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Psychiatric and Neurological Characteristics of Murder Defendants Referred for Pretrial Evaluation*

ABSTRACT: After literature review, this paper presents the largest study to date ($n = 270$) of psychiatric and neurological characteristics of accused murderers in the United States. This retrospective record review of pretrial detainees undergoing competency to stand trial and criminal responsibility evaluations examined demographic characteristics, psychiatric diagnosis, substance use patterns, Intelligence Quotient (IQ), and results of electroencephalogram (EEG), neuroimaging (MRI or CT) and neurological examination. Substance use and mood/adjustment disorders were common. Neuroimaging was abnormal in 18% of subjects and was associated with lower Performance IQ. EEG and neurological exam findings were not associated with measured cognitive impairment. While 16% of subjects had a FS IQ < 70, only 6% were diagnosed with mental retardation. Subjects with a psychotic disorder ($p = 0.001$) or an anxiety disorder ($p = 0.005$) were more likely to use a knife than other subjects in the study. Violence risk assessment in these patients must not only involve inquiry about firearm availability.

KEYWORDS: forensic science, forensic psychiatry, insanity defense, magnetic resonance imaging, electroencephalography, intelligence

In courts throughout the United States, murder and other forms of extreme violence have been associated with mental disorders and neurological abnormalities. This association has great significance for forensic mental health practitioners who are retained by defense attorneys to present a defendant's psychiatric or neurological illnesses to the court in an attempt to show that the defendant is incompetent to stand trial, or in cases of contested insanity, not criminally responsible. In death penalty cases a history of mental illness or organic brain impairment is frequently used by the defense for the purpose of mitigation or, in light of a recent U.S. Supreme Court decision, to bar the execution of the mentally retarded (1). Alternatively, prosecutors may attempt to use certain mental illnesses such as sexual disorders or personality disorders to establish future dangerousness as an aggravating factor.

Although courts continue to rely on expert testimony to educate juries about mental disorders, testimony in the fields of psychiatry and neurology has also been misused under the same guise. The use of medical experts as agents of influence in the courtroom has been an issue of debate since clinicians were qualified as experts over 200 years ago. The public perception of the misuse of the insanity defense stands as an example of the dissatisfaction with expert testimony in such cases (2–7). The gravity of capital murder trial outcomes on those accused, on the families of victims, and on the community at large demands that medical experts base their opinions on reliable information. Unfortunately, relatively little is known about the psychiatric and neurological characteristics of those accused or convicted of murder. Research involving accused or convicted murderers is inherently difficult due to problems with subject accessibility and informed consent issues that arise with incarcerated individuals or pretrial detainees. These obstacles to scientific research prevent exhaustive examination of this population, but several important studies have been published.

This paper reviews current literature and presents the largest study to date of psychiatric and neurological characteristics of accused murderers in the United States.

Literature

Violence has been associated with mental illness, *non compos mentis*, since at least the 16th century (8,9). Recent studies have continued to show that violent persons who commit violent offenses frequently have a psychiatric diagnosis (10). Neurological disorders have also been associated with violence. For example, families and caregivers have reported aggression and irritability in persons who have suffered traumatic brain injuries (11). Although the neurobiology of violent behavior remains a developing science (12,13), tools such as neuropsychological tests, electroencephalograms (EEGs) or radiographic studies have begun to clarify our understanding of the relationship between violence and abnormalities of the brain (14–20). Several studies have focused specifically on these findings in persons accused or convicted of murder.

Several investigators have commented on the presence of a psychiatric diagnosis in studies of individuals convicted of or charged with murder. Their results yield a broad range and prevalence of diagnoses. For example, Yarvis (21) found that 29% of his sample of 100 accused murderers had schizophrenia or affective psychosis based on DSM III criteria. He also reported a prevalence of antisocial personality disorder in 36% and borderline personality disorder in 18% of these defendants. Blake et al. (22) reported that 26% of murderers had paranoid schizophrenia, 29% had depression, and 13% had a dissociative disorder ($n = 31$). In contrast, other studies have found a much lower percentage of significant psychiatric illness. In a study of 54 accused murderers, Frierson et al. (23)

