuroimaging studies of violent schizophrenic individuals have revealed significant reductions in gray matter volume in the hippocampus and orbitofrontal cortex (Barkataki et al. 2006; Kumari et al. 2009). Similarly, schizophrenic murder defendants revealed reduced gray matter volume in the hippocampus and parahippocampal gyrus (Yang et al. 2010). These findings suggest that specific structural abnormalities of the fronto-limbic system, involving the hippocampus, parahippocampal gyrus and the prefrontal cortex, may predispose schizophrenic individuals who are already functionally compromised, psychiatrically and neuropsychologically, to engage in impulsive aggression and commit unprovoked violent acts, due to diminished inhibitory control.

## Objectives

The primary hypothesis of the current study was that schizophrenic men who murder family members manifest significantly worse neuropsychological impairment than nonviolent schizophrenic men. Additionally, we hypothesized that schizophrenic murderers manifest significantly worse neuropsychological impairment in multiple neurocognitive domains, including executive functions, attention, and memory, relative to nonviolent schizophrenic men. Consistent with previous findings regarding the relationship between executive dysfunction and violent antisocial behavior, in general (e.g., Golden et al. 1996; Grafman et al. 1996; Morgan and Lilienfeld 2000), and murder, specifically (Hanlon et al. 2010), we hypothesized that a fundamental difference between homicidal and nonhomicidal schizophrenic men is that schizophrenic murderers manifest significantly worse executive dysfunction, resulting in an impaired capacity for inhibitory behavioral control.

## Method

### Subjects

Subjects consisted of 14 males diagnosed with schizophrenia, paranoid type (DSM-IV). The 14 subjects comprised two distinct subgroups: (1) seven subjects were schizophrenic men charged with and/or convicted of first degree murder in relation to the deaths of one or more family members; (2) seven subjects were schizophrenic men with no criminal history and no history of domestic violence or antisocial behavior. The seven murderers were a criminally homogeneous group, given the fact that all seven committed domestic homicides, specifically spontaneous domestic homicides (i.e., spontaneous killing of a member of the household by a family member) (Douglas et al. 2006). Five

of the seven murderers committed acts of parricide, involving the murder of one or both parents (i.e., matricide and/or patricide). One subject committed filicide, involving the murder of his daughter and one subject committed sororicide, involving the murder of his sister, as well as the attempted murder of his mother. Table 1 provides a brief description of the domestic murders and the relationship between offenders and victims.

The seven nonviolent/noncriminal schizophrenic subjects were recruited as part of an ongoing longitudinal study of schizophrenia at the Conte Center for Neuroscience of Mental Disorders at the Washington University School of Medicine in St. Louis, Missouri. Recruitment of the nonviolent/noncriminal schizophrenic subjects occurred at various inpatient and outpatient treatment centers in the Saint Louis area. Diagnostic evaluation of each subject involved completion of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) (First et al. 1997), combined with a detailed review of all data from present and past hospitalizations and corroborative personal sources (e.g., family).

All subjects were undergoing treatment with antipsychotic medication at the time of the neuropsychological evaluation. Exclusion criteria included the following: (1) met DSM-IV criteria for substance abuse (moderate or severe) or dependence (any type) at the time of the neuropsychological evaluation or during the 6 months prior to the neuropsychological evaluation; (2) diagnosis of a severe medical disorder that would confound the assessment of psychiatric diagnosis, (3) history of significant closed head trauma or traumatic brain injury with loss of consciousness; (4) documented history of mental retardation or learning disorder. The two groups were matched (i.e., no statistically significant differences) on the following variables: age, education, race, gender, and handedness, given the correlation between handedness and hemispheric dominance (i.e., cerebral localization of language). Table 2 summarizes the demographics, clinical characteristics, and criminal factors of the subjects as a function of murder. Overall, the two groups were similar across all socio-demographic variables, substance abuse history, and clinical symptom presentation.

### Procedures

All subjects underwent a structured clinical interview (SCID-I) and neuropsychological testing, including the following measures: Wechsler Adult Intelligence Scale-III (WAIS-III) (selected subtests), Wechsler Memory Scale-III (WMS-III) (Logical Memory subtest), a measure of encoding, retention and retrieval of narrative verbal information, the California Verbal Learning Test (CVLT), a measure of encoding, retention, and retrieval of noncontextual verbal information in list-learning paradigm, the Trail Making Test (TMT), a measure of visuomotor tracking and psychomotor