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reported only 11% suffered from a major mental illness (functional psychosis or mood disorder). Antisocial personality disorder was found in only 10% of accused murderers and other personality disorders were found in 10%. Another study noted that only 1 of 25 (4%) persons convicted of murder had schizophrenia, whereas 8% had psychopathic personality and an additional 44% were diagnosed with another personality disorder (24). The variability in diagnostic prevalence among different studies is likely due to differences in study groups and methodology, including diagnostic criteria. Nevertheless, the results of all of these studies reveal a prevalence of mental illness greater than would be expected in the general population. This prevalence represents an important consideration for the legal system, especially given the growing concerns about psychiatric and cognitive impairments in capital litigation.

Two studies have attempted to relate the presence of a mental disorder to dangerousness in murder defendants. A 1990 study used non-DSM antisocial personality disorder criteria in conjunction with low IQ to distinguish death row murderers from those who had received a life sentence (25). A large Finnish study of 693 persons who had committed homicide reported the odds ratio for murder increased eightfold for males with schizophrenia and 6.5 times for females. Antisocial personality disorder presented an odds ratio of a ten times greater likelihood for males to commit homicide and a 50 times greater likelihood for women to commit homicide. No increase in violence was linked to a mood, anxiety, or cognitive disorder (26). Although this study relates diagnosis to risk, the forensic practitioner may be questioned about the application of these general inferences to specific cases.

Psychological instruments have also shed light on the association between mental illness and murder. Studies that have focused on intelligence measures in this population have revealed variable results. Most have demonstrated normal or low-average mean intelligence scores in populations of murderers (15,25,27–29). Two studies have also demonstrated Weschler Full Scale IQ scores in the borderline range (23,30). In a study of death row inmates, a mean verbal IQ score of 81.5 has been reported (31). It may be of greater importance to consider the range of intelligence across this population, as a significant number of accused or convicted murderers may fall into the borderline or mentally retarded range as reported by Blake (22) in 29% of subjects ($n = 31$) and Lewis (15) in 33% ($n = 12$). Individuals with intelligence in the borderline or mentally retarded ranges are more likely than individuals with normal intelligence to be found not competent to stand trial or to lack criminal responsibility. They may also represent a subclass of convicted murderers who are adjudicated incompetent to be executed. As of 2001, 16 states had banned the death penalty for persons with mental retardation, regardless of their competency to be executed, and other states had introduced similar legislation (32). The U.S. Supreme Court noted these statutes in its decision to make mentally retarded persons ineligible for the death penalty in all states (1).

A number of studies have revealed neurological abnormalities in persons accused or convicted of murder. These abnormalities have been elicited from neurological examinations, EEG studies, and brain imaging. Three studies have reported deficits on physical examination. The first, a study of 31 persons awaiting trial for or appeal of murder, revealed an abnormal neurological examination in 71% of persons, with evidence of frontal dysfunction in nearly two-thirds (65%) and/or temporal dysfunction in about a third (29%) (22). Frierson reported that 15% of accused murderers ($n = 54$) had an abnormal neurological examination. The third study found that 15 of 15 death row inmates had a reported history of prior significant head injury, 12 of which could be confirmed by examination (15).

A study in 1962 by Winkler and Kove (33) was among the first to recommend the use of EEGs in persons charged with murder or manslaughter. Their research found that 13 of 55 persons with these charges had abnormal EEG findings. Other studies have challenged this recommendation. For example, Sayed et al. reported a higher rate of total EEG abnormalities in a population found legally insane (66%), but similar EEG changes in a control group (34). Driver et al.'s (24) commentary that there is no strong case for routine EEG examination of all murder defendants being assessed prior to trial is based on his study that found similar rates of abnormality among three groups: those charged with murder (9%), those charged with lesser charges (11%), and a control population (10%). Two more recent studies reported abnormal EEG rates of 15% (23) and 40% (22).