**Table 1** Brief descriptions of the domestic murders committed by seven schizophrenic men

Subject 1	27 year old, single, Caucasian male who lived with his mother; physically assaulted his mother in their home, then cut her head off with a kitchen knife; reportedly in response to repeated commands from God to “kill Satan”
Subject 2	28 year old, single, African American male who lived with his mother; stabbed his mother to death with a kitchen knife in their home; defendant reported that the murder of his mother was “revenge for how I grew up”
Subject 3	31 year old, single, Caucasian male who lived with his mother; stabbed his mother to death with a kitchen knife in their home; reportedly in response to repeated commands from “the voice” to “kill the demon”
Subject 4	31 year old, single, African American male who lived with his mother and sister; stabbed his sister to death with a kitchen knife in their home and stabbed his mother multiple times, but she survived; defendant reported that the homicidal acts were “accidents”
Subject 5	43 year old, married, Caucasian male who lived with his wife and two children; strangled and drown his daughter in the toilet; reportedly in response to commands from God or an “Angel of God” to “kill the devil”
Subject 6	28 year old, single, African American male who lived with his parents; stabbed his mother to death with a knife and shot his father to death with a handgun
Subject 7	29 year old, single, African American male who lived with his parents; shot his mother and father to death with a handgun

speed (i.e., Trail Making A) and executive function involving cognitive flexibility and rapid conceptual alternation (i.e., Trail Making B), Verbal Fluency (FAS), a measure of generative fluency requiring rapid retrieval of words based on phonemic properties, and the Wisconsin Card Sorting Test (WCST), a measure of executive function requiring hypothesis testing, cognitive flexibility, and decision-making. All murderers underwent neuropsychological evaluations as part of their forensic examinations. In addition to the standardized neuropsychological tests listed above, all murderers successfully completed three independent symptom validity tests during the neuropsychological evaluations, in order to provide objective evidence of sufficient test-taking effort. Specifically, all seven murderers successfully completed the Test of Memory Malinger, the Word Memory Test, and the Rey 15-Item Memory Test, in addition to embedded symptom validity measures, including the Reliable Digit Span and recognition hits (i.e., > 9) on the CVLT. The nonviolent/noncriminal subjects were not administered independent symptom validity tests, but all seven subjects successfully completed embedded symptom validity measures, including the Reliable Digit Span and achieved a recognition hit score of greater than nine on the CVLT. As a result of the successful completion of several independent and/or embedded symptom validity measures, all neuropsychological test data were considered to validly and accurately represent their neuropsychological status at the time of the evaluations.

### Statistical Analyses

Data were analyzed using SPSS 15 for Windows. Group differences on neuropsychological measures were evaluated using the nonparametric Mann–Whitney *U* test. Findings are presented as means and standard deviations. Because of the small sample size in each group, effect sizes are also

presented and were computed using Cohen’s *d* where small, medium, and large effect sizes correspond to values of 0.20, 0.50, and 0.80, respectively.

## Results

### Verbal Memory and Learning

Table 3 shows means, standard deviations, and relevant test statistics for various aspects of verbal memory and learning on the CVLT and the Logical Memory subtest of the WMS-III. Verbal memory functions of the schizophrenic subjects who committed murder were significantly worse than those of the nonviolent/noncriminal schizophrenic subjects on two measures from the CVLT: (1) Verbal encoding as established by the total number of words recalled across five repeated learning trials on List A ( $p=0.04$ ,  $d=1.37$ ); (2) Level of verbal encoding as established by the total number of words recalled on Trial 5 ( $p<0.05$ ,  $d=1.24$ ). Although there were no other significant group differences on the CVLT measures, medium to large effect sizes were observed, in the expected direction, on the two remaining learning indices (Cohen’s *d*’s ranged 0.74–1.07), on one index of short term memory (i.e., short delay free recall,  $d=0.69$ ), the three indices of long-term memory (Cohen’s *d*’s ranged 0.85–0.97), and on the rate of forgetting ( $d=0.62$ ). Medium to large effect sizes were also observed, in the expected direction, on two organizational strategies on the CVLT: subjective clustering ( $d=1.00$ ) and serial clustering ( $d=0.79$ ), whereby schizophrenic murderers tended to use less effective organizational strategies compared to the nonviolent schizophrenic men.

On the Logical Memory subtest of the WMS-III, a measure of narrative verbal encoding and recall, no significant differences were noted between the groups on the immediate

**Table 2** Demographics, clinical characteristics, and criminal factors for schizophrenic subjects as a function of murder

Variables	Schizophrenic subjects	
	Committed murder ( <i>n</i> =7)	Nonviolent-noncriminal ( <i>n</i> =7)
Mean age (SD)	31.00 (5.45)	27.60 (3.23)
Mean years of education (SD)	12.29 (1.80)	10.86 (2.27)
Race, <i>n</i> (%)		
African-American	4 (57)	4 (57)
Caucasian	3 (43)	3 (43)
Sex, <i>n</i> (% Male)	7 (100)	7 (100)
Handedness, <i>n</i> (% Right)	7 (100)	7 (100)
Mean WAIS vocabulary (SD)	7.50 (2.35)	7.00 (2.77)
Type of housing, <i>n</i> (%)		
Alone	0 (0)	0 (0)
Lives with parents	5 (72)	4 (57)
Lives with roommate	0 (0)	1 (14)
In hospital	0 (0)	1 (14)
Lives with family	1 (14)	0 (0)
Lives with friend	1 (14)	1 (14)
Positive symptoms, <i>n</i> (% yes)		
Hallucinations	7 (100)	5 (71)
Auditory	7 (100)	5 (71)
Command	4 (57)	3 (43)
God/Satan content	4 (57)	1 (14)
Delusions	7 (100)	7 (100)
Paranoid	5 (71)	7 (100)
Grandiose	1 (14)	4 (57)
Religious	4 (57)	2 (29)
God/Satan content	4 (57)	3 (43)
Drug abuse, <i>n</i> (% yes)		
Alcohol	4 (57)	4 (57)
Cannabis	2 (29)	6 (86)
Cocaine	2 (29)	2 (29)
Heroin	1 (14)	1 (14)
Hallucinogen	0 (0)	0 (0)
Stimulant	0 (0)	1 (14)
Mean number of drugs (SD)	1.29 (1.50)	2.14 (1.35)
Criminal characteristics, <i>n</i> (% yes)		
Criminal history	3 (43)	0 (0)
History of violence	2 (29)	0 (0)

From the structured clinical interview for DSM disorders (SCID)

( $p=0.83$ ,  $d=0.18$ ) or delayed paragraph recall ( $p=0.24$ ,  $d=0.63$ ). However, a medium effect size was observed, in the expected direction, on the delayed paragraph recall with murderers performing worse than subjects with no violent or criminal history.

### Executive Functioning

Table 4 shows means, standard deviations, and relevant test statistics for measures of executive functioning. Schizophrenic murderers performed worse than nonviolent schizophrenic men on several measures from the WCST, including the number of categories completed ( $p=0.02$ ,  $d=1.50$ ), number of perseverative errors ( $p=0.04$ ,  $d=1.00$ ), and number of perseverative responses ( $p=0.03$ ,  $d=1.03$ ). A non-significant trend in the same direction was also noted on the trials to complete the first category on the WCST ( $p=0.09$ ,  $d=0.77$ ). There were no other significant differences between the two groups on measures of executive functioning. However, a medium effect size (pattern of effects in the same direction) was also revealed on verbal fluency (FAS) ( $d=0.52$ ).

### Discussion

Although the propensity for individuals with schizophrenia to commit violent criminal acts (e.g., Brennan et al. 2000; Hodgins 2008; Naudts and Hodgins 2006), including homicide (e.g., Wallace et al. 2004), is well established, the role of neuropsychological impairment in impulsive violent aggression, such as spontaneous domestic homicide, has not been extensively examined (e.g., Schug and Raine 2009; Yang et al. 2010). Based on the current findings, the severity of neurocognitive impairment manifested by men with paranoid schizophrenia, appears to be a contributing factor with regard to the commission of spontaneous domestic homicide. Specifically, when compared to nonviolent schizophrenic men with similar psychotic symptom profiles and substance abuse histories, who were matched for age, education, race, gender, and handedness, schizophrenic men who committed spontaneous domestic homicide (i.e., murder of one or more family members) manifested significantly worse neuropsychological impairments, involving memory and executive dysfunction.

Executive functioning of the schizophrenic murderers was significantly worse than the nonviolent schizophrenic controls, as assessed with the WCST, a measure of cognitive flexibility and concept formation, requiring selective response inhibition and the formulation of alternative solutions to novel problems based on direct feedback regarding the accuracy of one's decisions. The behavioral implications of this difference in executive functions include the following: (1) A defective capacity for response inhibition or inhibitory control may render a psychotic individual who is experiencing command hallucinations less capable of inhibiting impulsive aggressive actions; (2) Cognitive rigidity manifested in the form of perseverative thought patterns may render a psychotic individual suffering from paranoid

**Table 3** Performance of schizophrenic murderers and nonviolent/noncriminal schizophrenic men on selected indices of the California Verbal Learning Test (CVLT) and the Wechsler Memory Scale-III (WMS-III)