Neuroimaging, including computerized tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET), has offered an opportunity to objectively evaluate the brains of murder defendants. The Blake (22) and Frierson (23) studies both consider CT and MRI collectively. However, Blake's study of 19 individuals found that 9 (47%) had brain changes, mostly atrophy or white matter lesions, whereas Frierson's work suggests a much lower rate of imaging abnormality as only 5 of 54 murder defendants (9%) had findings on CT or MRI. One study has used PET to show reduced metabolism of glucose in the prefrontal lobes of murderers (35). Another study comparing "affective" murderers to "predatory" murderers found significant differences in bilateral prefrontal regulation as reflected by glucose metabolism (36).

These prior studies form the framework for the current investigation. This descriptive study involves a large database of pretrial detainees accused of murder and court-ordered to undergo a combined competency to stand trial and criminal responsibility evaluation. Because the goal of psychiatric and psychological evaluation of murderers is to offer accurate information to attorneys and the courts, it is important to determine which evaluation techniques may be most useful. The sociological and legal implications of results are relevant to a variety of legal issues, including competency to stand trial and criminal responsibility, diminished capacity, mitigation, capacity for rehabilitation, and decisions regarding competency to be executed.

Method

The Institutional Review Board (IRB) of the South Carolina Department of Mental Health (SCDMH) approved this research project. All subjects in this retrospective record review underwent court-ordered competency to stand trial (CST) and criminal responsibility (CR) evaluations at William S. Hall Psychiatric Institute between January 1995 and September 2000. These subjects were referred for evaluation from criminal courts throughout South Carolina. During this period, 297 murder defendants underwent pretrial evaluation and complete records were located for 270 of these subjects ($n = 270$). At the time of evaluation, prosecutors had notified 13 of these murder defendants of intent to seek the death penalty. These evaluations included a review of police records and other evidence related to the alleged offense, prior inpatient and outpatient mental health records, and a social history obtained from a family member. The clinical forensic assessment followed a protocol utilized at the examining facility that included a diagnostic interview, mental status examination, competency to stand trial and criminal responsibility interview, MRI or CT scan, EEG, neurological examination, and psychological intelligence measurement using the Wechsler Adult Intelligence Scale–Revised (WAIS-R) or Wechsler Adult Intelligence Scale–Third Edition (WAIS-III).

Demographic variables examined in this study included age, sex, race, marital status, inpatient and outpatient psychiatric history, presence of a codefendant, relationship to the victim (spouse or paramour, parent, child, sibling, relative, acquaintance, stranger), sex and race of victim, weapon choice (gun, knife, other), and use of substances at the time of the alleged crime. Diagnoses were recorded from court reports for up to five Axis I diagnoses and two Axis II diagnoses. Diagnoses included those present at the time of the alleged offense as well as those present at the time of the evaluation. The opinions regarding CST and CR were recorded as well as the opinion as to whether the defendant lacked substantial capacity to conform their conduct to the requirements of the law, a finding that would make them eligible for a guilty but mentally ill (GBMI) verdict in South Carolina (37). In South Carolina a defendant may be found not guilty by reason of insanity (NGRI) if, as a result of mental disease or defect, they lacked the ability to distinguish legal or moral right from legal or moral wrong or to recognize the particular act charged as morally or legally wrong (38). Because those initially found incompetent to stand trial but likely to be restored to competency with treatment were eventually treated for a two-month period, only CST data from the final court report (i.e., after treatment) were recorded.

After a descriptive statistical analysis of this database ($n = 270$), a series of 2×2 cross-tabulation analyses were performed comparing various categorical characteristics of the murderers in the sample, including gender, ethnicity, diagnostic category, substance abuse, relationship to victim, and organicity. Chi-square analyses were performed to assess the extent and significance of various associations. In addition, a series of analyses of variance (ANOVAs) were performed to determine if there were any differences in IQ between subjects with and without evidence of organicity on MRI, EEG, or neurological examination.