Tests	Schizophrenic subjects		P	Cohen's <i>d</i>
	Committed murder ( <i>n</i> =7) M (SD)	Nonviolent ( <i>n</i> =7) M (SD)		
CVLT				
Verbal encoding				
Trial 1 (total)	4.57 (1.40)	5.14 (0.69)	0.21	0.54
Total recall trials 1-5	35.14 (9.46)	45.29 (5.41)	0.04	1.37
Trial 5 (total)	8.86 (3.13)	12.00 (1.92)	0.049	1.24
Learning slope	-0.50 (1.53)	0.36 (0.80)	0.33	0.74
Trials 5 minus 1	4.29 (3.35)	6.86 (1.46)	0.16	1.07
Short-term memory				
Short delay free recall	7.57 (2.82)	9.00 (1.83)	0.37	0.62
Short delay cued recall	8.71 (1.98)	9.29 (2.43)	0.61	0.26
Long-term memory				
Long delay free recall	7.00 (2.24)	9.43 (2.76)	0.11	0.97
Long delay cued recall	8.00 (2.16)	9.86 (2.19)	0.14	0.86
Recognition discriminability	-1.00 (1.00)	-0.14 (1.03)	0.10	0.85
Rate of forgetting				
Short- long-delay free recall	0.57 (0.98)	-0.43 (2.23)	0.10	0.62
Organizational strategies				
Semantic cluster	-0.36 (0.56)	-0.21 (0.91)	0.74	0.20
Serial cluster	-0.43 (0.53)	0.29 (1.29)	0.19	0.79
Subjective cluster	-0.50 (0.41)	-0.07 (0.45)	0.11	1.00
Wechsler memory scale-III				
Logical memory test (SS)†				
Immediate recall	6.50 (1.38)	6.86 (2.73)	0.83	0.18
Delay recall	7.83 (0.98)	6.57 (3.05)	0.24	0.63

SS scaled scores

and persecutory delusional beliefs incapable of formulating nonviolent alternatives to stopping their perceived

persecution; (3) The diminished capacity to benefit from direct feedback regarding the accuracy of one's decisions

**Table 4** Performance on measures of executive functioning and working memory by schizophrenic murderers and nonviolent/noncriminal schizophrenic men

Tests	Schizophrenic subjects		P	Cohen's <i>d</i>
	Committed murder ( <i>n</i> =7) M (SD)	Nonviolent ( <i>n</i> =7) M (SD)		
Trail making test (seconds)				
Trails A	51.29 (23.77)	43.53 (14.63)	0.85	0.40
Trails B	118.86 (39.33)	111.13 (62.76)	0.57	0.20
FAS total correct	24.71 (9.36)	31.29 (15.94)	0.48	0.52
WCST				
Trials to complete 1st	39.57 (41.10)	18.43 (14.03)	0.09	0.77
Categories completed	3.14 (2.12)	5.57 (1.13)	0.02	1.50
Perseverative errors	35.14 (27.94)	15.29 (11.63)	0.04	1.00
Perseverative responses	42.86 (36.25)	16.71 (14.51)	0.03	1.03
Letter number sequencing (SS)†	8.17 (1.60)	8.00 (2.16)	0.99	0.09
Digit span (total) (SS)				
Forward span	7.29 (1.25)	8.57 (2.61)	0.33	0.66
Backward span	8.00 (1.73)	8.86 (2.12)	0.36	0.45
	5.29 (2.14)	6.29 (2.14)	0.33	0.47

SS scaled scores. FAS verbal fluency. WCST Wisconsin card sorting task. † One subject who committed murder was missing data on letter-number sequencing

may render a psychotic individual who is experiencing command hallucinations and persecutory delusions unable to comprehend or appreciate the consequences of his aggressive behavior.

Memory functions, particularly verbal encoding, of the schizophrenic murderers were also significantly worse than selective memory functions of the nonviolent schizophrenic controls, as assessed with the CVLT. Rate of verbal encoding (i.e., acquisition of to-be-remembered verbal information) of the schizophrenic murderers was significantly slower and the amount of encoded verbal information was significantly less than that of the nonviolent schizophrenic controls. The functional implications of this difference in memory encoding include the following: (1) A defective rate of encoding reflects an abnormally slow rate of information processing that may render a psychotic individual less capable of acquiring new information that may impact and possibly influence delusional thought processes; (2) A deficient level of encoding denotes that a substantial portion of available information is not acquired or successfully encoded, and as a result, that information is not available for future retrieval. This failure to successfully encode information provided by a perceived persecutor may exacerbate persecutory delusions when a psychotic individual is subsequently questioned or challenged by the perceived persecutor regarding the previously provided information, because the psychotic individual can neither recall nor recognize information that was never encoded.