TABLE 1—*Demographic variables.*

Mean age	32.8 years (range 17–79)
Sex	88% male, 12% female
Race	37% Caucasian
	63% African American
Marital status	59% single
	16% divorced
	15% married
	10% widowed
Inpatient psychiatric history	28% yes, 72% no
Outpatient psychiatric history	39% yes, 61% no
Presence of codefendant	16% yes, 84% no
Relationship to victim	37% Acquaintance
	23% Spouse
	21% Stranger
	10% Relative
	3% Parent
	6% Child
Sex of victim	62% Male
	38% Female
Race of victim	47% Caucasian
	53% African American
Weapon choice	59% Firearm
	16% Knife
	25% Other
Use of substances at crime	23% Alcohol
	7% Cocaine
	6% Cannabis

TABLE 2—*Diagnostic characteristics using DSM III-R and DSM IV.*

Any Axis I or II disorder	91%
Any Axis I disorder	86%
Substance use disorder	64%
Mood disorder	13%
Adjustment disorder	13%
Psychotic disorder	8%
Anxiety disorder	7%
Cognitive disorder (dementia, delirium)	6%
Developmental disorder	4%
Personality disorder	13%
Mental retardation	6%

Results

The demographic variables are summarized in Table 1. Marital status was recorded for the record at the time of the evaluation and inpatient and outpatient psychiatric histories were recorded for the time period prior to the alleged offense. For subjects who had an inpatient psychiatric history, the average number of hospitalizations was two (range 1–14). The use of substances at the time of the alleged offense was recorded from both police and defendant reports.

Diagnostically, substance use disorders were most common, but mood and adjustment disorders were also frequent (see Table 2). While 64% of subjects met diagnostic criteria for a substance related disorder, the individual rates of substance dependence or abuse diagnoses were as follows: alcohol 42%, cannabis 27%, cocaine 23%, opioid 2%, and other 6%. Men in this sample were 4.64 times more likely than women to have a history of substance abuse (Chi-square = 16.57, $p = 0.0000$). The most common substance used at the time of the alleged offense was alcohol (23%). This sample had an 83% rate of substance use, regardless of whether or not diagnostic criteria for a substance use disorder were met. For example, 74% reported a history of alcohol use, 36% reported a history of cannabis use, and 47% reported a history of cocaine use. On Axis III, nervous system diseases were diagnosed in 7% of subjects, including seizure disorders (4%).

The vast majority of defendants were eventually found competent to stand trial (93%), criminally responsible (97%), and to have the capacity to conform their behavior to the requirements of the law (96%).

Twenty-nine percent of these murder defendants had a history of a head injury accompanied by a loss of consciousness. MRI or CT scans were abnormal in 18% of 269 subjects (see Table 3). Electroencephalogram abnormalities were found in 15% of 268 subjects (see Table 4). Most frequently, those abnormalities that were localized involved the temporal lobe (28% of abnormal EEGs). Neurological examinations were normal in 98% of subjects and did not detect the brain pathology seen on neuroimaging or EEG. All of the subjects who had abnormal neurological exams also had abnormalities on EEG and imaging except for one subject whose neurological exam revealed evidence of cerebellar dysfunction. The average Full Scale IQ was 83 (range 56–132) with an average Verbal IQ of 83 (range 54–131) and Performance IQ of 84 (range 56–132). Sixteen percent of defendants had a FS IQ < 70, but only 38% of these low-IQ defendants were assigned a diagnosis of mental retardation. In examining the logistic associations between IQ and competency to stand trial, lower IQ was strongly associated with a finding of incompetence ($p < 0.0006$). Neuroimaging and EEG abnormalities were not associated with a lower Full Scale or Verbal IQ. However, subjects with abnormal MRI/CT results had significantly lower Performance IQ scores on average when compared with subjects who had normal MRI/CT results (80.7 points versus 85.4 points; $F = 4.33$, $p = 0.039$).

TABLE 3—*MRI/CT abnormalities.*

Interhemispheric subdural hematoma
Gliotic injury to bilateral frontal lobes and temporal lobe tips
Bullet lodged in left parietal/occipital lobe
Interhemispheric subdural hematoma and contusion of left frontoparietal region
Moderate atrophy
Generalized cerebral atrophy and periventricular leukomalacia
Interhemispheric subdural hematoma
Subcortical hyper intensities consistent with gliosis
Central atrophy and asymmetric aeration of the left anteriorclinoid vs. ICA aneurysm
Extreme encephalomalacia in right temporal and parietal lobe
Premature atrophy
Metal fragments in right frontal lobe
Cyst in posterior fossa
Left ventricle larger than right
Left frontal encephalomalacia and gliosis; left temporal cyst, left MCA infarct
Enlarged posterior and occipital horns and left lateral ventricle
Right pontine glioma
Micro infarct in left frontoparietal white matter
Bilateral basal ganglia infarcts and diffuse hyper intense white matter signal
Gliosis and encephalomalacia in left anterior temporal lobe; pineal cyst
Frontal lobe atrophy
Gliosis of left frontal lobe
Gliosis of left temporal lobe with focus of encephalomalacia in post right parietal lobe
Atrophy and periventricular leukomalacia
Cavum vergae
Multiple white matter signal abnormalities suggestive of vasculitis
Mild atrophy
Pineal cyst
Left midbrain microinfarct
Two right thalamic high signal foci
Generalized atrophy
Thornwaldt cyst
Irregular contour of the left lateral ventricle
White matter abnormalities suggestive of multiple sclerosis
Left temporal lobe gliosis
Pineal cyst
Sella mass, probably a macroadenoma (13 mm)
Epidermoid inclusion cyst
Generalized atrophy, right midparietal microinfarct
White matter hyper intensity in left mid parietal lobe
Widespread white matter lesions
Symmetric parieto-occipital white matter lesions: ischemic lesions, gliosis, or demyelination
Prominent pituitary
Right frontal lobe gliosis
Subcortical right parietal lesions
Numerous parietal micro infarcts
Left parietal infarct
Periventricular leukomalacia
Frontal encephalomalacia
Focal parietal lobe hyper intensities

TABLE 4—*EEG abnormalities.*

Single sharp waves in right temporal lobe
Generalized slowing ($n = 3$)
Left frontal and temporal epileptiform discharges
Diffuse irregular background
Paroxysmal abnormality in left anterior quadrant
Asymmetry between posterior parts of the brain
Sharp theta waves in temporal area
Cortical irritability
Dysrhythmia with high voltage sharp theta waves
Focal abnormalities in left temporal area
Cortical irritability
Dysrhythmia
Sharp and spike waves from right posterior quadrant
Asymmetry between the temporal lobes
Outbursts of slow waves
Slowing in anterior left temporal area
Low voltage fast activity background
Moderate slowing
Lateralized slowing to right side
Paroxysmal tendency ($n = 2$)
Asymmetry in temporal lobe
Frontal asymmetry
Focus in the right anterior quadrant
Slow irregular background
Outbursts of high voltage theta activity
Left temporal lobe sharp waves ($n = 2$)
Left temporal lobe abnormality
Asymmetric photic driving
Theta waves in right temporal lobe
Moderate paroxysmal tendency
Spike slow wave seen
Right central parietal sharp wave transients
Highly irritable cortex with observed seizure
Diffuse slow waves
Mild left temporal slowing
Bifrontal slowing

In a comparative analysis of diagnosis and weapon choice, subjects with a psychotic disorder were significantly less likely to use a gun as compared to those without a psychotic disorder (Chi-square = 10.02, $p = 0.007$). Also, the probability of using a knife instead of a gun was five times more likely to occur among subjects with a psychotic disorder (Chi-square = 10.27, $p = 0.001$) and subjects with an anxiety disorder (Chi-square = 7.93, $p = 0.005$), and 3.6 times more likely to occur among subjects with a substance use disorder (Chi-square = 9.22, $p = 0.002$). This finding was compounded in subjects with a co-occurring psychotic and substance use disorder as these individuals were 13 times more likely to use a knife versus other weapons.

In a comparative analysis of diagnosis and relationship to the victim, individuals with psychotic disorders were not different from other subjects with respect to their relationship to the victim. However, among subjects with mood disorders, the probability of being related to the victim was 2.7 times more likely as compared to subjects with all other disorders (Chi-square = 7.56, $p = 0.006$). There were no other findings related to diagnosis and victim relationship.