Clearly there are numerous limitations to the current findings. First, the sample sizes are quite small thereby limiting generalization to all schizophrenic individuals who commit spontaneous domestic homicide. Conversely, the fact that significant effects were demonstrated in such small samples, in a way, strengthens the findings. Second, none of the nonviolent schizophrenic subjects reportedly manifested homicidal ideation, whereas all of the murderers manifested homicidal ideation, at least briefly, at the time of the crime. Third, although the two groups were matched on multiple demographic variables, as well as the basic types of psychotic symptoms and history of substance abuse, other aspects of psychotic thought content were not controlled. Finally, all of the murderers killed family members, primarily parents and predominantly mothers. Obviously, the relationships between parents and sons are characterized by longstanding familial dynamics that are influenced by a host of factors. Those factors generally remain unknown for the subjects in both groups.

Despite these limitations, the current findings provide empirical support for the notion that neuropsychological impairment, involving specific neurocognitive deficits that are commonly manifested by individuals with schizophrenia, may be a key factor to understanding why some schizophrenic men spontaneously murder family members. As

such, these findings suggest that, in addition to the presence and type of psychotic symptoms manifested by schizophrenic individuals who commit murder, the trier-of-fact should also consider the type and severity of neuropsychological impairment manifested by schizophrenic individuals who are charged with murder. Clearly, it is imperative that the trier-of-fact be provided with all relevant information regarding the mental abnormalities manifested by schizophrenic individuals who commit murder. Given the current findings, objective test data obtained from neuropsychological evaluations may assist the trier-of-fact in rendering sound and informed decisions by providing information regarding neurocognitive defects, particularly executive dysfunction, that likely influenced the commission of the homicidal act. Finally, given the current findings, neuropsychological assessment of schizophrenic individuals with homicidal ideation may help predict if such individuals have increased potential to murder family members.

## References

- Barbarotto, R., Castignoli, G., Pasetti, C., & Laiacona, M. (2001). Global cognitive decline in schizophrenia with remission of symptoms? *Brain and Cognition*, *46*(1–2), 29–34.
- Barkataki, I., Kumari, V., Das, M., Taylor, P., & Sharma, T. (2006). Volumetric structural brain abnormalities in men with schizophrenia or antisocial personality disorder. *Behavioral Brain Research*, *169*(2), 239–247.
- Bilder, R. M., Bogerts, B., Ashtari, M., Wu, H., Alvir, J. M., Jody, D., ... Lieberman, J. A. (1995). Anterior hippocampal volume reductions predict frontal lobe dysfunction in first episode schizophrenia. *Schizophrenia Research*, *17*(1), 47–58.
- Bilder, R. M., Goldman, R. S., Robinson, D., Reiter, G., Bell, L., Bates, J. A., ... Lieberman, J. A. (2000). Neuropsychology of first-episode schizophrenia: Initial characterization and clinical correlates. *American Journal of Psychiatry*, *157*(4), 549–559.
- Bjorkly, S. (2002a). Psychotic symptoms and violence towards others – a literature review of some preliminary findings. Part 1: delusions. *Aggression and Violent Behavior*, *7*(6), 617–631.
- Bjorkly, S. (2002b). Psychotic symptoms and violence towards others – a literature review of some preliminary findings. Part 2: hallucinations. *Aggression and Violent Behavior*, *7*(6), 605–615.
- Bourget, D., Gagne, P., & Labelle, M. (2007). Parricide: a comparative study of matricide versus patricide. *The Journal of the American Academy of Psychiatry and the Law*, *35*(3), 306–312.
- Brennan, P., Mednick, S., & Hodgins, S. (2000). Major mental disorders and criminal violence in a Danish birth cohort. *Archives of General Psychiatry*, *57*(5), 494–500.
- Buckley, P. F., Hrouda, D. R., Friedman, L., Noffsinger, S. G., Resnick, P. J., & Camlin-Shingler, K. (2004). Insight and its relationship to violent behavior in patients with schizophrenia. *The American Journal of Psychiatry*, *161*(9), 1712–1714.
- Cannon, T. D., Zorrilla, L. E., Shtasel, D., Gur, R. E., Gur, R. C., Marco, E. J., ... Price, R. A. (1994). Neuropsychological functioning in siblings discordant for schizophrenia and healthy volunteers. *Archives of General Psychiatry*, *51*(8), 651–661.
- Csernansky, J. G., Joshi, S., Wang, L., Haller, J. W., Gado, M., Miller, J. P., ... Miller, M. I. (1998). Hippocampal morphometry in schizophrenia by high dimensional brain mapping. *Proceedings*

- of the National Academy of Sciences of the United States of America, 95(19), 11406–11411.
- Cuffel, B. J., Shumway, M., Choujian, T. L., & MacDonald, T. (1994). A longitudinal study of substance use and community violence in schizophrenia. *The Journal of Nervous and Mental Disease*, 182(12), 704–708.
- Dickinson, D., Ramsey, M. E., & Gold, J. M. (2007). Overlooking the obvious: a meta-analytic comparison of digit symbol coding tasks and other cognitive measures in schizophrenia. *Archives of General Psychiatry*, 64(5), 532–542.
- Douglas, J. E., Burgess, A. W., Burgess, A. G., & Ressler, R. K. (2006). *Crime classification manual* (2nd ed.). San Francisco: Jossey-Bass.
- Elvevag, B., & Goldberg, T. E. (2000). Cognitive impairment in schizophrenia is the core of the disorder. *Critical Reviews in Neurobiology*, 14(1), 1–21.
- Erb, M., Hodgins, S., Freese, R., Muller-Isberner, R., & Jockel, D. (2001). Homicide and schizophrenia: maybe treatment does have a preventive effect. *Criminal Behaviour and Mental Health*, 11(1), 6–26.
- Fazel, S., & Grann, M. (2004). Psychiatric morbidity among homicide offenders: a Swedish population study. *The American Journal of Psychiatry*, 161(11), 2129–2131.
- Fazel, S., Grann, M., Carlstrom, E., Lichtenstein, P., & Langstrom, N. (2009). Risk factors for violent crime in schizophrenia: a national cohort study of 13, 806 patients. *The Journal of Clinical Psychiatry*, 70(3), 362–369.
- Fazel, S., Langstrom, N., Hjern, A., Grann, M., & Lichtenstein, P. (2009). Schizophrenia, substance abuse, and violent crime. *Journal of the American Medical Association*, 301(19), 2016–2023.
- First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1997). *Structured clinical interview for DSM-IV axis I disorders*. Arlington: American Psychiatric Association.
- Friedman, J. I., Harvey, P. D., Coleman, T., Moriarty, P. J., Bowie, C., Parrella, M., ... Davis, K. L. (2001). Six-year follow-up study of cognitive and functional status across the lifespan in schizophrenia: A comparison with Alzheimer's disease and normal aging. *American Journal of Psychiatry*, 158(9), 1441–1448.
- Goldberg, T. E., Ragland, J. D., Torrey, E. F., Gold, J. M., Bigelow, L. B., & Weinberger, D. R. (1990). Neuropsychological assessment of monozygotic twins discordant for schizophrenia. *Archives of General Psychiatry*, 47(11), 1066–1072.
- Goldberg, T. E., Torrey, E. F., Berman, K. F., & Weinberger, D. R. (1994). Relations between neuropsychological performance and brain morphological and physiological measures in monozygotic twins discordant for schizophrenia. *Psychiatry Research*, 55(1), 51–61.
- Golden, C. J., Jackson, M. L., Peterson-Rohne, A., & Gontkovsky, S. T. (1996). Neurocycological correlates of violence and aggression: a review of the clinical literature. *Aggression and Violent Behavior*, 1(1), 3–25.
- Grafman, J., Schwab, K., Warden, D., Pridgen, A., Brown, H. R., & Salazar, A. M. (1996). Frontal lobe injuries, violence, and aggression: a report of the Vietnam head injury study. *Neurology*, 46(5), 1231–1238.
- Green, C. M. (1981). Matricide by sons. *Medicine, Science, & the Law*, 21(3), 207–214.
- Green, M. F. (1996). What are the functional consequences of neurocognitive deficits in schizophrenia? *The American Journal of Psychiatry*, 153(3), 321–330.
- Hanlon, R. E., & Mayfield, M. W. (2005). Murder in Chicago: insanity and tragedy. In R. L. Heilbrunner (Ed.), *Forensic neuropsychology casebook* (pp. 268–284). New York: Guilford Press.
- Hanlon, R. E., Rubin, L. H., Jensen, M., & Daoust, S. (2010). Neuropsychological features of indigent murder defendants and death row inmates in relation to homicidal aspects of their crimes. *Archives of Clinical Neuropsychology*, 25(1), 1–13.