Discussion

Among demographic variables, the finding that only 15% of defendants were married would suggest that marriage might be a protective variable against murder or extreme violence. Among murder defendants whose victim was not a spouse, the presence of a spouse may provide an external intervening variable in the prevention of violent behavior through both direct intervention and indirect deterrence.

More important, 43% of defendants had a prior history of psychiatric contact during inpatient (28%) and/or outpatient (39%) treatment. This finding underscores the importance of violence risk assessments in general psychiatric practice. Psychiatrists who carefully inquire about prior violent acts may be able to provide primary prevention strategies (limiting access to weapons, civil commitment, etc.) to diminish the likelihood of future violent acts.

The prevalence of a psychotic disorder (8%) in this study was much lower than the prevalence of schizophrenia or affective psychosis reported in prior studies by Yarvis (29%) and Blake (25%). The prevalence of a personality disorder (13%) was also much lower than that reported in prior studies (20–54%). This difference in

prevalence may reflect variations in methodology, overreporting in other studies, or underreporting in this study. Also, the sample in this study may be less selected (i.e., referral of a higher percentage of total murder defendants) and therefore contain relatively fewer mentally disordered defendants. In any event, all studies, including the present study, reveal a much higher prevalence rate of these psychiatric diagnoses than would be found in the general population. The results of this study would indicate that alcohol use, compared with the use of illicit substances, is more likely to be associated with violent behavior. Alcohol may be more disinhibiting than the use of cannabis, cocaine, or other substances, especially in male subjects, regardless whether diagnostic criteria for alcohol abuse or dependence are met. Although 42% of this sample met diagnostic criteria for alcohol abuse or dependence, only 23% admitted to using or were documented as having used alcohol at the time of the alleged offense. Murder defendants may commonly deny alcohol use at the time of their alleged offenses.

Although 16% had a measured FS IQ < 70, only 6% were diagnosed with mental retardation. If the defendant was suspected of malingering, the IQ was not recorded in this study. The stress of incarceration experienced by pretrial murder defendants may have in some cases impaired performance on psychometric measures of intelligence. The importance of examining adaptive functioning in the diagnosis of mental retardation may also be a relevant factor.

The subjects in this study were ultimately found competent to stand trial at a relatively high rate (93%). This includes, however, subjects who were initially incompetent to stand trial but who were subsequently restored to competency with treatment. The high rate of a finding of criminal responsibility most likely reflects an overinclusive referral pattern of murder defendants for pretrial evaluation and the conservative South Carolina test for insanity that is based on a narrow cognitive standard.

The associations between psychiatric illness and weapon choice have implications for violence risk assessments. Risk assessments among individuals with psychotic or anxiety disorders should include an inquiry about access to knives as well as firearms as these disorders were associated with a greater likelihood of using a knife in the commission of a murder as compared with other weapons. Individuals with a psychotic disorder may be more likely to engage in impulsive violence where planning and firearm acquisition do not occur. Anxiety-disordered individuals may be less likely to own a gun or have access to a firearm in their home environment. In any event, risk assessments in these patients should not be limited to inquiry about firearms only.

The MacArthur study (39) found that violence among mentally ill people discharged from acute inpatient psychiatric treatment was most frequently targeted at family members and friends. The vast majority of defendants in the present study also knew their alleged victim. However, individuals with a mood disorder, not schizophrenia or another psychotic disorder, were most likely to know their victim. Although this association may represent depressed persons who kill their children or spouse, further investigation will be necessary to draw any clear conclusions.