- Harms, M. P., Wang, L., Mamah, D., Barch, D. M., Thompson, P. A., & Csernansky, J. G. (2007). Thalamic shape abnormalities in individuals with schizophrenia and their nonpsychotic siblings. *The Journal of Neuroscience*, 27(50), 13835–13842.
- Hillbrand, M., Alexandre, J. W., Young, J. L., & Spitz, R. T. (1999). Parricides: characteristics of offenders and victims, legal factors, and treatment issues. *Aggression and Violent Behavior*, 4(2), 179–190.
- Hodgins, S. (2008). Violent behavior among people with schizophrenia: a framework for investigations of causes, and effective treatment, and prevention. *Philosophical Transactions of the Royal Society B*, 363, 2505–2518. doi:10.1098/rstb.2008.0034.
- Hoff, A. L., Sakuma, M., Wieneke, M., Horon, R., Kushner, M., & DeLisi, L. E. (1999). Longitudinal neuropsychological follow-up study of patients with first-episode schizophrenia. *The American Journal of Psychiatry*, 156(9), 1336–1341.
- Honea, R., Crow, T. J., Passingham, D., & Mackay, C. E. (2005). Regional deficits in brain volume in schizophrenia: a meta-analysis of voxel-based morphometry studies. *The American Journal of Psychiatry*, 162(12), 2233–2245.
- Humphreys, M. S., Johnstone, E. C., MacMillan, J. F., & Taylor, P. J. (1992). Dangerous behaviour preceding first admission for schizophrenia. *The British Journal of Psychiatry*, 161, 501–505. doi:10.1192/bjp.161.4.501.
- Keshavan, M. S., Tandon, R., Boutros, N., & Nasrallah, H. A. (2008). Schizophrenia, “just the facts”: what we know in 2008: part 3: neurobiology. *Schizophrenia Research*, 106(2–3), 89–107.
- Krakowski, M., Volavka, J., & Brizer, D. (1986). Psychopathology and violence: a review of literature. *Comprehensive Psychiatry*, 27(2), 131–148.
- Kumari, V., Barkataki, I., Goswami, S., Foor, S., Das, M., & Taylor, P. (2009). Dysfunctional, but not functional, impulsivity is associated with a history of seriously violent behavior and reduced orbitofrontal and hippocampal volumes in schizophrenia. *Psychiatry Research: Neuroimaging*, 173, 39–44.
- Kuperberg, G. R., Broome, M. R., McGuire, P. K., David, A. S., Eddy, M., Ozawa, F., ... Fischl, B. (2003). Regionally localized thinning of the cerebral cortex in schizophrenia. *Archives of General Psychiatry*, 60(9), 878–888.
- Liettu, A., Saavala, H., Hakko, H., Rasanen, P., & Joukamaa, M. (2009). Mental disorders of male parricidal offenders. *Social Psychiatry and Psychiatric Epidemiology*, 44(2), 96–103.
- Link, B. G., Stueve, A., & Phelan, J. (1998). Psychotic symptoms and violent behaviors: probing the components of “threat/control-override” symptoms. *Social Psychiatry and Psychiatric Epidemiology*, 33(13), S55–S60.
- Mamah, D., Wang, L., Barch, D., de Erausquin, G. A., Gado, M., & Csernansky, J. G. (2007). Structural analysis of the basal ganglia in schizophrenia. *Schizophrenia Research*, 89(1–3), 59–71.
- Marleau, J. D., Auclair, N., & Millaud, F. (2006). Comparison of factors associated with parricide in adults and adolescents. *Journal of Family Violence*, 21(5), 321–325.
- Martinez-Aran, A., Penades, R., Vieta, E., Colom, F., Reinares, M., Benabarre, A., ... Gasto, C. (2002). Executive function in patients with remitted bipolar disorder and schizophrenia and its relationship with functional outcome. *Psychother Psychosom*, 71(1), 39–46.
- Mishara, A. L., & Goldberg, T. E. (2004). A meta-analysis and critical review of the effects of conventional neuroleptic treatment on cognition in schizophrenia: opening a closed book. *Biological Psychiatry*, 55(10), 1013–1022.
- Monahan, J., Steadman, H. J., Appelbaum, P. S., Robbins, P., Mulvey, E. P., Roth, L. H., & Grisso, T. (2000). Developing a clinically