This study also reveals that neuroimaging (CT/MRI) is more useful than neurological examination or electroencephalogram (EEG) in documenting organic brain findings of clinical significance. In this study, neuroimaging was the only objective measurement correlated with an objective measure of functional impairment (Performance IQ). Additionally, neuropsychological evaluation may be more beneficial than routine intelligence measurement in documenting specific areas of functional impairment associated with neuroimaging findings. A Performance IQ that is significantly lower than Verbal IQ should lead the forensic clinician to consider neuroimaging in the evaluation of murder defendants. Although the relationship of functional and other measurable impairments to forensic psychiatric practice is relevant on a jurisdictional and case-by-case basis, this study suggests that if IQ testing is abnormal, then neuroimaging and possibly subsequent neuropsychological batteries should be considered. While neuroimaging abnormalities were not related to competency or criminal responsibility findings, they may be important during the mitigation phase of capital murder trials. Although neuroimaging abnormalities were common relative to the general population, the vast majority (98%) of defendants did not have an abnormal neurological exam. Brain dysfunction may manifest in behavioral or cognitive difficulties in the absence of strict focal neurological findings. An understanding of the link between structural brain abnormalities and resultant criminal behavior requires measures beyond the scope of this study, but that such a large percentage of defendants had neuroimaging findings versus neurological exam findings supports consideration of the use of the former in forensic evaluations.

Several limitations are inherent to this retrospective study of murder defendants. This research offers diagnostic conclusions by psychiatrists who have evaluated these defendants, not diagnostic conclusions drawn from a structured and standardized diagnostic interview. Although the evaluators were board certified psychiatrists, a uniform diagnostic method was not used. Also, while the neuroimaging modalities of MRI and CT differ in their clinical utility, the choice of modality was determined clinically by the evaluator and we chose to consider the results of the two methods collectively. Also, because this sample represents only about one-third of all South Carolina murder defendants, the results may not be generalized to all murder defendants.

Future studies should examine the difficulties in the diagnosis of mental retardation in this population, especially given the importance of this task in death penalty cases. Specifically, adaptive functioning findings (employment history, school history, ability to live independently, etc.) should be examined carefully in defendants with intelligence measured in the mentally retarded or borderline intellectual functioning ranges.

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References

1. *Atkins v. Virginia*, 122 S.Ct. 2242 (2002).
2. Pasework RA. Opinions about the insanity plea. J Forensic Psychol 1981;8:63–7.
3. Balistr B. Guilty but mentally ill debate continues. New York Law J 2000;10:2.
4. Pasework RA, Seidenzhal D. Opinions concerning the insanity plea and criminality among mental patients. Bull Am Acad Psychiatry Law 1979;7:199–204. [PubMed]
5. Slater D, Hans VP. Public opinion of forensic psychiatry following the Hinckley verdict. Am J Psychiatry 1984;141:675–9. [PubMed]
6. Resnick PJ. Perceptions of psychiatric testimony: a historical perspective on the hysterical invective. Bull Am Acad Psychiatry Law 1986;14:203–19. [PubMed]
7. Wahl O. Post-Hinkley views of the insanity defense. Am J Forensic Psychology 1990;8:3,5–7.
8. Levin HS, Benton AL, Grossman RG. Neurobehavioral consequences of closed head injury. Oxford: Oxford University Press, 1982.
9. Monahan J. A terror to their neighbors: beliefs about mental disorder and violence in historical and cultural perspective. Bull Am Acad Psychiatry Law 1992;20:191–5. [PubMed]