- useful actuarial tool for assessing violence risk. *The British Journal of Psychiatry*, 176, 312–319. doi:10.1192/bjp.176.4.312.
- Morgan, A. B., & Lilienfeld, S. O. (2000). A meta-analytic review of the relation between antisocial behavior and neuropsychological measures of executive function. *Clinical Psychology Review*, 20(1), 113–136.
- Narr, K. L., Bilder, R. M., Toga, A. W., Woods, R. P., Rex, D. E., Szeszko, P. R., ... Thompson, P. M. (2005). Mapping cortical thickness and gray matter concentration in first episode schizophrenia. *Cerebral Cortex*, 15(6), 708–719.
- Naudts, K., & Hodgins, S. (2006). Neurobiological correlates of violent behavior among persons with schizophrenia. *Schizophrenia Bulletin*, 32(3), 562–572.
- Palmer, B. W., Dawes, S. E., & Heaton, R. K. (2009). What do we know about neuropsychological aspects of schizophrenia? *Neuropsychology Review*, 19(3), 365–384.
- Reichenbert, A., Weiser, M., Rabinowitz, J., Caspi, A., Schmeidler, J., Mark, M., ... Davidson, M. (2002). A population-based cohort study of premorbid intellectual, language, and behavioral functioning in patients with schizophrenia, schizoaffective disorder, and nonpsychotic bipolar disorder. *American Journal of Psychiatry*, 159(12), 2027–2035.
- Saykin, A. J., Gur, R. C., Gur, R. E., Mozley, P. D., Mozley, L. H., Resnick, S. M., ... Stafiniak, P. (1991). Neuropsychological function in schizophrenia. Selective impairment in memory and learning. *Archives of General Psychiatry*, 48(7), 618–624.
- Saykin, A. J., Shtasel, D. L., Gur, R. E., Kester, D. B., Mozley, L. H., Stafiniak, P., ... Gur, R. C. (1994). Neuropsychological deficits in neuroleptic naive patients with first-episode schizophrenia. *Archives of General Psychiatry*, 51(2), 124–131.
- Schug, R. A., & Raine, A. (2009). Comparative meta-analyses of neuropsychological functioning in antisocial schizophrenic persons. *Clinical Psychology Review*, 29(3), 230–242.
- Singhal, S., & Dutta, A. (1992). Who commits matricide? *Medicine, Science, & the Law*, 32(3), 213–217.
- Steadman, H. J., Mulvey, E. P., Monahan, J., Robbins, P. C., Applebaum, P. S., Grisso, T., Roth, L. H., & Silver, E. (1998). Violence by people discharged from acute psychiatric inpatient facilities and by others in the same neighborhoods. *Archives of General Psychiatry*, 55(5), 393–401.
- Swanson, J. W., Holzer, C. E., Ganju, V. K., & Jono, R. T. (1990). Violence and psychiatric disorders in the community: evidence from the epidemiologic catchment area surveys. *Hospital & Community Psychiatry*, 41(7), 761–770.
- Swanson, J. W., Borum, R., Swartz, M. S., & Monahan, J. (1996). Psychotic symptoms and disorders and the risk of violent behaviour in the community. *Criminal Behaviour and Mental Health*, 6(4), 309–329.
- Swanson, J. W., Swartz, M. S., Van Dorn, R. A., Elbogen, E. B., Wagner, H. R., Rosenheck, R. A., Stroup, S., McEvoy, J. P., & Lieberman, J. A. (2006). A national study of violent behavior in persons with schizophrenia. *Archives of General Psychiatry*, 63(5), 490–499.
- Swanson, J. W., Van Dorn, R. A., Swartz, M. S., Smith, A., Elbogen, E. B., & Monahan, J. (2008). Alternative pathways to violence in persons with schizophrenia: the role of childhood antisocial behavior problems. *Law and Human Behavior*, 32, 28–240. doi:10.1007/s10979-007-9095-7.
- Swartz, M., Swanson, J., Hiday, V., Borum, R., Wagner, H., & Burns, B. (1998). Violence and severe mental illness: the effects of substance abuse and nonadherence to medication. *The American Journal of Psychiatry*, 155(2), 226–231.
- Tiihonen, J., Isohanni, M., Rasanen, P., Koiranen, M., & Moring, J. (1997). Specific major mental disorders and criminality: a 26 year prospective study of 1966 northern Finland birth cohort. *The American Journal of Psychiatry*, 154(6), 840–845.
- Vaughn, M. G., Fu, Q., Delisi, M., Beaver, K. M., Perron, B. E., & Howard, M. O. (2010). Criminal victimization and comorbid substance use and psychiatric disorders in the United States from the NESARC. *Annals of Epidemiology*, 20(4), 281–288.
- Wallace, C., Mullen, P. E., & Burgess, P. (2004). Criminal offending in schizophrenia over a 25-year period marked by deinstitutionalization and increasing prevalence of comorbid substance use disorders. *The American Journal of Psychiatry*, 161(4), 716–727.
- Walsh, E., Buchanan, A., & Fahy, T. (2002). Violence and schizophrenia: examining the evidence. *The British Journal of Psychiatry*, 180, 490–495. doi:10.1192/bjp.180.6.490.
- Wick, R., Mitchell, E., Gilbert, J. D., & Byard, R. W. (2008). Matricides in South Australia: a 20-year retrospective review. *Journal of Forensic and Legal Medicine*, 15(3), 168–171.
- Yang, Y., Raine, A., Han, C., Schug, R. A., Toga, A. W., & Narr, K. L. (2010). Reduced hippocampal and parahippocampal volumes in murders with schizophrenia. *Psychiatry Research: Neuroimaging*, 182(1), 9–13.