10. Tiihonen J, Isohanni M, Rasabeb P, Koiranen M, Moring J. Specific major mental disorders and criminality: a 26-year prospective study of the 1966 [PubMed] Northern Finland birth cohort. Am J Psychiatry 1997;154:840–5.
11. Hall KM, Kazmark P, Stevens M, Englander J, O'Hare P, Wright J. Family stressors in traumatic brain injury: a two-year follow-up: Arch Phys Med [PubMed] Rehabil 1994;75:876–84.
12. Garza-Trevino ES. Neurobiological factors in aggressive behavior: Hosp Community Psychiatry 1994;45:690–9.
13. Volavka J, Martell D, Convit A. Psychobiology of the violent offender. J Forensic Sci 1992;37:237–51.
14. Cummings JL. Clinical neuropsychiatry. Orlando: Grune and Stratton, 1985.
15. Lewis DO, Pincus JH, Feldman M, Jackson L, Bard B. Psychiatric, neurological, and psychoeducational characteristics of 15 death row inmates [PubMed] in the United States. Am J Psychiatry 1986;143:838–45.
16. Tancredi LR, Volkow N. Neural substrates of violent behavior: implications for law and public policy. International J Law and Psychiatry 1988;11:13–49.
[PubMed]17. Pincus JH, Lewis DO. Episodic violence. Semin Neurol 1991;11:146–54.
18. Grafman J, Schwab K, Warden D, Pridgen A, Brown HR, Salazar AM. Frontal lobe injuries, violence, and aggression: a report of the Vietnam [PubMed] head injury study. Neurology 1996;46:1231–8.
19. Martell DA. Estimating the prevalence of organic brain dysfunction in maximum-security forensic psychiatric patients. J Forensic Sci [PubMed] 1992;37:878–93.
20. Amen DG, Stubblefield M, Charmicheal B, Thisted R. Brain SPECT [PubMed] findings and aggressiveness. Ann Clin Psychiatry 1996;8:129–37.
21. Yarvis RM. Axis I and Axis II diagnostic parameters of homicide. Bull [PubMed] Am Acad Psychiatry Law 1990;18:249–69.
22. Blake PY, Pincus JH, Buckner C. Neurologic abnormalities in murderers. [PubMed] Neurology 1995;45:1641–7.
23. Frierson RL, Schwartz-Watts DM, Morgan DW, Malone TD. Capital versus noncapital murderers. J Am Acad Psychiatry Law 1998;26:403– [PubMed] 10.
24. Driver MV, West LR, Faulk M. Clinical and EEG studies of prisoners [PubMed] charged with murder. Br J Psychiatry 1974;125:583–7.
25. Heilbrun, Jr AB. Differentiation of death-row murderers and life-sentence murderers by antisociality and intelligence measures. J Pers Assess [PubMed] 1990;54:617–27.
26. Eronen M, Hakola P, Tiihonen J. Mental disorders and homicidal behavior [PubMed] in Finland. Arch Gen Psychiatry 1996;53:497–501.
27. Wagner EE, Klein I. WAIS differences between murderers and attackers referred for evaluation. Perceptual and Motor Skills 1997;44:125–6.
28. Nestor PG. Neuropsychological and clinical correlates of murder and other forms of extreme violence in a forensic psychiatric population. J Nerv Ment Dis 1992;180:418–23. [PubMed]
29. Nestor PG, Haycock J. Not guilty by reason of insanity of murder: clinical and neuropsychological characteristics. J Am Acad Psychiatry Law 1997;25:161–71. [PubMed]
30. DeWolfe AS, Ryan JJ. Weschler performance IQ greater than verbal IQ index in a forensic sample: a reconsideration. J Clin Psychol 1984;40: 291–4. [PubMed]
31. Cunningham MD, Vigan MP. Without appointed counsel in post-conviction proceedings: a study of self-representation competency in Mississippi death row inmates, 1997 as cited in: Stafford Smith CA, Starnes RV: Folly by Fiat: Pretending that death row inmates can represent themselves in state capital post-conviction proceedings. Loyola Law Review 45, 1999.
32. Mooneyham S. Death penalty bill clears Senate committee. The Associated Press State and Local Wire. Raleigh, NC, 12 April 2001.
33. Winkler GE, Kove SS. The implications of electroencephalographic abnormalities in homicide cases. J Neuropsychiatry 1962;3:322–30.
34. Sayed ZA, Lewis SA, Brittain RP. An electroencephalographic and psychiatric study of thirty two insane murderers. British J Psychiatry 1969;115:1115–24.
35. Volavka J. Neurobiology of Violence. Portland: American Psychiatric Press, 1995.
36. Raine A, Meloy JR, Bihrle S, Stoddard J, LaCasse L, Buchsbaum MS. Reduced prefrontal and increased subcortical brain functioning assessed using positron emission tomography in predatory and affective murderers. Behav Sci Law 1998;16:319–32. [PubMed]
37. S.C. Code Ann. §17-24-20.
38. S.C. Code Ann. §17-24-10.
39. Steadman HJ, Mulvey EP, Monahan J, et al. Violence by people discharged from acute psychiatric inpatient facilities and by others in the same neighborhoods. Arch Gen Psychiatry 1998;55:393–401. [PubMed]

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